The 3rd UNISEC-GLOBAL MEETING
University of Tokyo, Tokyo, Japan
3-5 July 2015

Turkish UNISEC (UTEB) 2015 Activities

Prof. Dr. Alim Rustem Aslan, UTEB Coordinator, UNISEC Global PoC Manager, Space Systems Design and Test Laboratory
Istanbul Technical University, Faculty of Aeronautics and Astronautics, Istanbul, Turkey
aslanr@itu.edu.tr
Acknowledgement

This is to acknowledge

UNISEC-TR(UTEB)

as a Local Chapter of the UNISEC-Global, due to recommendations made by the Steering Committee, a supreme organ of the UNISEC-Global. This acknowledgement extends one year effective on November 20, 2014.

Prof Dr. Alim Buseem ASLAN is designated as Secretary of UNISEC-TR(UTEB) on its behalf and a Point of Contact hereafter.

Rui Kawashima
Secretary General,
UNISEC-Global

November 20, 2014
JOINT UNDERTAKING of ACADEMIA
Governement, Aerospace Co. and SMEs

- Istanbul Tecnical University
- Airforce Academy, Sabancı University
- AES Aero (SME)
- Ertek Ltd. (SME)
- Gumush Space(SME)
- HAVELSAN
- ASELSAN
- AMSAT-TR
- Turkish University Union of Space Education
- Turkish Aerospace Industries
- TURKSAT Co.
- Ministry of Transportation, Communications
UNISEC-TR History

• Started Nov 2011, by three Istanbul Universities (ITU, TurAFA, YTU)
• Over 20 participant universities
• Support of government, aerospace industry and research institutions
• 9 meetings so far hosted by starters and supporting institutions
• Working on establishing UTEB as a legal entity
• Define a joint project with government and industry support based on national needs
• International cooperation
# MEETINGS

<table>
<thead>
<tr>
<th>Meeting #</th>
<th>HOST, Location</th>
<th>Date</th>
<th>University Participation</th>
<th>Institutional Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>İTÜ, Istanbul</td>
<td>2.11.2011</td>
<td>21</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>RAST 2013, Istanbul</td>
<td>13.06.2013</td>
<td>14</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>AIAC 2013, METU, Ankara</td>
<td>12.09.2013</td>
<td>11</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>TUBITAK SPACE, Ankara</td>
<td>06.12.2013</td>
<td>14</td>
<td>9</td>
</tr>
<tr>
<td>5</td>
<td>ISTANBUL TECHNOCITY, Gebze</td>
<td>04.03.2104</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>TurAFA/ASTIN, Istanbul</td>
<td>20.06.2014</td>
<td>13</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>Afyon Kocatepe, Afyon</td>
<td>20.01.2015</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>8</td>
<td>TAI, Ankara</td>
<td>29.04.2015</td>
<td>14</td>
<td>16</td>
</tr>
<tr>
<td>9</td>
<td>RAST 2015, Istanbul</td>
<td>17.06.2015</td>
<td>16</td>
<td>13</td>
</tr>
</tbody>
</table>
Starting in 1989, Turkey ordered a number of communication satellites of which the first one were placed in orbit in August, 1994.

New decisions have been made by the government to support industry and research establishments including universities to carry out research, design and development studies on space technology.

One of such decisions was made in 2005 by the National Higher Council of Science and Technology that set specific goals and budgeted space technology projects.

Development of qualified work force
These efforts will be better coordinated with the establishment of the National Space Agency
A total of 17 Turkish satellites will come into orbit from 2012 to 2020.
Many countries of the world have individual government-sponsored space programs... as well as there are group efforts that combine multi-national expertise...

<table>
<thead>
<tr>
<th>Country</th>
<th>Country</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>Iraq</td>
<td>Russia</td>
</tr>
<tr>
<td>Australia</td>
<td>Israel</td>
<td>Saudi</td>
</tr>
<tr>
<td>Brazil</td>
<td>Italy</td>
<td>Singapore</td>
</tr>
<tr>
<td>Canada</td>
<td>Japan</td>
<td>S. Korea</td>
</tr>
<tr>
<td>Chile</td>
<td>Kazakhstan</td>
<td>Spain</td>
</tr>
<tr>
<td>China</td>
<td>Luxembourg</td>
<td>Sweden</td>
</tr>
<tr>
<td>Czech Rep</td>
<td>Malaysia</td>
<td>Taiwan</td>
</tr>
<tr>
<td>Europe</td>
<td>Mexico</td>
<td>Thailand</td>
</tr>
<tr>
<td>France</td>
<td>Multi-national</td>
<td>Turkey</td>
</tr>
<tr>
<td>Germany</td>
<td>North Korea</td>
<td>UAE</td>
</tr>
<tr>
<td>Hungary</td>
<td>Norway</td>
<td>UK</td>
</tr>
<tr>
<td>India</td>
<td>Pakistan</td>
<td>Ukraine</td>
</tr>
<tr>
<td>Indonesia</td>
<td>Philippines</td>
<td>USA</td>
</tr>
<tr>
<td>Iran</td>
<td>Portugal</td>
<td></td>
</tr>
</tbody>
</table>
2015 Summary

