POC Presentation in the 2nd UNISEC-Global Meeting

Country : Australia

Title : ANU Advanced Instrumentation and Technology Centre

Author : Dr Naomi Mathers

Abstract :

The Advanced Instrumentation and Technology Centre (AITC) is a national facility in Canberra, Australia. It was established to support the development of the next generation of instruments for astronomy, and space science. The AITC offers an end-to-end capability with expertise in the design, manufacture, integration and test of precision instrumentation and complex systems for astronomy and space.

The AITC is currently supporting the development of an instrument for the Giant Magellan Telescope project and developing the adaptive optics sub-system. They are also applying adaptive optics to the problem of tracking and de-orbiting space debris that might cause damage to satellites as part of the Space Environment Management Co-operative Research Centre.

These projects provide a framework for national and international collaboration. They also support the development of future capability through hands-on projects, work placements and access to experts. The aims of the UNISEC Global initiative are well aligned with that of the AITC, providing an excellent opportunity to increase international collaboration and opportunities for students. This presentation will provide a brief update on the AITC, current opportunities for domestic and international students, and future plans.

Country : Bangladesh

Title : Exploring Modular Architecture for Nano Satellite and Opportunity for Developing Countries

Keyword: Nano satellite, Space technology, Remote Sensing.

Abstract :

The extended SPACE Technology has the potential to provide information, infrastructure and inspiration that meets national needs in developing countries like Bangladesh. Many countries recognize this; in response they are investing in new national satellite programs to harness satellite services. Technology related to space is one example of a tool that can contribute to development both by addressing societal challenges and by advancing a nation’s technological capability. To cope up with the advanced world in space technology Bangladesh seems to be highly potential country for satellite, Robotics, embedded systems and renewable energy research. BRAC University, Bangladesh is planning to launch a nano

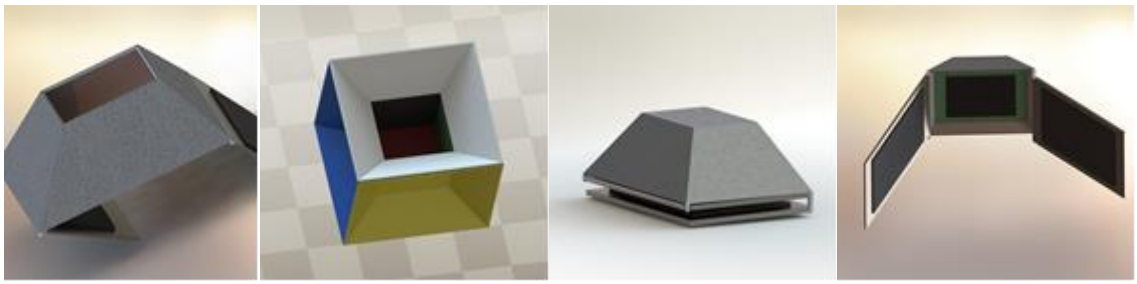
satellite with the collaboration of KIT, Japan. The proposed nano satellite project mission is to experiment about social, commercial and agricultural survey needs in Bangladesh. Each of the proposed applications of the project will improve the lives of millions of people of Bangladesh and it will be a pathfinder mission for the people of this country. Another intention of this project is to create a cheap satellite based remote sensing for developing countries as the idea of large space systems is very costly for us therefore we have decided to make a Nano-satellite.

The primary mission objective is to monitor formation and depression of Bay of Bengal leading to major hurricane, typhoon and other storm. The reason for monitoring monsoon wind & rainfall characteristics is to because excessive rainfall causes flood which is one of the major natural disaster of our country. Meteorologists are reporting that rainfall in Bangladesh in changing drastically (early on set and late on withdrawal in monsoon rain). Moreover, weather forecast use various observations from which to analyses the current state of the atmosphere. As Bangladesh is an agricultural country and most of the people here depend on agriculture for their livelihood therefore agriculture is one of the most important application fields of satellite. By using earth observation data we can do crop inventory, yield prediction, soil/crop condition monitoring and subsidy control. Another advantageous of this nano satellite is to monitor the forestry which helps to balance the eco-system as in recent years killing animals and cutting down trees illegally increasing immensely. By analyzing earth observation data can protect natural resources and ensure the safety of the animals in forest.

