59th Virtual UNISEC-Global Meeting

Nikolay Tomov

UNISEC – Bulgaria Chairman, CASTRA Board Member

BULSIM Chairman

SEE Operations Chair

History of Local Chapter Activities

- Established in 2018 legally managed by CASTRA *
- Adopted Guiding Principles of UNISEC-Global
- Follows the Vision of UNISEC-Global

- *Participated in MIC in 2012, 2016, 2019*
- *Attended UNISEC-Global Meeting in 2013, 2016, 2017, 2018, 2019, 2021, 2024*
- *Participated in CLPT8*
- *Organized MIC Seminars, Workshops in 2012, 2013, 2016, 2018*
- *Held CanSat/HEPTA-Sat Training Program/Competition in 2016 and 2017*

** **Cluster AEROSPACE TECHNOLOGIES, RESEARCH AND APPLICATIONS (CASTRA)** is an industry driven non-government organization – cluster, consortia of technology driven SMEs, Academic and research organisations and other professional NGOs, all developing technologies, products and services in the aerospace domain.*

RADIATION HARD ASIC Design & Test

MEMS

Sensors and actuators

GNSS tracking solutio

Moon base greenhouse simulation study

Embedded IoT systems

Example of a federated modeling and simulations of space infrastructure & virtual reality tools

RF systems design

High-reliability digital electronic systems

UAV systems

Vertical takeoff and landing Low profile disc shaped UAV

MW Antennas

Satellite communication systems

Jet UAV shooting targets

Dron detection and counter measures system

Visual-MWIR camera, laser range finder,spectral analyzer, jammer

carbon fiber products for automotive, space, robotics, consumer

Multi-spectral camera prototype with integrated high-speed downlink

missions design. EO imaging and data comm payload development

FMCW panoramic drone radar

Design & manufacturing of specialized equipment and industrial systems

Software tools

AI & BigData tools for satellite based ICT systems

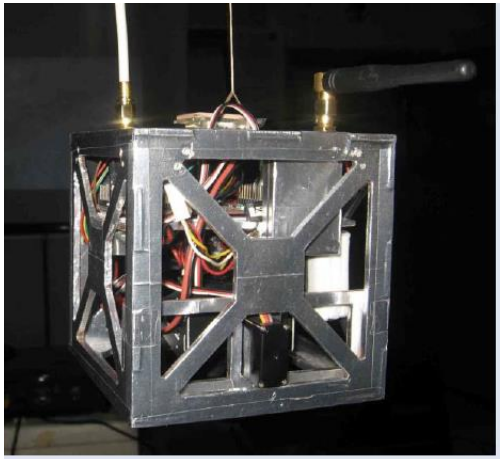
Multispectral and SAR remote sensing data processing from air/space born sensors

UNISEC GLOBAL
University Space Engineering Consortium

Hosted UNISEC-Global Events

- 4th UNISEC – Global Meeting in 2016
- 7th Nano-satellite Symposium in 2016
- 4th Mission Idea Contest for Micro/Nano-Satellite Utilization in 2016
- 1st Deorbit Device Competition in 2016
- Hepta-Sat Training in 2017
- CanSat Training Competition in 2019

CubeSat and CanSat for Education



University Members

University members of UNISEC-Bulgaria:

- Sofia University
- National Military University
- Varna High School of Mathematics (associate)
- Technical University – Plovdiv
- Aerospace Technics and Technologies Lab at TU-Sofia (in process)
- Naval Academy – Varna (in process)
- Bourgas University (in process)

Aerospace Engineering
MSc Programs in Bulgaria

1881

Start-ups

Three start-ups initiatied by UNISEC- Bulgaria former students

*51

R&D Initiative for building a Spacecraft

Gives planetary-scale awareness for each organization based on Earth Observation Data

“Space Vision” Ltd.

