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KING MONGKUT'S UNIVERSITY OF TECHNOLOGY NORTH BANGKOK

# KNACKSAT\*: A Thai Educational Satellite

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King Mongkut's University of Technology North Bangkok (KMUTNB)

Bangkok, Thailand

\*KNACKSAT: KMUTNB Academic Challenge of Knowledge SATellite

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laboratory

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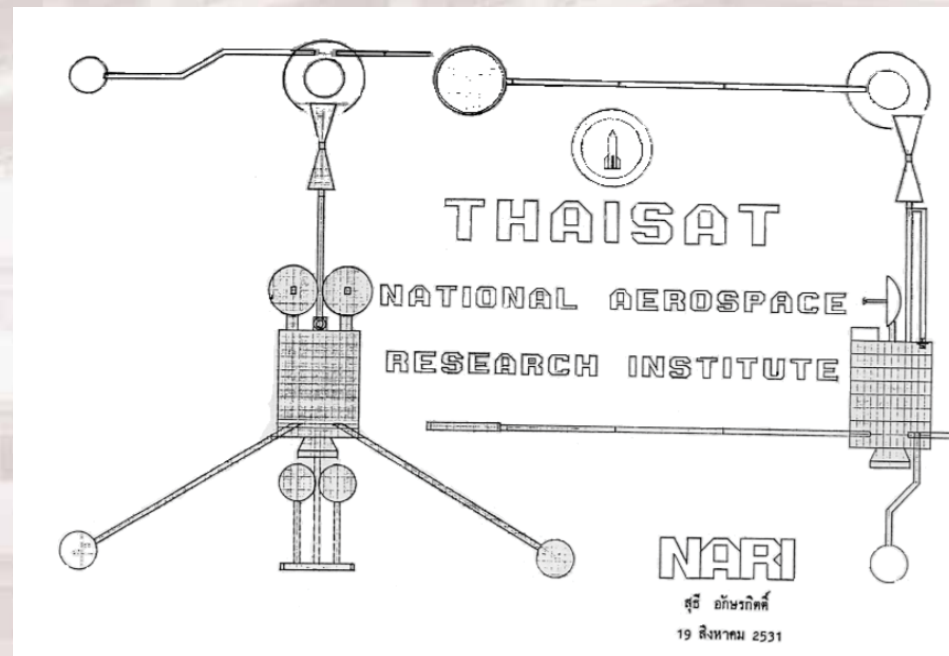
# Outline

- History
- KNACKSAT
  - Introduction
  - Missions
  - Requirements
  - Subsystems
  - Integration Test
  - Etc.



# History

- ThaiSat, 1988.  
Proposed by Dr. Suthee Aksornkit



<http://www.thaiscience.info/journals/Article/TJKM/10469766.pdf>



# History

- ThaiCom 1, 1993 (Note. The latest one is ThaiCom 8)  
Operated by Thaicom Public Company Limited



<http://www.thaicom.net>



# History

- TM-Sat (Thai Micro-SATellite) or Thaipat, 1998  
Designed and developed by Mahanakorn University of Technology and University of Surrey



<http://www.space.mict.go.th/knowledge.php?id=thaipat>



# History

- SMMS (Small Multi-Mission Satellite), 2008  
Joint project of China, Iran, Republic of Korea, Mongolia, Pakistan and Thailand. Kasetsart University involved in design and development of the Ka-Band communication subsystem.



<http://www.ku.ac.th/e-magazine/jan52/it/engineers.htm>

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# History

- THEOS (Thailand Earth Observation System) or Thaichote, 2008  
Operated by Geo-Informatics and Space Technology Development Agency (GISTDA)



<http://www.gistda.or.th/main/th/node/90>



# History

- In 1998, King Mongkut's University of Technology North Bangkok (KMUTNB) started offering an undergraduate program in Aerospace Engineering.
- KMUTNB Satellite Attitude Dynamic and Control Simulator, 2000

