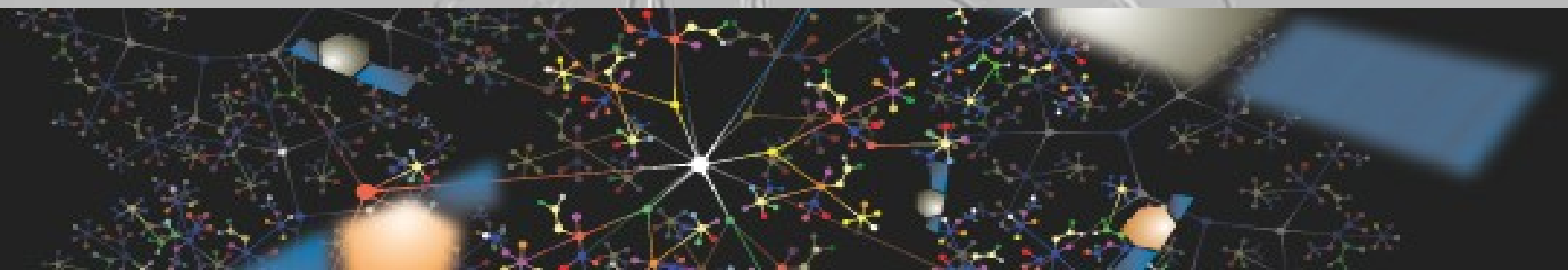




# New Opportunities for Bulgaria in the Area of Aerospace Engineering and Communications

**1<sup>st</sup> UNISEC-Global Meeting, 23-24 Nov., Tokyo, Japan**



# Bulgaria is a relatively old Space State

If you don't know, Bulgaria is a relatively old space country and has a serious experience in the space research since 1972:

- Two Bulgarian cosmonauts;
- Bulgarian big satellites – “Bulgaria-1300”;
- Bulgarian space food;
- Bulgarian space gardens, etc.



# Outline of the presentation

After the increasing of the world-wide interest to the micro- and nanosatellites several new opportunities appeared in Bulgaria in the area of the modern aerospace engineering:

- 1. New project "μSat": for building and launch of small Bulgarian non-commercial Earth-exploration microsatellite;
- 2. New M.Sc. program for combined education of the Bulgarian students in the area of aerospace engineering and wireless communications;
- 3. Establishing of a small Student Space Control Station for satellite tracking, telemetry and communications with space and near to the Earth surface aerospace vehicles;
- 4. Inter-University Relationships and other UNISEC-like activities



# Bulgarian Small Satellite Project "μSat" 2014-2016

**КАПИТАЛ** Абонамент

ПОЛИТИКА И ИКОНОМИКА БИЗНЕС ЛИГТ МУЛТИМЕДИЯ ДЕБАТИ ново (22) КАПИТАЛ КАПИТАЛ DAU.Y K100

**КАРИЕРИ**

- КРИТИЧНИ СЪВЕТИ ЗА РАБОТА, СТАЖОВЕ И ОБЧЕЩА
- КРИТИЧНИ КЛУБОВЕ ПО ИНТЕРЕСИ
- ТРУДОВО-ПРАВНИ КОНСУЛТАЦИИ
- МЕНИДЖЪРИНГ СЪВЕТИ
- ПРОФИЛ НА РАБОТОДАТЕЛИ
- ИНТЕРВЮТА С УСПЕШНИ МЕНИДЖЪРИ

НОВО ДНЕВНИК ВИДЕО

// ПОЛИТИКА И ИКОНОМИКА

**Първи стъпки в аерокосмическата индустрия**  
*До две години България може да изпрати в Космоса малък спътник,*

25 авг 2013, 17:40, 4536 прочитания 18 0052

**Mission Idea Contest (MIC)** shared a link.  
 September 7

Good news!  
 We are pleased to share a wonderful news from Bulgaria.  
 The small satellite mission described in Bulgaria's MIC2 semi-finalist paper won the Bulgarian government grant for the implementation!!