R&D in aerospace engineering and new technologies

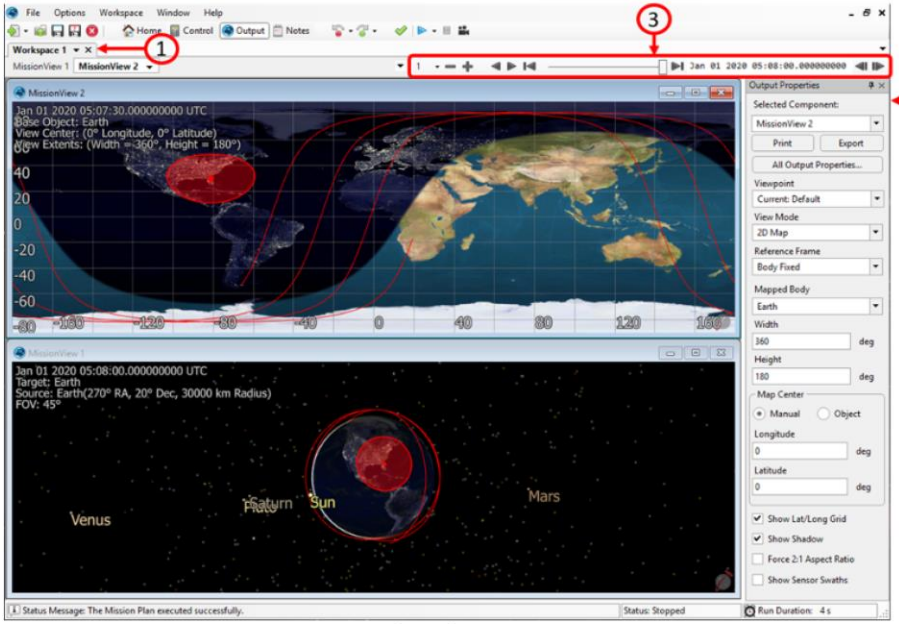
More to come…

SEE
Simulation Exploration Experience

- *Annual Space Simulations initiative for Universities coordinated by NASA experts*
- *Locally supported by UNISEC-Bulgaria and [BULSIM]*

https://simulationexplorationexperience.org

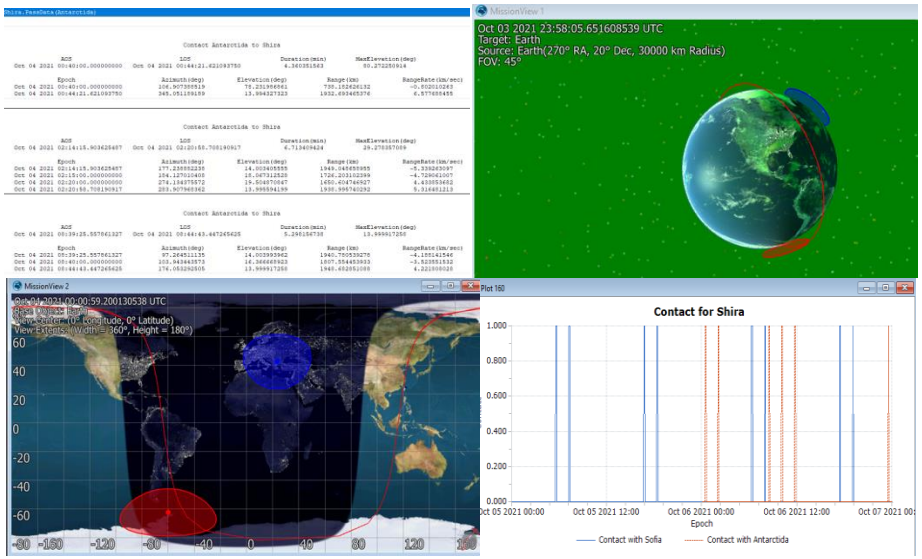
FreeFlyer® Training



The FreeFlyer Output Screen

FreeFlyer® Training for Lecturers

Designing Mission Plans and Satelite Comminications students work by using FreeFlyer®



SYNERGY
Simulation & Training

[Synergy S&T](#) is an official Vallue Added Reseller of [a.i. solutions](#) for EU

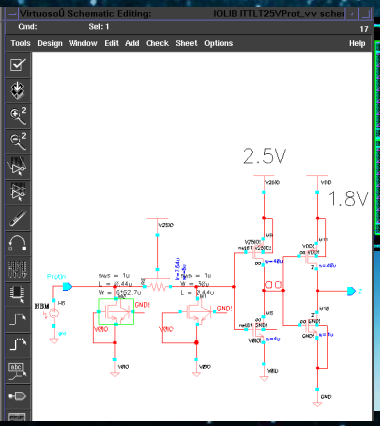
novorell technologies

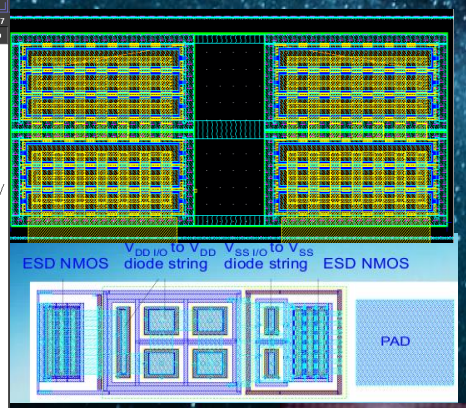
UNISEC BULGARIA
University Space Engineering Consortium

AMG TECHNOLOGY

CASTRA

Radiation – robust Integrated Circuits design libraries and verification tools for ESD reliability in IMEC's radhard DARE IC design libraries for space systems. ESA qualified, Flight heritage.