The main target of Bangladesh is to send own satellite in space. It was figured out that the vision of building small satellites is very possible in five years if we can give emphasis on human resource capacity building & develop an infrastructure. The very first step has been taken by The Robotics lab of BRAC University, Bangladesh to start this project by signing research collaboration with LaSEINE laboratory of Kyushu Institute of Technology, Japan who are pioneer on nano-satellite research in Japan. The project will be led by a team of faculty members from BRAC University supervising a group of undergraduate and postgraduate students. For project management a full time research assistant will be appointed. This kind of extensive research is very expensive and need high end technology & researcher. Since it also involve the national security and interest, it is very difficult to continue without direct support of Government. So, we are expecting financial help from the government of our country. We plan to deploy our nanoSat from ISS through nanoSat launching Robotic arm. With the collaboration of KIT and JAXA, our plan is to send our nanoSat in a cargo ship such as HTV-IV.

The proposed structure is composed of six individual pyramid shapes whose vertex has

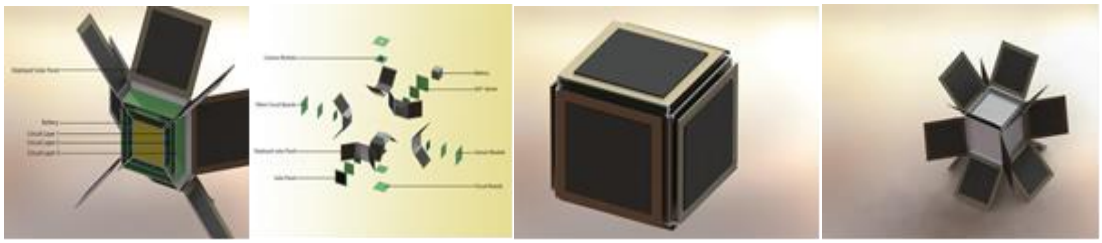
been clipped. Each Pyramid is 10 cm x 10 cm at the base with the height of 5 cm. Each pyramid structure has been clipped at 2.5 cm height (Figure 1(a)).



(a) (b) (c) (d)

Figure 1. (a) A single pyramid Unit (b) Six pyramids assembled to form a cube (c) A single unit with its solar panels folded (d) A single unit with its solar panels deployed.

Assembling six pyramids therefore leave a cavity of 5 cm x 5 cm x 5 cm in the center. This space is mainly intended for battery (Figure 1(b)).In contrast to usual cube sat structure; this structure allows us to setup observatory equipments to all six sides. Additionally, as the structure is made of six individual units, we can design and test each mission as a unit. This will further shorten the length of cubesat development period. Our aim is to adopt lego style architecture for cubesat. Of course, this will not allow us to build structure like 2u (10 cm x 10 cm x 20 cm), 3u (10 cm x 10 cm x 30 cm) cubesat format. By increasing the base size of the individual pyramids, the size of the cubesat can be increased. Each unit has 2 solar panels. The solar panels match the size of the base of the pyramid structure. Two solar panels are deployable and they fold on top of the other as seen in the Figure 1(c). The units are assembled alternatively, so when the solar panels are deployed they take the form as indicated in this Figure 1(d).



(a) (b) (c) (d)

Figure 2. (a) Cross sectional view of assembled nanoSat with solar panels deployed (b) Exploded view of nanoSat (c) Trimetric view of proposed model (solar panels undeployed) (d) Trimetric view of proposed model (solar panels deployed).

In our design we could stack three circuit boards on top of another (Figure 2(a)). The board sizes are 6.66 cm x 6.66 cm, 8.33 cm x 8.33 cm. Gap between top board and the middle board is 0.835 cm. The gap between lower board and the middle board is 0.88 cm. These boards can either house sensors or control circuits. Top circuit board can be a solar panel,

sensor or a camera as per mission needs. Overall, the structure is entirely modular like lego piece (Figure 2(b)). Cubesat can be assembled and later modified as per mission requirement. Trimetric view of proposed model (solar panels undeployed) and trimetric view of proposed model (solar panels deployed) are shown in Figure 2(c) and 2(d) respectively. Three axis Reaction wheels are very essential for our design as there is a requirement for constant repositioning of nano satellite in order to get the maximum benefit from six open faces. Operating a single axis reaction wheel can take up to 28 watts of power, whereas a typical 1u solar panel can provide two watts of power. Continuous operation of reaction wheel will drain the battery quickly. In addition, it will put increased load on battery, decreasing its longevity. Hence we need to increase the number of solar panels so that it could harness enough power for the equipments to operate properly.