Please take a look at the followin... [See More](#)



**Първи стъпки в аерокосмическата индустрия**  
[www.capital.bg](http://www.capital.bg)

Within 2-3 years, Bulgaria could send into the space a small μ-satellite, which will cover the following three standard functions:

- 1) to collect images from the near space;
- 2) to transmit/receive data for backhaul communications and
- 3) for education purposes.

The developer is a group of companies and scientists together in an Aerospace cluster in Bulgaria

## CASTRA (Aerospace Technology, Research and Applications).

The project already received an official governmental support, being approved for funding under the European Operational Program "Competitiveness".



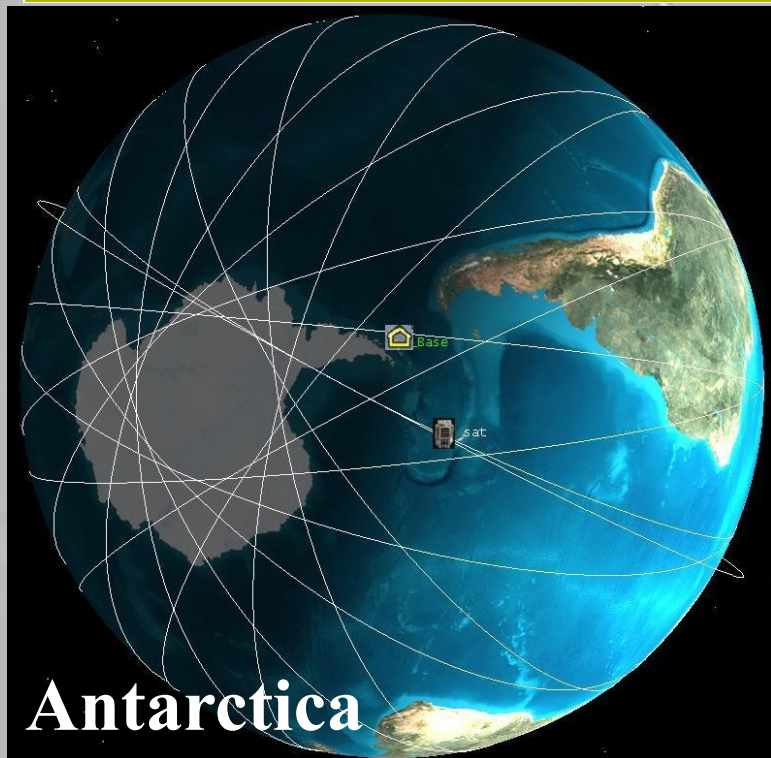
# Communications with the Bulgarian Antarctic Base

One of its issues will be in the field of information services for Antarctica, where communications are very difficult and there teams wait long to transmit data. Orbit may be set so as to pass there from daily or even several times a day, to collect data and to transmit it to Sofia and to other parts of the world in Europe, America, Asia, etc. So researchers can quickly receive feedback and respond as needed. The concept of satellites already been assessed as viable and promising in the International aerospace competition in Japan MIC2 (Nagoya, October 2012)





# Non-Commercial Backhaul Communications with the Polar Region Using University Small Satellites

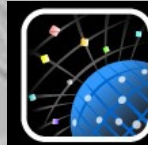


Antarctica



Arctic

Our concept is to standardize and to improve the so-called "*communication function*" of the university small satellites in close-to-circular polar orbit in order to ensure backhaul communications with the Polar regions! (Is this possible in each case for each satellite?)



