Goals and achievements of studying my PhD under PNST fellowship

A success story of:
Mohamed Yahia Edries
Contents

- A short BIO
- Motivations to join PNST Program
- What did PNST Program add to me?
- How could I transfer the gained knowledge to my country?
- Lessons learned from study in Japan
- My life in Japan
Education:

- BSc. Electrical Engineering, Faculty of Engineering, Cairo University (2000)
- MSc. Electrical Engineering, Faculty of Engineering, Cairo University (2009)
- PhD. Integrated Systems Engineering, KYUTECH (2016)

Experience:

- Researcher at Electrical and Electronics Dep., Space Division
- 18 years in Egyptian Space Program (Now EgSA)
- Satellite System Engineer and leader of Electrical Power Systems group
- Lecturer of Power Electronics in the Egyptian Universities
- Supervisor of graduation projects of the BSc. students
What is PNST?

- The PNST fellowship is a post-graduates programmes on nanosatellite technologies
- launched in 2013 by the Kyushu Institute of Technology (Kyutech) in Japan and the United Nations Office for Outer Space Affairs (UNOOSA)
- Targeting the students from developing countries or nations that do not yet have space-faring capabilities
Motivations to Join PNST fellowship

- I need to devote enough time to study PhD
- My colleague in NARSS joined DNST in 2011 (Dr. Mohamed Ibrahim)
- I was so enthusiastic to deal with advanced facilities not available in Egypt
- To discover the secrets of Japan

My Goals...

PhD in Space Engineering

Know-How of Nanosatellites technologies

Imitate the model in my country

In Sep. 2013
Road to PhD.

Laboratory of Spacecraft Environment Interaction Engineering (LaSEINE)
Road to PhD.

- SEIC
  - Space Engineering International Course
    - Space Systems Engineering
    - Introduction to Satellite Engineering
    - Satellite Power System
    - Space Environment Testing
    - Power Semiconductor Devices
    - Project-Based Learning
    - Japanese Language

December 14, 2020
Mohamed Yahia
Road to PhD. (Cont.)

- **R&D**
  - Optimization of EPS development
  - Design and Carrying out of Experiments
  - Project Based Learning
  - Publishing papers

Single Event-latchup test at Kyoto University

IAA award MIC’2014  
SEL test at Takasaki’s reactor  
TID test at Kyushu University
Road to PhD. (Cont.)

HORYU-IV Team

---

**Mass**: 12 Kg  
**Dim.**: 30 x 30 x 30 cm  
**Orbit**: 570 Km, 31°  
*Launched in Feb. 17th., 2016*

**Main Mission**: High voltage (~300V) generation and investigation of the arcing on Solar Panels due to interaction with the space environment  
**Aux. Missions**: CAM, Digi-Singer and Space environment measurements
To develop a “Lean” EPS for lean satellites

To meet all design requirements

To propose testing methods and procedures

To investigate all expected faults in the system and do FTA
Why we apply “Lean” concepts?

- To give the **customers** and stakeholders a kind of **value** to **invest** more in satellites development
- To **define** a New **Standards** to combine the Satellites comply for **Lean**

Number of launched Satellites < 100 kg
(Source: Kyutech)
What are the “Lean” concepts?

- Concepts and philosophies in both the **development** and the **management** processes

- “Lean” satellite perfectly describes any satellite which uses **optimization** concepts in its **development**

- **Low cost, fast delivery, and risk acceptance**
Reduce wiring and harness
Safety Requirements
Efficiency
Fast delivery
Development of EPS of a lean satellite

Problem Statement

Low Cost
- Reduce the Number of prototypes
- Reduce the margin components
- Use of COTS Components
- In-House PCB and Battery Assembly
- Use of Space heritage components
- Radiation and TID tests
- Redundancy in some parts
- Simple design

Fast delivery
- Use of Integrated solution
- Enviromental test within the satellite
- Overlap between design phases
- Order FM model before finishing all EM tests
- Reduce wiring and harness
- Use of Buck type DC/DC converters
- Use of high efficiency components
- Efficient PPT topology

Risk Acceptance
- Use of unknown failure rates components
- Reduce the scope of tests
- Use EM parts for FM
- Last moment modifications
- Using Ni-MH batteries
- Prevent Battery Overvoltage
- Solar Arrays shunting
- Separation mechanism

3 Lean Concepts

3 Design Requirements

Robustness and Reliability
Efficiency
Safety Requirements
## Concepts

|-------------|----------|-----------|-----------|-------------|------------|--------|
| • Reduce prototypes  
• Reduce margin | Overlap between design phases | Use of unknown  
Use space Heritage comp. | Use of high efficiency components | Use Ni-MH Batteries |

| Design     | COTS | Use Integrated Solutions | Last moment modifications | Simple | • Use of Buck Conv.  
• Efficient PPT | • Prevent Battery Overcharge  
• Shunting |

<table>
<thead>
<tr>
<th>Manufacturing</th>
<th>In-House Assembly</th>
<th>Order FM before EM test finish</th>
<th>Use EM parts for FM model</th>
<th>Redundancy</th>
<th>Reduce Harness</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Testing</th>
<th>Environment Test within Satellite</th>
<th>Reduce scope of tests</th>
<th>SEL and TID tests</th>
<th>Separation Mechanism</th>
</tr>
</thead>
</table>
What did PNST Fellowship add to me?

- Having PhD in 3 years in advanced technologies
- Practicing satellite development life-cycle
- Enhance my scientific thinking and hands-on experience
- How to adapt in a multicultural system
- Establish solid and versatile connections with many people
- Strengthen the commitment towards my country
How can I transfer the gained knowledge to my country?

- Start Cubists projects for undergrads
- Teach junior Engineers

Capacity Building

In Oct. 2016
Promoted to a Researcher position at NARSS Space Division
Promoted to a head of Electrical Systems Department in EgSA
A Principal Investigator of a project for design and implementation of a nanosatellite PCDU
A System Engineer of “TeDDSat” Alliance
A System Engineer of “NExSat” nanosatellite
Electrical Power System Designer of “NARSSCube” satellites
A Lecturer for “Power Electronics” in one of the Egyptian Universities
A Supervisor of many Graduation Projects
Lessons learned from study in Japan

- Laboratory is my HOME
- Safety is the first priority
- Be Accurate and neat
- Publish or perish
- Together Everyone Achieves More
- Learning Japanese language is a must

Satellite Projects in Egypt since 2016

Designed and Made in Egypt

Tested in and Launched from Japan
My life in Japan
Thanks