The equipment needed for this satellite is not available in Bangladesh and we have to design this satellite by purchasing equipment's from abroad or we have to design satellite compatible sensors, solar panel, power cells, control systems and mechanical structure and make it from expert countries. We have no highly equipped lab for testing all the equipment's of satellite. We have to test all the equipment, sensors, mechanical structure, solar, panel and lastly the whole satellite. As this is the first time we are starting our research to build our own satellite, so obviously we need a lot of help. LaSEINE lab of KIT, Japan is highly equipped with entire testing facilities for the satellite related equipment's including the whole small size nano-satellite. Hopefully with the help of KIT, testing problem will be solved.

Country : Egypt

Title : UNISEC-Egypt: Work in Progress

Abstract :

Space research at Cairo University has flourished since our first contact with UNISEC in 2011 through Can-Sat Leader Training Program (CLTP1, and CLTP3). Since then, a lot of efforts have been done to improve space research and education in Cairo University. Space Systems Technology laboratory (SSTLab) was established and many students were involved in its activities such as CanSat training program, Cube satellite systems, Quad and Octo-copter, and international competitions participation. This presentation will discuss what have been done in Egypt and steps taken to establish UNISEC-Egypt.

Country (Region): Europe

Title : UNISEC-Europe

Author: Klaus Schilling

Abstract :

Objective of UNISEC-Europe is to motivate by space exploration motivated tasks students of different age classes to promote hands-on activities to realize systems in complementarity to today's more theoretically oriented classes in Europe. Exemplary cooperations concern ground station networks, joint CubeSat missions, and educational workshops / conferences. But also joint proposals for funding at European level supporting these objectives are promoted.

Joint standards in student satellite design are identified as a key issue for exchange of materials between worldwide partners. Therefore in UNISEC Europe emphasis is placed on definition of electrical interface standards for CubeSats. The vision is to support exchanges of satellite hardware at the level of subsystems boards. Thus, subsystems from different suppliers could be flexibly integrated for different functionalities in a specific mission. We want to invite worldwide partners interested in this topic to join our working group in order to generate and promote a standard accepted by a broad international community for the benefit of future international cooperative satellite projects.

Country : Ghana

Title : The Prospects of the Formation of UNISEC-GLOBAL Ghana Chapter

Author : Mr. Manfred Quarshie

Abstract :

Ghana has the prospects of exploring Space Science as it has started taken measures in order to achieve that objective in the very near future and one of the very basic steps to take is through collaborative efforts from the various institutions and Agencies belonging to both the government and private.

Since the launching of the CanSat in 15th May 2013 in Ghana, the interest among institutional leaders and government has greatly increased as engaging them has become easier.

The commencement of the formation of UNISEC-GLOBAL Ghana Chapter started in 2012 with only two intuitions showing interest (All Nations University and Ghana Technology University) as it was highly challenging to bring others onboard merely because space since was something that is new to most institution and also there is not Ghanaian institution having a program in Space and Satellite Technology.

There was a substantial increase in the interest of the formation as other two institutes (Kwame Nkrumah University of Science and Technology and Ghana Space Science and Technology Institute) also came to join the discussions on the possible formation of

UNISEC-GLOBAL as they saw it as a huge benefit to their various institutions and one of the best way to go into Space Science

Ghana's Progress in forming UNISEC took a turn when there was an official presentation on UNISEC-GLOBAL as part of the 3rd Workshop on Space Science and Satellite Technology at ALL Nation University on April 8, 2014 which was used to motivate and encourage other institution to not only showing interest but forming UNISEC Ghana Chapter. In attendance were the following institutions: All Nations University, Kwame Nkrumah University of Science and Technology, Center for Scientific and Industrial Research, Ghana Space Science and Technology Institute, Ghana technology University and University of Energy and Natural Resource. An initial meeting was held just after the presentation as an initial step in forming UNISEC- Ghana it also gave members tasks and vision towards the formation of UNISEC-Ghana.