The 2nd

**Mission Idea Contest**

for Micro/Nano-satellite Utilization



**UN/Japan**

**Nano-Satellite Symposium**

**Nagoya, Japan**

**October 10-13, 2012**

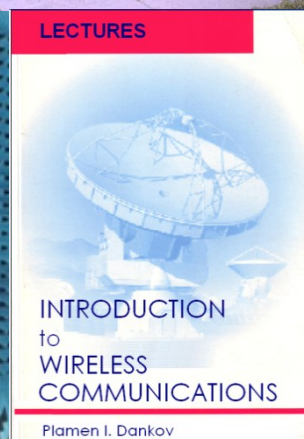
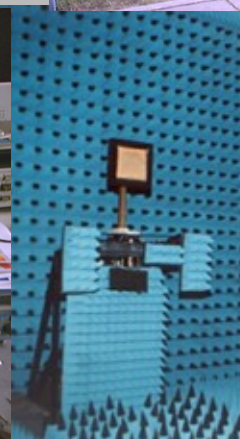
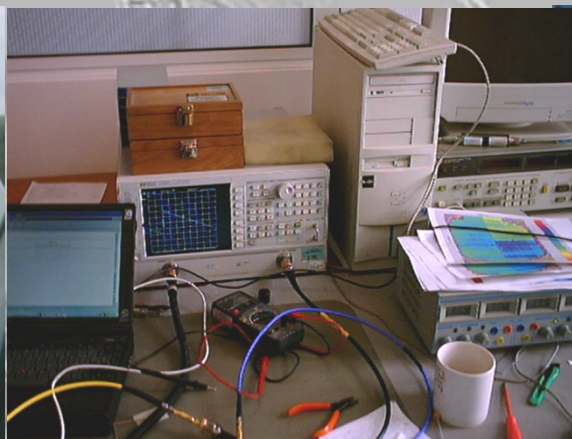
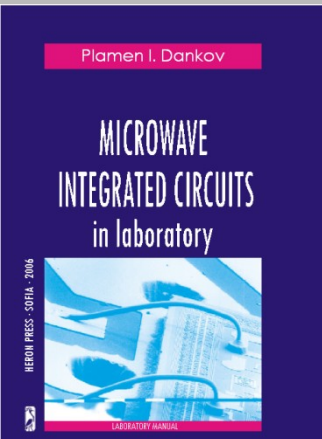
# New M.Sc. Program “Aerospace Engineering and Communications” in Sofia University, Bulgaria

A new master program “Aerospace Engineering and Communications” (in Bulgarian; English or Russian) has been established to “fill up the vacuum” in the modern aerospace engineering in Bulgaria. The program has two modules:

Module 1. Aerospace Engineering (small aerospace vehicles)

Module 2. Wireless and Satellite Communications“

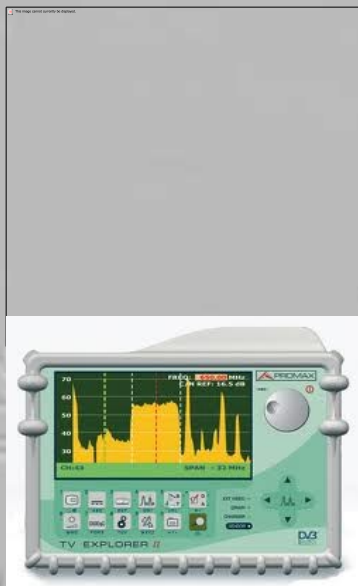
The idea is to combine these areas and to “produce” specialists with MSc. degree in the both areas.





# Small Student Space Control Center in Faculty of Physics, Sofia University, Bulgaria

We consider the project for realization of a small Student Space Control Center ("Project SSCC"; or Satellite tracking ground station) for telemetry and communication with university micro-satellites in the Faculty of Physics in Sofia University, Bulgaria *as a part of other projects*, connected with the new activity in the aerospace engineering sector in Bulgaria. Our partner in this project will be the Sungkyunkwan University (SKKU), College of Information and Communication Engineering, Republic of Korea.