• 3 UTEB Meetings (total of 9 meetings)
• 10th meeting planned following CanSat-II
• H2020 applications with other UNISEC members
• 2nd Turkish CanSat Leader Training Course
• PreMIC4, ISTS30/NanoSat
• UN South Africa Symp on BSTI
• IAC2015
• Ongoing projects (QB50, UBAKUSAT, others)
• Efforts Towards an association, lawyer help
• Strong support of aerospace industry
• Efforts toward formulating a multi-institutional nanosat project. Funding ???
UNISEC-TR Meeting 7

New Aerospace department in AKU
Info on ongoing UNISEC GLOBAL activities (MIC, CLTP, NanoSat Symp)
International Meetings
Define a UTEB Space Project
UNISEC-TR Meeting 8

UTEB Project Proposal
How to undertake the Project
Visit of TAI Space Facilities
Space Medicine and Biological research
UTEB legal establishment
Discussion topic:

The elements required for a successful and useful space education: Project based applied education

Testing Tutorial
MODEL UYDU Tasarımı ve İMALATI EĞİTİMİ
II. CanSAT Uygulaması

CANSAT Nedir?

AMAÇ
CanSat eğitiminde, uzay sistemleri alanında kurumsal gelişim ve uzay mühendislerine yönelik uygulamalı eğitim programları geliştirilmiştir. Uzay mühendisliği ve bilimlerine alanında yetişmiş bir araştırmacı tarafından alınan bilgiyi, öğrencilerin uzay mühendisliği ve bilimlerindeki gelişiminde kullanacak şekilde aktarılır.

CanSAT Temelli Uzay Eğitiminin Hedefi
Uzay mühendisliği ve bilimlerine alanında yetişmiş bir araştırmacı tarafından alınan bilgiyi, öğrencilerin uzay mühendisliği ve bilimlerindeki gelişiminde kullanacak şekilde aktarılır.

Car-SAT Eğitim Adımları
Görev Analizi ve Özet Haritalama
Güç Besleme ve Kontrol
GPS Engelli Programlama
Sinyal ve Uzay Bilimi
Kütüphanenin Ekipmanları
Altyapı ve Ağ Serbeste Tasarım
Mekanik Teslimat
Tasarım, Test ve Iletişim
Görev Sonrası Uzay Bilimi

Kimler Katılabılır?
Uzay alanında çalışanphin, Mühendislik, Teknik Bilimler, ve Uzay Bilimleri, Uzay Bilimleri ve Teknolojileri öğrencileri veya mezunları katılabilir.

Tarih
14-22 Ağustos 2015

Yer
Canakkale Cumhuriyet Üniversitesi
Terleme ve Yeterlilik

Canakkale Uzay Bilim ve Teknolojileri Bölümü

Eğitim Gideri: 1500 TL
Eğitim gideri, eğitim dokümanlarını, uygulamalı dersleri, uyuş yapmadan kullanılan matemeleri ve fırıncıları içermektedir. Konaklama ve günlük işe masraflarını içermez.

İLETİŞİM: burcu@comu.edu.tr, erkanyilan@comu.edu.tr

Sponsorlar

ISTANBUL TEKNİK ÜNİVERSİTESİ
Akademi Çarşısı

İTÜ

CanSAT Design and Building Course

- Descend and Landing System Design
  - Introduction
  - Forces Acting on the Parachute
  - Equilibrium of Forces in Steady Descent
  - Parachute characteristics and performance
  - Parachute simulation during descending

\[ P = P_0 \exp\left(-\frac{x}{a}\right) \]

\[ z = -\frac{2}{R^2} \ln\left[\frac{P}{P_0}\right] \]

\[ F_D = \frac{1}{2} \rho C_D A V^2 \]
CanSAT Launch

- 14-22 August 2015
- Çanakkale 18 Mart Univ. Facilities
- Applications accepted
2015 Projects

- TURKEY - TUNISIA joint Project
  - Development of intelligent control modules for nano satellites

- TURKEY – JAPAN
  - UBAKUSAT

- QB50
  - BeEagleSat
  - HavelSat

- Others
JAPAN-TURKEY MEETING FOR SPACE COOPERATION
UDX GALLERY, NEXT, TOKYO
2/04/2015

NANO-SATELLITE LAUNCH PROGRAM
UBAKUSAT

Prof.Dr. Alim Rustem Aslan
Manager, Space Systems Design and Test Laboratory
Istanbul Technical University, Faculty of Aeronautics and Astronautics,
Istanbul, Turkey
aslanr@itu.edu.tr
OBJECTIVE

- Turkey – Japan Space co-operation between academic and government institutions
- Launch of a Turkish CubeSat from Japanese Launch facilities
Program Partners

**TURKEY**
- Ministry of Transport Maritime Affairs and Communications
- Istanbul Tecnical University
- Ertek Ltd. (SME)
- Gumush Space (SME)
- TAMSAT/AMSAT-TR
- TURKSAT INC
- Turkish Aerospace Industry
- UNISEC-TR