The final stage for the formation was done in 5th June, 2014 where series of talks and discussions were done among member institutions.

In conclusion, Ghana is almost ready to inaugurate UNISEC-Ghana as there are still meetings going on among member institutions regarding modalities and guidelines in the formation of UNISEC-Ghana Chapter.

Country : Korea

Title : Recent status of CubeSat development as the UNISEC-Global activity: Korea

Author : In-Seuck Jeung, Ji Hyun Park

Keyword: CubeSat, Nano-Satellite, Space Research

Abstract :

Here, current status of CubeSat development in Korea will be summarized and introduced. Two 3U CubeSat developed by KyungHee University, CINEMA, have been orbiting and operating their missions. Followed by CubeSat competition supported by KARI (Korea Aerospace Research Institute), 6 other missions have been awarded to KAIST, Korea Aviation University, Yonsei University in 2013, and KyungHee University, ChungNam University, Chosun University in 2014.

On the other effort, Seoul National University supported by NRF (National Research Foundation, Korea) with the link to EU-FP, has been working on QB50 mission as same as KAIST. In presentation, all the details of each mission, which until now 10 CubeSat activities have been accumulated, will be orally delivered and discussions related with each mission can be made.

Most of missions have been finalized their CDR procedures, and moved to the engineering model development, and initial test, validation, acceptance. Launch campaign would be

one year period from December 2015 until November 2016 by Cyclone in Brazil for the case of Seoul National University as the general schedule of QB50 project, while other 6 missions would have same period of proposed launch campaign. This launch opportunity has been now open for the bid to the proposed launch service agencies, and selection would be announced by the end of this year.

Regarding activities related to UNISEC-Global, Seoul National University satellite team has been granted funding from College of Engineering for hosting Nano-Satellite colloquium. The colloquium is not only intended to gather professors from Seoul National University, but will be held for a meet-up for professors from other universities within Korea who are interested in Nano-Satellites. Colloquium discussions are focused on ideas for future nano-satellite missions, collaboration, and ways of participating in CanSat and/or CubeSat activities. The colloquium will be held throughout the year.

Country : Lithuanian

Title : Lithuanian Small Satellite Activities

Author : Vidmantas Tomkus

Keyword: Cubesat, Cansat, Cansat rocket

Abstract :

As small satellite technologies get more popular and affordable Lithuania has joined the countries operating their own satellites while launching two Cubesat's in the beginning of 2014. The satellites LituanicaSat-1 and LitSat-1 were brought to the International Space Station (ISS) together with other 32 Cubesat's by Orbital Commercial Resupply Services Mission (Orb-1) on Jan 9, 2014 and launched into the space (at an altitude of 420 km) on 28th February 2014. The service was provided Nanoracks LLC, US.

The satellites were developed by two Lithuanian Universities – LituanicaSat-1 by Vilnius University and and LitSat-1 by Kaunas University of Technology as the test and demonstration platforms for future missions, to analyse the possibilities and ways of constructing, launching and controlling CubeSats. Both satellites were 1U Cubesat type, had ARM Cortex M4 On Board Computer, passive magnetic attitude control and telecommunication modules in VHF and UHF bands. Locally manufactured Silicon and GaAs solar panels were tested in the flight. Additionally LituanicaSat-1 had photo camera and radio amateur repeater on-board and Litsat-1 performed the tests of space qualified GPS receiver and radio amateur linear transponder.

Both teams have successful reached all the goals of orbital experimental works, collected the trajectory data and broadcasted welcome message in Lithuanian language from outer space. The operational time of LituanicaSat-1 in the orbit was 5 months, and Litsat-1 faced

an extremely rapid (both in time and compared to other satellites launched at the same time) orbital decay with orbital life of only 83 days. The mission data are processed to evaluate the influence of different deceleration reasons now. According to the comparison of theoretical (computational) and experimental data it was determined that besides aerodynamic drag the damping of the magnetic hysteresis could have considerable influence on the dissipation of the kinetic energy.