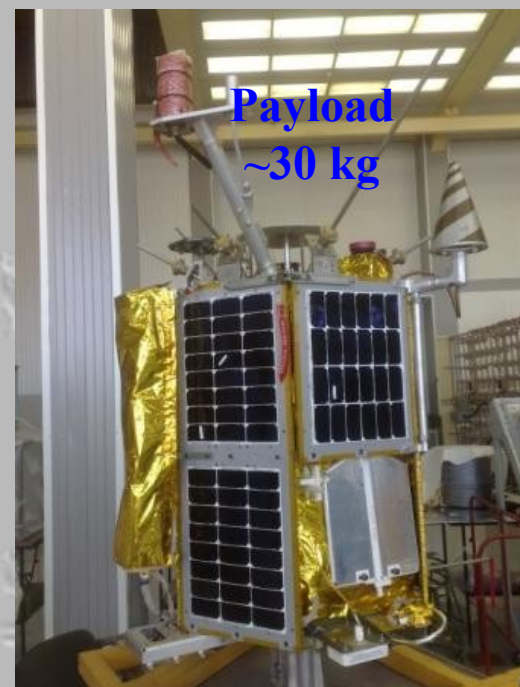


# Expected Functionality of the SSCC in Faculty of Physics

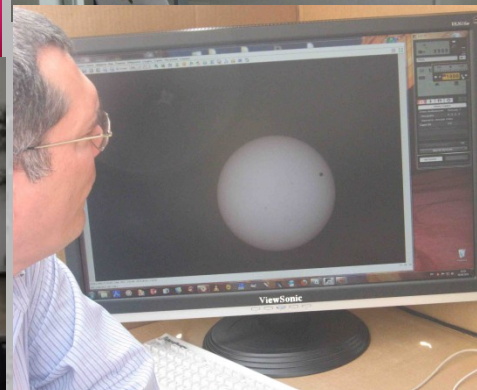
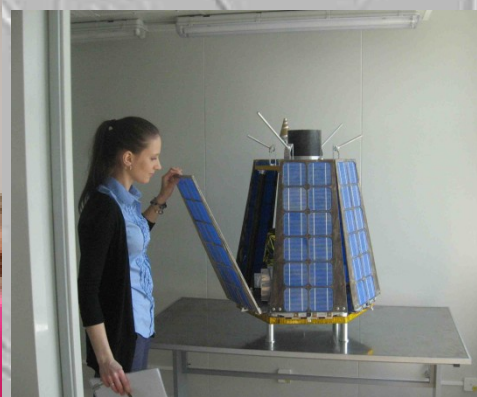
- 1) Tracing of small LEO satellites on orbit through the telemetry channels in VHF/ UHF band.
- 2) Reception of information from the satellites through the existed communication channels (for example, in S band) and its processing, storage, display, documentation, exchange with the partners by land communication systems, etc.
- 3) Implementation of two-way connections (through uplink/downlink channels in the S and even in X band) for implementation of backhaul communications to remote Earth stations that have no other option or have limited opportunities for communication links with the outside world – for example, in Antarctica. This is a function of the "mobile inbox" (through the known technology "store and forward"). In this option we can join the UNISEC Ground Station Network!
- 4) Ensuring possibility for precise determination to the distance to satellites and other object by laser rangefinder, mounted near to the communication antennas. Ensuring possibility for on-line visual observation of the LEO satellites or other objects through small telescope with high-resolution camera, mounted near to the communication antennas.
- 6) Education of students (in BSc. and MSc. degree) applying modern forms of education
- 7) Non-space applications of the Student Space Control Center – for tracking and high-speed communications with aerospace objects with nearer proximity to the Earth surface – meteorological balloons, unmanned vehicles, etc.
- 8) Communication and logistic support of the University Rescue Squad (URS) of Sofia University, which has long history and its team is very active.

# Inter-University Relationships: 1) Sofia University – Siberian State Aerospace University

First of all, in 2012 we signed an Agreement of Cooperation between the Siberian State Aerospace University (SibSAU) in Krasnoyarsk, Russian federation and Sofia University "St. Kliment Ohridski" in Bulgaria. This agreement allows us to exchange students and lecturers, to develop science projects and to use the signals from several existing on-orbit university satellites of SibSAU (RS-22; RS-30; RS-39; RS-40).