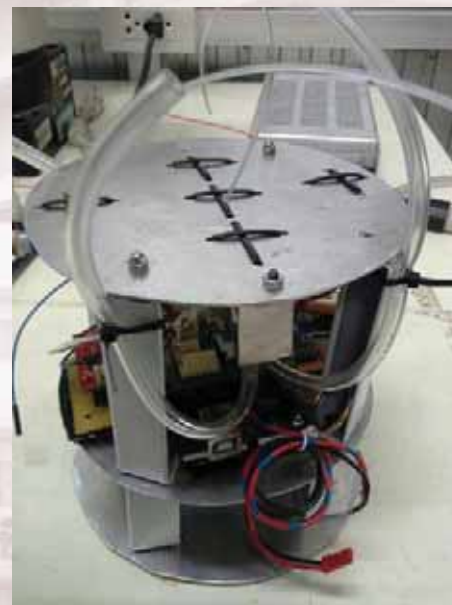
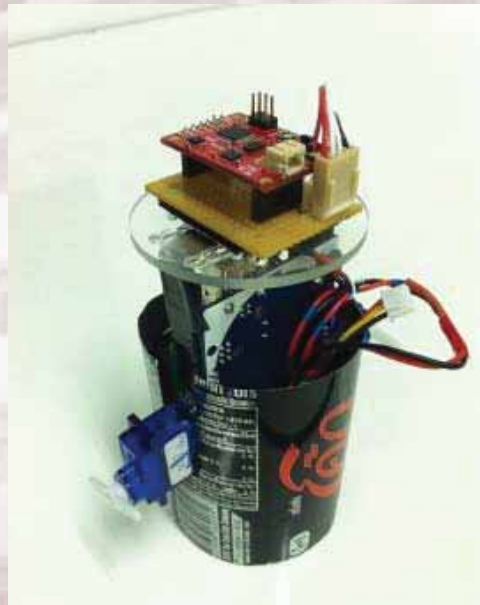






# History

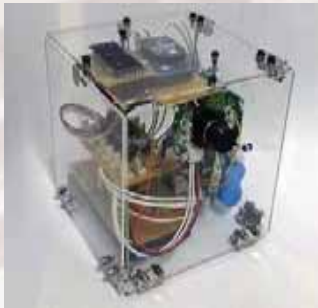
- KMUTNB CanSat Project started in 2012.





# History

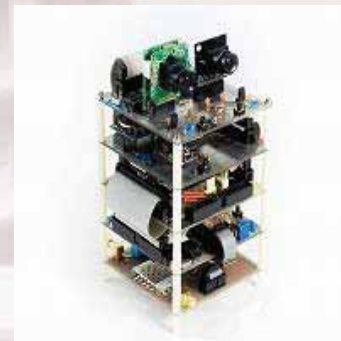
- KMUTNB CubeSat Project started in 2012.



**First prototype  
2012**



**BBM  
2013**



**EM  
2014**



**EM\*  
2015**

\* EM2015 is a joint project between KMUTNB and GISTDA.



# History

- I wrote this article introducing CubeSat to Thai society 10 years ago. However, no attention was drawn at that time.



<http://www.space.mict.go.th/knowledge.php?id=cubesat>



# History

We are not alone !

Other CubeSat activities going on in Thailand include:

- JAISAT (Joint Academy for Intelligent Satellites for Amateur Radio of Thailand, The Radio Amateur Society of Thailand.
- SpaceBox, King Mongkut's Institute of Technology Ladkrabang (KMITL) and King Mongkut's University of Technology Thonburi (KMUTT)
- LESASAT, Learning Center for Earth Science and Astronomy



# KNACKSAT: Introduction

- KNACKSAT is a 1U CubeSat satellite.  
(KmutNb Academic Challenge of Knowledge SATellite)
- 270k USD granted from NBTC Thailand in OCT 2015  
(National Broadcasting and Telecommunications Commission)
- Fully in-house developed satellite in Thailand.



# KNACKSAT: Missions

## ➤ Main Missions

To acquire basic space technologies by demonstrating :

- Remote sensing technology (Earth Imaging)
- Active attitude control
- Communication via HAM radio