The team of Vilnius University works on the design of Cubesat thruster and Kaunas University of Technology develops piezoelectric suspension of the precise Attitude Control System now. The students are involved in the Research and Development works. The components are planned to be tested in the next missions in 2016.

After the participation of Lithuanian representative in the CanSat Leader Training Program (CLTP) in 2012 Lithuanian Space Association organised the first Lithuanian Cansat (CS) and Unmanned Aerial (UAV) competition in 2013. Ten Lithuanian and one Ukrainian team participated in the event. The Cansat lunch was provided by Space Science and Technology Institute (Lithuania) using Cesaroni Pro-38 rocket motors. The rocket lifted two standard 350 g Cansats into the altitude of 1 kilometre. Additionally the participants attended in the Open class of Cansat's competition (up to 700 g) for the safe landing of the "Eggsat". The second Lithuanian CS and UAV competition is organised in 2014. In the Open class the teams compete supplementary for the precise landing of the Cansat within the radius between 3 and 100 m.

Country : Mexico

Title : Aerospace Systems Develop in Mexico

Author : B. Bermúdez Reyes

Abstract :

Aerospace history begins in Mexico since the early twentieth century. Some events can be numbered in aeronautics, as was the first Naval battle in Topolobampo Port, Sinaloa in 1914, the creation of the Mexican Air Force in 1915, the design and manufacture of aircraft as the "Serie A" "Serie C" and "Serie H", engines like the "Latinoamerica" and propeller "Anahuac" since 1917 in the National Workshops. This technological advancement evolved into aerospace in 1957 when Dr. Gustavo del Castillo y Gama, Juan F. Cardenas and Candelario Perez, began designing rockets and launch pads at the San Luis Potosi Autonomous University, the objective was bombing clouds to generate rain in the Mexican Plateau. Also, they did continue with the development of solid fuel rocket engines for space applications and they built launch pads in the desert state of San Luis Potosi, called "Cabo Tuna". In 1961 at the Autonomous University of Nuevo León Becerra Engineers Miguel Diaz

and Rodolfo Garza Villareal designed and developed a rocket that was launched from a launch pad also built in the Mina town, Nuevo León. After this they continued with the design and manufacture of nozzles for solid rocket motors. In 1959 and 1960 the Ministry of Communications and Transport assigned to P. Becerril Engineer to design, develop and launch the first space rocket SCT-1 and SCT-2 at an altitude of 300 and 400 km respectively in order to obtain atmospheric data from space. With these advances, in 1965 by presidential decree the Outer Space National Commission was created, which was aimed to promote research in satellite systems, meteorological sensors, space law, remote sensing and bioengineering. This development continued until 1977 when another presidential decree disappears. However, in the early 80's, in Mexico, Morelos II and the Solidarity telecommunication satellites were developed. In 1995 and 1996, the National Autonomous University of Mexico developing three satellites: UNAMSAT-1, and UNAMSAT-B and UNAMSAT-3. Of which UNAMSAT-B spent a year in orbit. During the first decade of XXI century Mexican scientists were collaborating on various research projects of space systems internationally. In 2010, by presidential decree, the Mexican Space Agency was created in order to conduct research, linking the various Aerospace activities in the country between public and private, national and international institutions. Currently in Mexico are being conducted researches in thermal insulation systems and cosmic radiation, communications, space propulsion, architecture design of small satellites, space medicine, geological monitoring, etc.

Country : Nigeria

Title : TOWARDS UNISEC-NIGERIA, THE JOURNEY SO FAR

Author : Nnadih Ogechukwu, Etim Offiong, Olaleye Salu

Abstract :

Space education in Nigeria started with the inception of the African Regional Centre for Space Science and Technology Education in English (ARCSSTE-E), a UN affiliated Centre and also one of the activity Centres of the Nigeria Space Agency; the National Space Research and development Agency (NASRDA). ARCSSTE-E’s mandate is to educate all English speaking Africa countries on Space, its benefits to man and how they can participate in it through her Postgraduate Diploma program and series of space education outreach program to schools.