Payload  
~30 kg

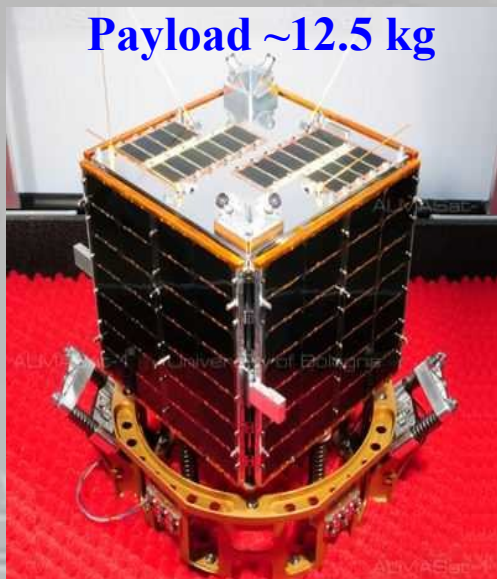


“Yubileiny-2”; 2012;  
SibSAU, Krasnoyarsk



# Inter-University Relationships: 2) Sofia University – University of Bologna, Italy

We started similar inter-university collaboration (based mainly on the new Erasmus+ agreements) with the University of Bologna, Italy; with Assoc. Prof. Paolo Tortora. Since January 2013, Prof. Tortora is managing the ESEO (European Student Earth Orbiter) mission, funded by the Education Office of the European Space Agency (ESA) and led by to the spin-off of the Laboratory of Microsatellites and Space Microsystems (ALMASpace Srl) in collaboration with 10 universities and research institutions in Europe.



“ALMASat-1”; 2011;  
Bologna University, Italy

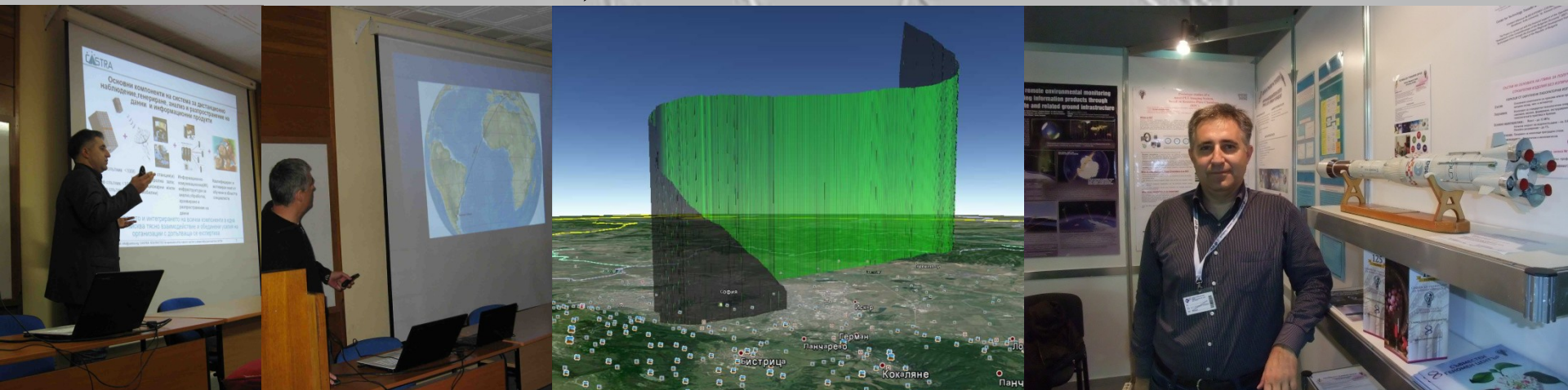




# UNISEC-like activities



We organized MIC2 seminar in February 2012, several students seminars in the area of aerospace engineering and communications, participations in aerospace exhibitions (for example MAKX'2013 in Moscow; Plovdiv fair'2013), several student exercises (meteorological balloons; unmanned vehicles) and other activities.