**JAPAN**
- Ministry of Education, Culture, Sports, Science and Technology (MEXT)
- Japan Aerospace Exploration Agency (JAXA)
- Kyushu Institute of Technology
Duties

**TURKEY**
- Develop and test 3U CubeSat, UBAKUSAT
- Compliance with JEM Payload Accommodation Handbook
- Transport to KIT/Japan

**JAPAN**
- Further Testing of UBAKUSAT
- Assist in document preparation for Launch
- Launch
UBA KSAT, MISSION

[Diagram showing satellite communications between two ground stations via VHF uplink and UHF downlink.]
UBA KSAT, Details

- Size standard 3U CubeSat, 10*10*34cm
- Mass approximately 2 kg, max 3kg
- Main payload a VHF/UHF Transponder

<table>
<thead>
<tr>
<th>Input Frequency</th>
<th>145.940 – 145.990 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Frequency</td>
<td>435.200 – 435.250 MHz</td>
</tr>
<tr>
<td>Transponder Type</td>
<td>Inverting – Linear</td>
</tr>
<tr>
<td>Modulation</td>
<td>All Mode (AM, FM, SSB, CW, FSK, etc.)</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>50 KHz</td>
</tr>
<tr>
<td>RF Power (max)</td>
<td>1 Watt - 30 dB</td>
</tr>
</tbody>
</table>

- Battery 30Whr
- Passive Magnetic Stabilization system
TRANSPONDER - OBC
Transponder:
Uplink  145,940 – 145,990 MHz
Downlink  435,200 – 435,250 MHz

Beacon:  Downlink 437,225 MHz

Modem central frequencies:
Uplink (m)  144,675 MHz
Downlink (m)  437,225 MHz
PMACS
POWER SYSTEM, CLYDE SPACE
OTHER SUBSYSTEMS

• 3U Structure, Kill switch, RBF,

• Umbilical

• Antenna release and Beacon card

• TAMSAT SIMPLESAT: an independent satellite with all subsystems and radiation measurement sensor
3USAT Assembly in Clean Room
TIME FRAME

• HAND UBAKUSAT From ITU to KIT in January 2016

• HAND UBAKUSAT From KIT to JAXA in late March 2016

• Launch in 2016
BeEagleSAT and HavelSat

• BeEagleSAT is a joint project of Istanbul Technical University, Turkish Air Force Academy, and Sabanci University along with SMEs and Industry (UTEB MEMBERS).
• One of 2U CubeSats of the QB50 Network
• HavelSat is developed by ITU and Havelsan Co
XRD of BeEagleSat

Lay foundations of producing scientific space payloads in Turkey!
QB50 Project Benefits

• A good example of multi institution international collaboration
• Mix of budgets: from QB50 and local budget
• Local budget from UTEB members, aerospace industry, ITU spinoff mikroSMES
• One/Two QB50 WS meetings per year
• Detailed very valuable documentation
• A good school for enhancing spacecraft design, management and ground station operation skills
• Carrier possibilities for students, young engineers
X-Band Comm on a CubeSat

- **Telemetri**
- **Telekomand**
- **Transponder**
- **VHF UPLINK**
- **UHF DOWNLINK**
- **Ku Band UPLINK**
- **X-Band DOWNLINK**

- **Satellite**
- **GS-1 TM/TC**
- **GS-2 Transponder**
PARS ROCKET TEAM

• Hybrid rocket development
OUTREACH at High Schools
2015-2016

• Further UTEB Meetings (10th...)
• 7th NanoSat + 4th MIC and UG Meetings in Istanbul
• Ongoing projects (QB50, 3USAT etc)
• Efforts Towards forming an association
• Efforts toward formulating a multi-institutional nanosat project. Look for funding

• WAY FORWARD

• A legal association with individual members OR
• An advisory and facilitator umbrella institution
  • Legal issues and funding to be handled by universities
We Look Forward To a Fruitful Cooperation
Towards being a civilization living in the Solar System

Alim Rüstem ASLAN
Istanbul Technical University
Department of Space Engineering
+90532 480 3449
aslanr@itu.edu.tr
usl.itu.edu.tr
**BENEFITS**

- **CanSats and Nano Satellites** are a very useful tool for starting space work by everybody.
- Students, through hands-on work, developing the necessary skills and experience to succeed in the space industry.
- Overall, nanosat projects provide an outstanding intercultural experience and a global network of students and engineers with the possibility of exchange and cooperation programs.
- UTEB/UNISEC like bodies may facilitate project development and funding.

**Benefits**

- **NANOSATs** may be the answer to very large budgeted, long time taken government space programs.
- Improving capability NanoSat in mission VS very capable largeSat in development.
• 2 book chapters on nanosats
• H Steyn visit
• Design courses
• 2nd CanSat
• PARS rocket team
• UBAKUSAT with KIT and JAXA and J governement
• RAST2015
• NATO AVT group (contribution to zaragoza)
• Papers for ISTS, QB50 WS, IAC, UN-BSTI, AVT