UNISEC-Nigeria idea was proposed by the Nigerian representative in during a meeting held before the first Nano Satellite symposium at Kitakyushu Japan. In view of that, we have successfully trained some students from different Universities on various areas of space systems development (Rockets, Robots and small Satellite) using Cansat as a model as

well as the lessons learned during the CLTPs we participated. As a result of this training, University Students have developed prototype of a Cubesat as a test bed for the technology. Some have also participated in a contest- “Microsoft Imagine Cup” and won awards using Cansat developed by their institution.

In a way to further promote and encourage space system development, ARCSSTE-E has intensify her space education programs towards the tertiary institutions as part of their extra curriculum activities via the space clubs established in those Universities to encourage the students to better understand and take up challenges in this field

This paper presents a detailed description of this contest “Microsoft Imagine Cup” and various prototyped systems developed by some institutions. It will also present a draft structure of UNISEC-Nigeria concept, organizations that will be involved to facilitate her activities, the prospect and how UNISEC-Nigeria can bring all Universities together.

Country : Saudi Arabia

Title : The First Can-Sat Leader Training Program in Saudi Arabia

Author : Sultan Alsultan

Abstract :

This paper reports the first Saudi space science and technology educational program. And it held at the The Environmental Remote Sensing Center “TECRS” for a number of Saudi university instructors and Saudi Arabia specialist. The first course of this program (CLTP1-SA) was held for two weeks from Sept 1 to Sept 4, 2014. Number of participants from different Saudi universities was participating in this first round. In this paper the activities which had been done during these two weeks and the Can-Sats drop test results will be presented.

Country : South Africa

Title : UNISEC-SA Local Chapter: Founding, Structure and Future

Author : Arno Barnard

Abstract :

In October 2014 South African universities and industry will lay the foundations for creating a cooperation structure to further the art of Satellite Engineering in South Africa for the foreseeable future. Currently the major role players providing satellite research and design services are Stellenbosch University, Cape Peninsula University of Technology and two satellite services companies. Other South African universities and national research institutions have expressed interested in participating in the South African Satellite Engineering Consortium effort. During the planned seminar in October, current satellite

research and activities in the satellite field will be presented and showcased by students and attendees. This event will also provide the opportunity to establish UNISEC-SA, a Local Chapter of UNISEC Global. We will aim to create a steering committee, for UNISEC-SA, consisting of a representative from each of the founding members.
The presentation at the 2nd UNISEC Global meeting will report on the success of this event, basic information about the founding members, as well as the plans of UNISEC-SA for the future.

Country : Taiwan

Title : Space research/education activities in Taiwan

Author : Jyh-Ching Juang

Keywords: CubeSat, Microsatellites, Sounding rocket, Space education, International collaboration

Abstract :

The presentation will discuss space research/education activities in Taiwan. Overall, space-related activity is an area that calls for international collaboration such as the endeavour that has been put forth by the UNISEC Global and multiple-disciplinary interactions through the integration of science, engineering, and educational communities. The presentation aims to report some activities in Taiwan in which research on the integration of space instrument, satellite system engineering, and hybrid rocket is performed in a coherent manner at one education organization. The educational program for the training of the student teams will be highlighted. This is followed by the joint projects conducted at the university to seek for the development of sounding rockets, nanosatellites, and scientific instruments. The efforts for the integration in the technical level and management level will then be described. Finally, outreach activities including international cooperation will then be discussed.

Country : Tunisia

Title : Recent advancements in building UNISEC Tunisia

Abstract :

Small satellite technologies will be an important development maker of specific information technology applications in the next decade. Tools, means, production control and lunch accessibility of nanosatellite will allow developing new applications and new services. The impact on society is even more important when countries and governments in developing attached to them. In consequence, with other universities and research centers, we founded a consortium to create UNISEC Tunisia. The group is sensitive to the importance of new

ideas and original technological developments especially for our region needs and local development models.

We present in this paper the recent activity developments of the project and perspectives.

The 4 universities and the Tunisian Telecommunication Studies and Development Center "CERT" in the context of UNISEC introduce new training and new human benefit projects.

We organized special seminars, with a prestigious scientist, to PhD students and senior researchers. To develop technical means, the ground station is under construction at the University of Monastir and cubesat mounting laboratories at the University of Sfax.

New orientation of microelectronics, signal processing, energy distribution, RF and antennas subjects are conducted in relation with nanosatellite design and application. We develop original new microsensors and microsystem elements for space or ground segments.