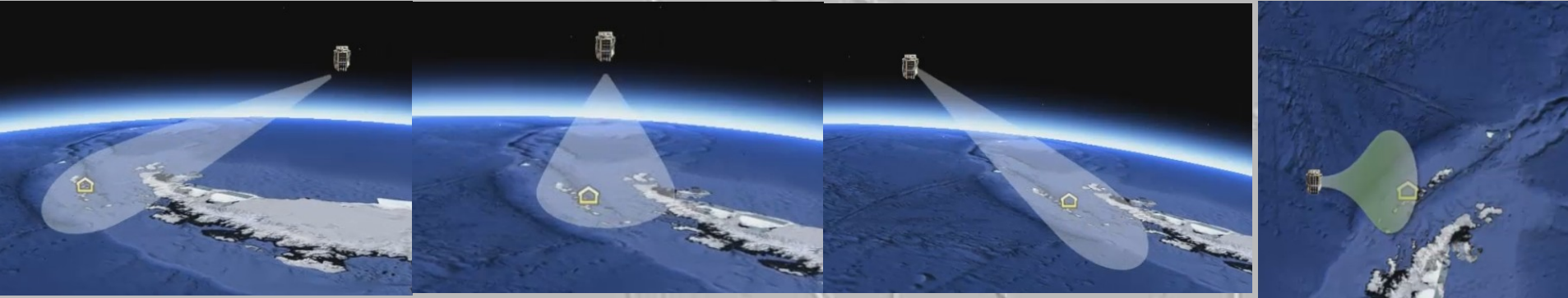


MIC2 seminar, February 2012

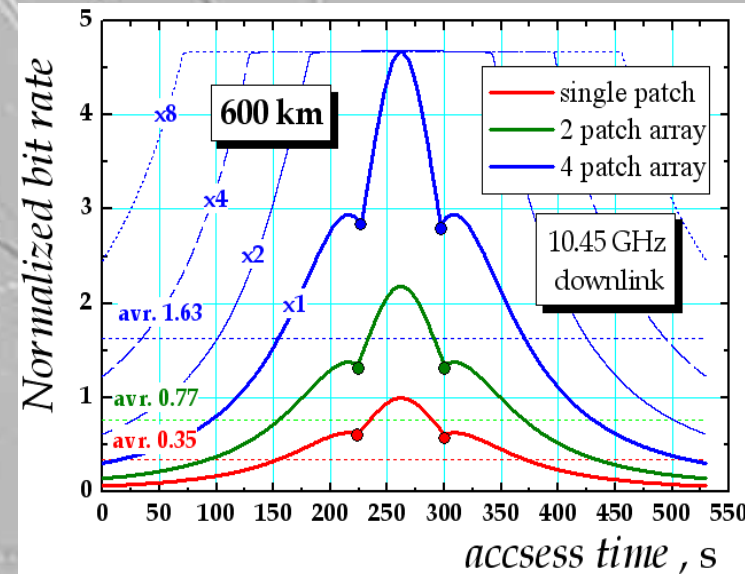




# Topics of the UNISEC-like activities in Sofia University – 1) Extended Communication Sessions



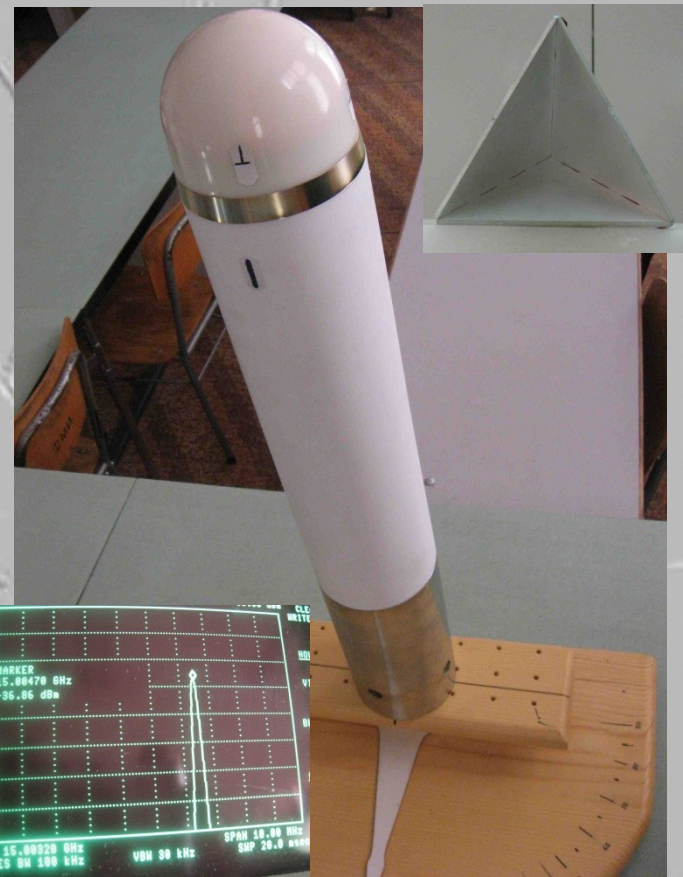
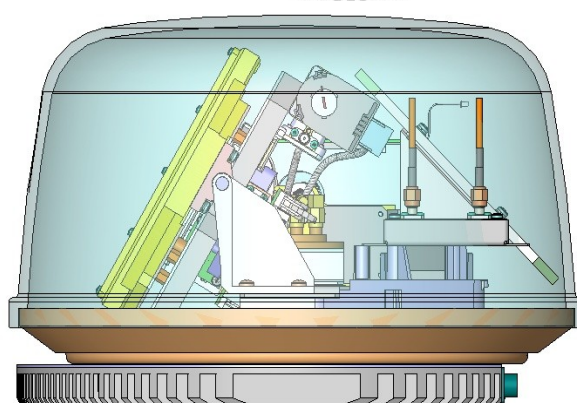
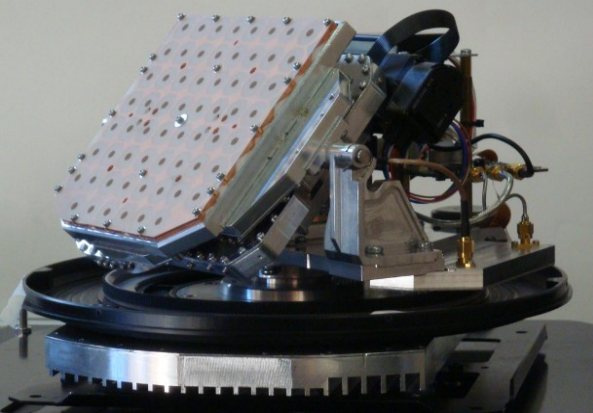
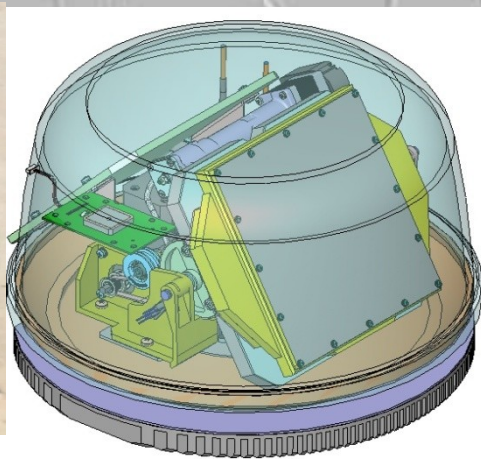
The communication session can be prolonged using switchable on-board antenna