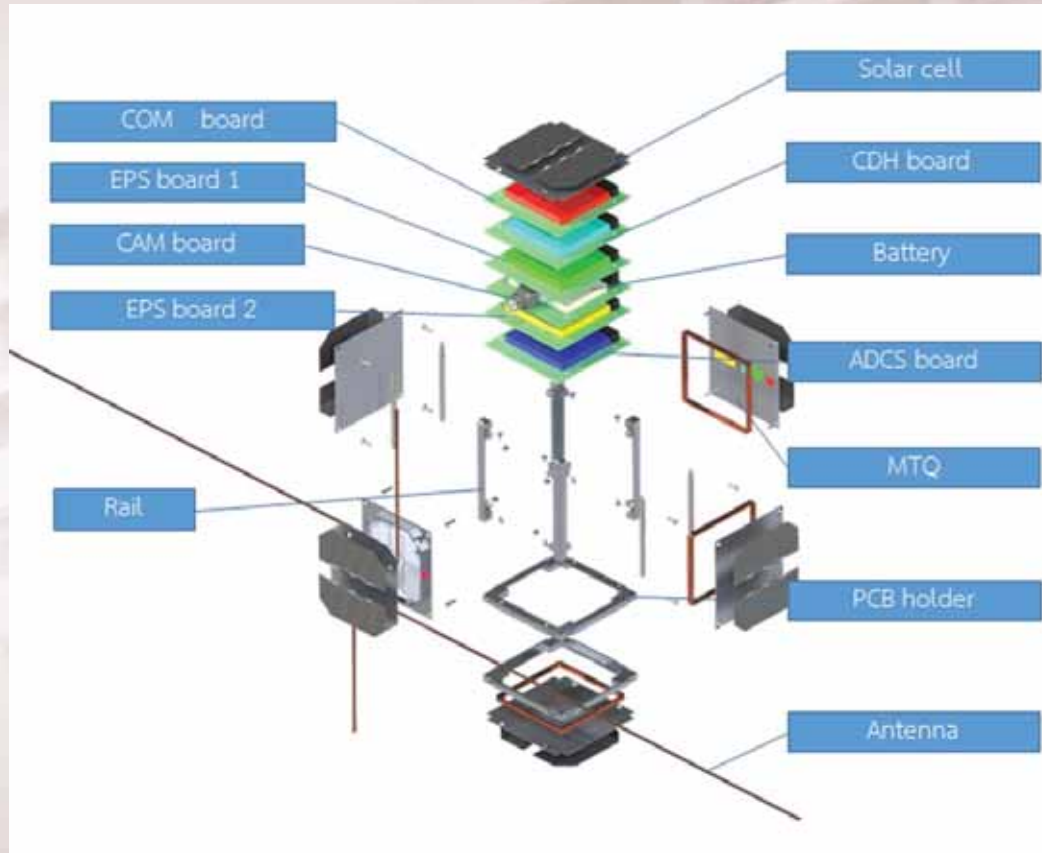
# KNACKSAT: Requirements

## ➤ Satellite design requirements

- Modular design
- Size 10 x 10 x 10 cm
- Weight less than 1.33 kg
- Internal Bus : I2C interface
- Communication : GFSK 9600 and FSK 1200 bps
- Image size : QQVGA – FULL HD



# KNACKSAT: Subsystems



1. Structure Subsystem, **STR**
2. Communication Subsystem, **COM**
3. Electrical Power Subsystem, **EPS**
4. Command and Data Handling Subsystem, **CDH**
5. Attitude Determination and Control Subsystem, **ADCS**
6. Camera Subsystem (or Payload), **CAM**





# KNACKSAT: Integration Test



PC Command



TableSat Model



PC Monitor



# KNACKSAT: Integration Test



<https://www3.nhk.or.jp/nhkworld/en/news/editors/1/thailandsaerospacehopes/>

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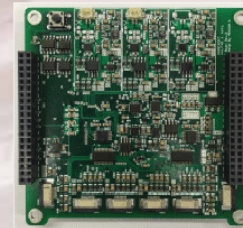
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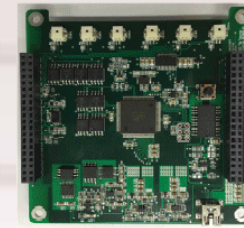


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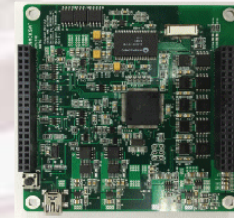
# KNACKSAT: Engineering Model



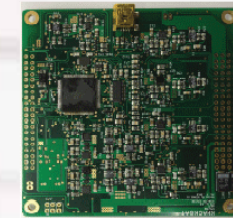
ADXS



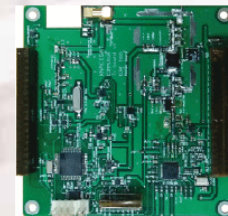
CDH



CAM



EPS



TX



RX

Ready for Environment Tests

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# KNACKSAT: How to get to this point?

5+ teaching staff

15+ students

Many valuable supports from friends around the world



**Kyutech**  
Kyushu Institute of Technology



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Team Discussion

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# KNACKSAT: How to get to this point?



## Soldering and Inspection

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## Software Development and Testing

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# KNACKSAT: How to get to this point?



## Ground Station Installation

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# KNACKSAT: How to get to this point?



## Preliminary Design Review

Thanks to Mr. Masanobu Tsuji, Prof. Shinichi Nakamura and Prof. Shinichi Nakasuka



# KNACKSAT: Future Works

- Environment testing  
(27 Feb – 7 March 2017, Center for Nanosatellite Testing Laboratory of Spacecraft Environment Interaction Engineering, Kyushu Institute of Technology )
- Critical Design Review (CDR)
- Flight Model (FM) Fabrication
- Software Fine Testing and Validation
- Launch (550-600km, SSO, Q4/2017)
- Ground Operation and Control



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**Thank you  
For your attention**

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