As an important project, we are currently developing a new mission with CRTEAN to control water quality and quantity. CRTEAN is the Regional Centre for Remote Sensing of northern Africa states. It depends on UN-ECA and is constituted by 7 countries in the sub region of North Africa: Algeria, Libya, Morocco, Mauritania, Tunisia, Egypt and Sudan.

Country : Turkey

Title : UNISEC-TR ACTIVITIES AND DEVELOPMENTS

Author : A.R. ASLAN

Abstract :

Following 1st UNISEC GLOBAL meeting, UNISEC-TR (UTEB) activities have continued within calendar year 2014. Within 2014 UTEB hold 3 meetings (4th to 6th) each one hosted by an institution. Two of them were TUBITAK Space Research Centre and Istanbul Techno polis, both are kin to take role and support UTEB activities, to benefit from the graduates with hands on activities. UTEB hold a two week CanSat Leader Training course, from 15 to 27th of June, thanks to experience gained from CLTP of Japan. Further UTEB CLTP courses will be organized at different UTEB member institutions. Currently UTEB members are looking forward to jointly submit a project proposal to national authorities to receive considerable funding with which a good number of students with practical project experience will be ready to support national and international aerospace industry and research centres, as well as starting their own businesses particularly at university techno cities. Figures 1 to 5 gives examples of UTEB activities held during 2014.

UTEB is also looking forward to establish itself as a legally recognized organization. Preparations are handled with a lawyer who has interest in UTEB and space law.

The presentation will detail UNISEC-TR activities within 2014 and beyond.

Figure 1: Participants of 5th UTEB meeting hosted by TUBITAK Space Research Centre in Ankara, the Turkish Capital city.