panel with 5 faces. Thus, 4-5 communication sessions with one base station in Antarctica can be organized: 1 on “base” orbit and 2-3 on “side” orbits.



## 2) Other topics

“On-the-move” antenna ground stations for satellite signal reception, mounted on land-mobile vehicles (through the Bulgarian company RaySat BG, part of the Gilat Networks).

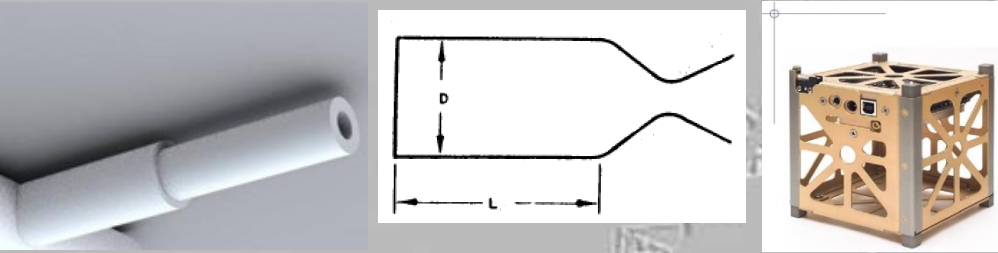
Radar-cross section (RCS) measurements of flying objects.