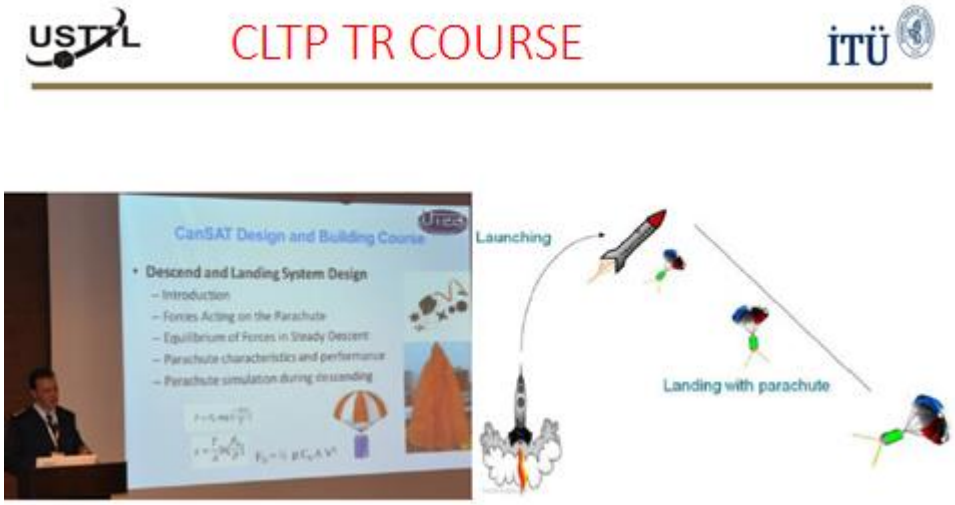


Figure2: UTEB's 1st CLTP Course hold in ITU from 15 to 27th of June, 2014

Figure 3: Launch of CanSats during 1st UTEB CLTP

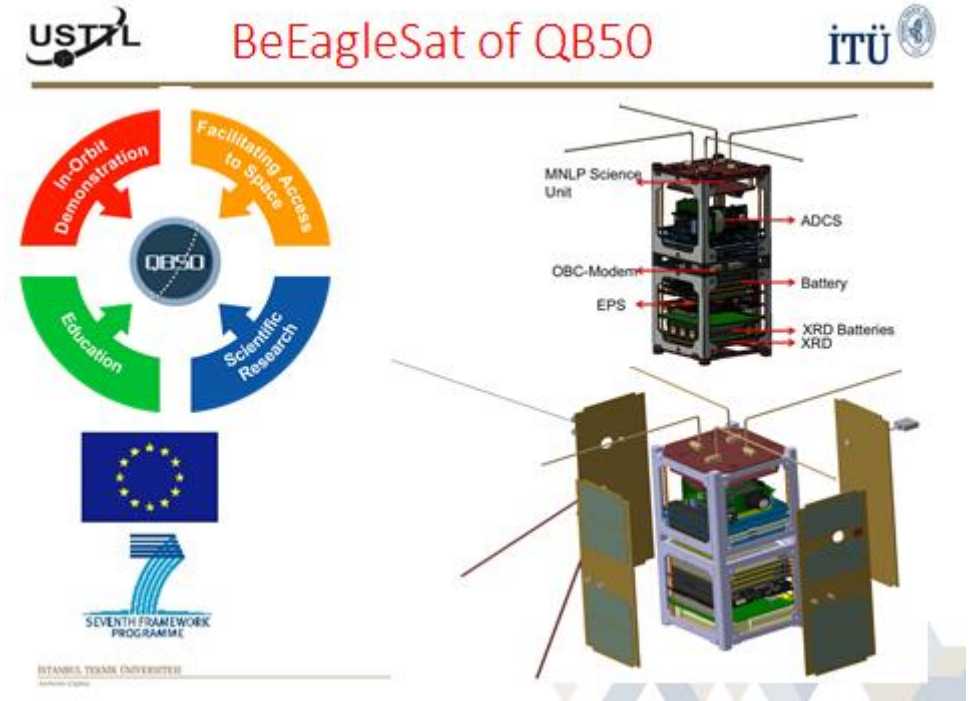


Figure 4: BeEaglast of QB50 jointly carried out by 3 UTEB universities

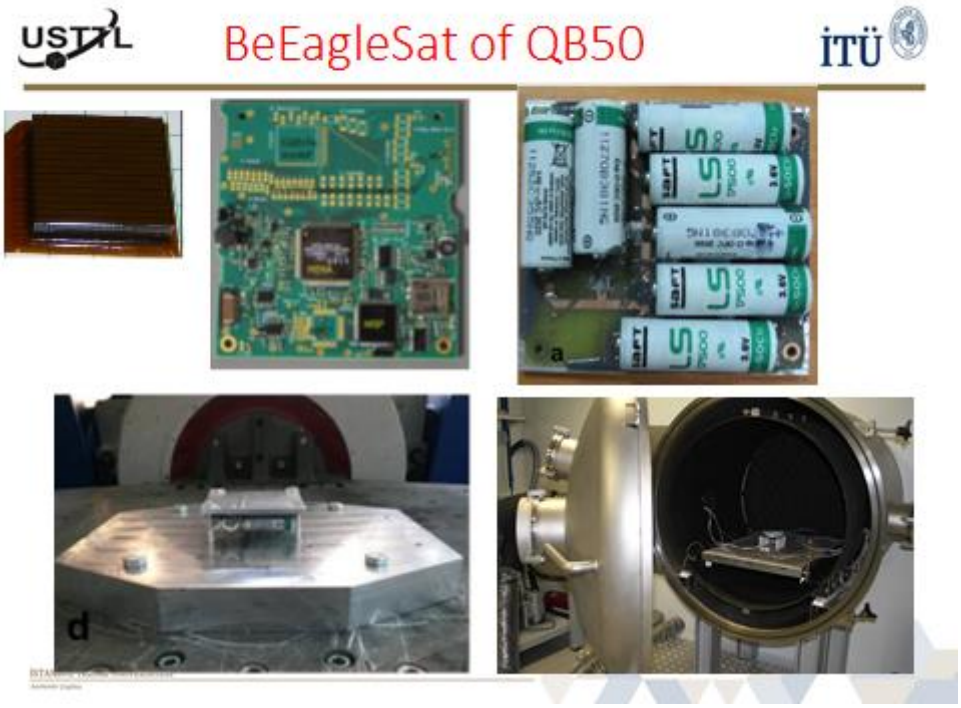


Figure 5: XRD of BeEaglast of QB50 jointly carried out by 3 UTEB universities and student established micro SMEs.