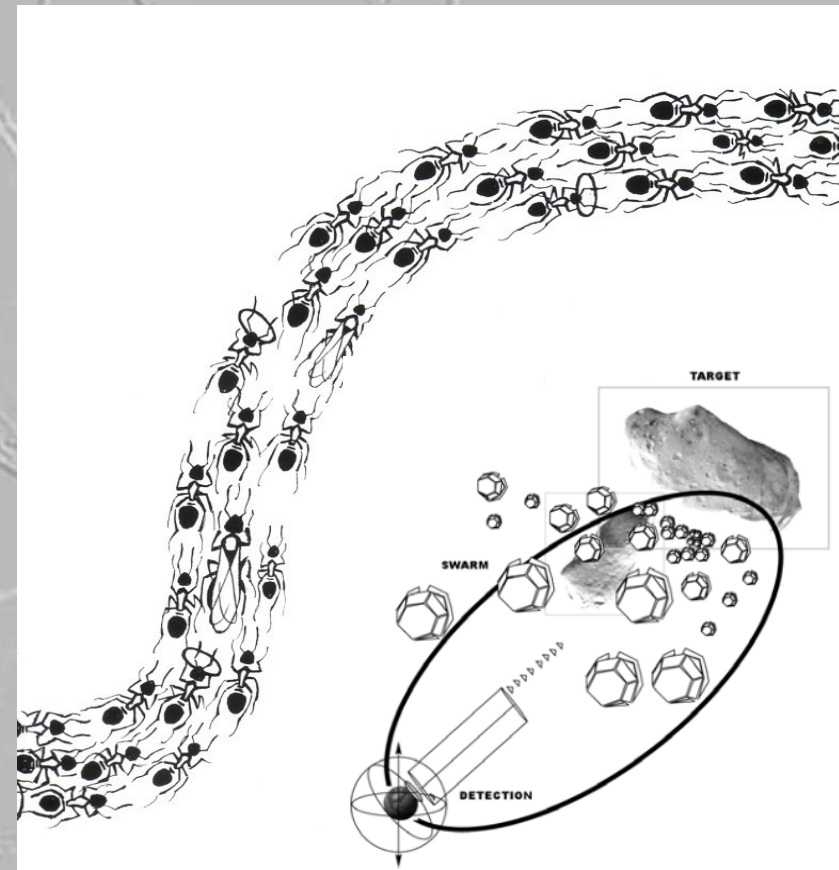
### 3) Other topics

Experiments with atmospheric-pressure plasma sources, possibilities for building of small plasma thrusters for CubeSats orbit maneuvers and ideas for the safety discontinuance of the small satellite missions.



Argon-plasma jet in atmospheric pressure, experimentally observed in Faculty of Physics

Development of the ideas for investigation of the group of small micro- and nanosatellites under the “swarm intelligence” concept and possible applications





# Point Of Contacts (POC for UNISEC-Global) and Regional Coordinators (MIC2 and MIC3) for Bulgaria

## See the sites:

<http://www.unisec-global.org/pointofcontact.html>

<http://www.unisec-global.org/dankov.html>

<http://www.spacemic.net/regionalcoordinators3.html>

Assoc. Prof. Plamen Dankov,  
Sofia University “St. Kliment  
Ohridski“, Faculty of Physics;  
5, J. Bourchier Blvd., 1164-Sofia,  
BULGARIA

PhD Vesselin Vassilev,  
CEO of CASTRA (Cluster for  
AeroSpace Research, Technology and  
Application); 30, Boris Rangelov Str,  
1138-Sofia, BULGARIA

## E-mails:

[dankov@phys.uni-sofia.bg](mailto:dankov@phys.uni-sofia.bg);

[PlamenD@gilat.com](mailto:PlamenD@gilat.com)

## E-mails:

[vesselin.vassilev@castra.org](mailto:vesselin.vassilev@castra.org);

[info@castra.org](mailto:info@castra.org)





CASTRAS

**Thank you  
for your  
attention!**