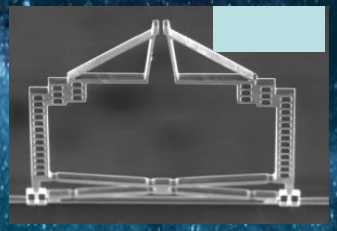


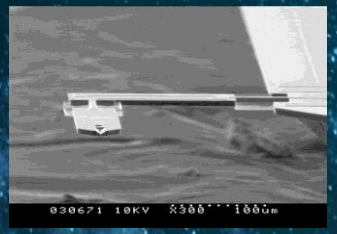
Current TRL: 9

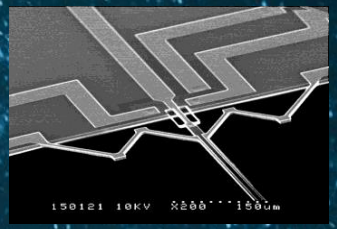
Contact: Dr. Vesselin Vassilev, vesselin.vassilev@castra.org

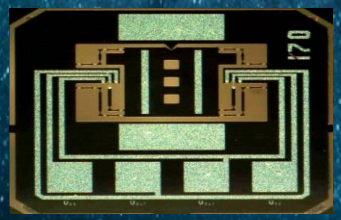
Technology, design and manufacturing of advanced MEMS sensors and actuators for high-precision high sensitivity applications, including avionics, gyro-systems, accelerometers, level meters, force and pressure sensors, gas sensors, bio -sensors

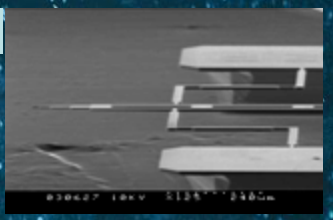
Contact: Mr. Vladimir Stavrov, vs@amg-t.com

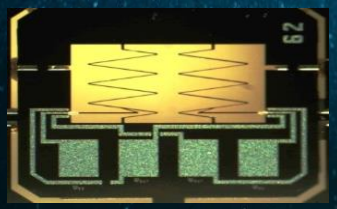


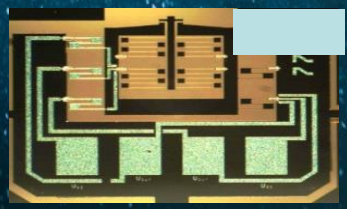










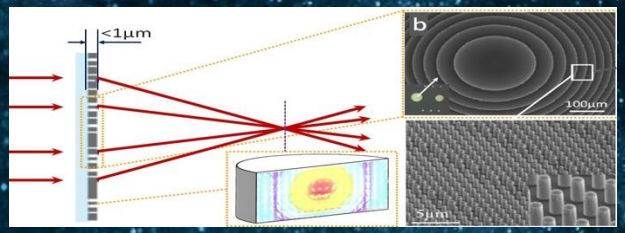


Current TRL: 7-9

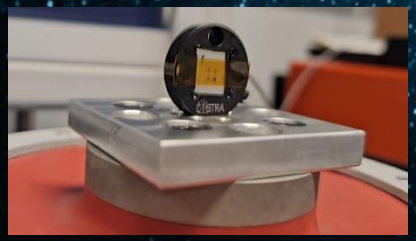
NIR-SWIR meta optics for designing of advanced space based multi-spectral imaging sensors

Contact: Dr. Alexandar Krumov
info@laboraxpert.com

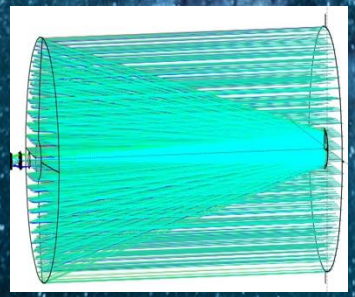
The nano-fabrication *technology* allows creating novel lightweight, complex functionality optical elements to be used in the design of advanced space application optical systems for remote sensing of Earth and planets



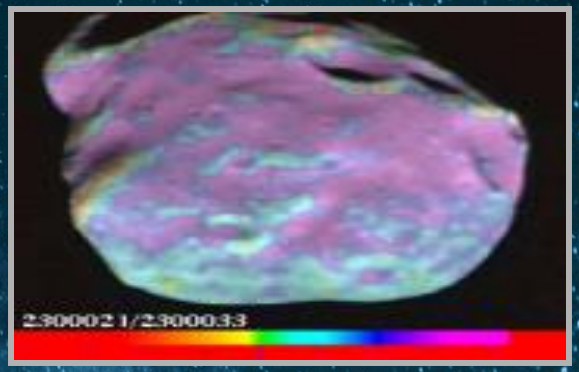
nano-fabricated meta-lens structure



Meta-lens assembly in a random vibration test system for space environment testing



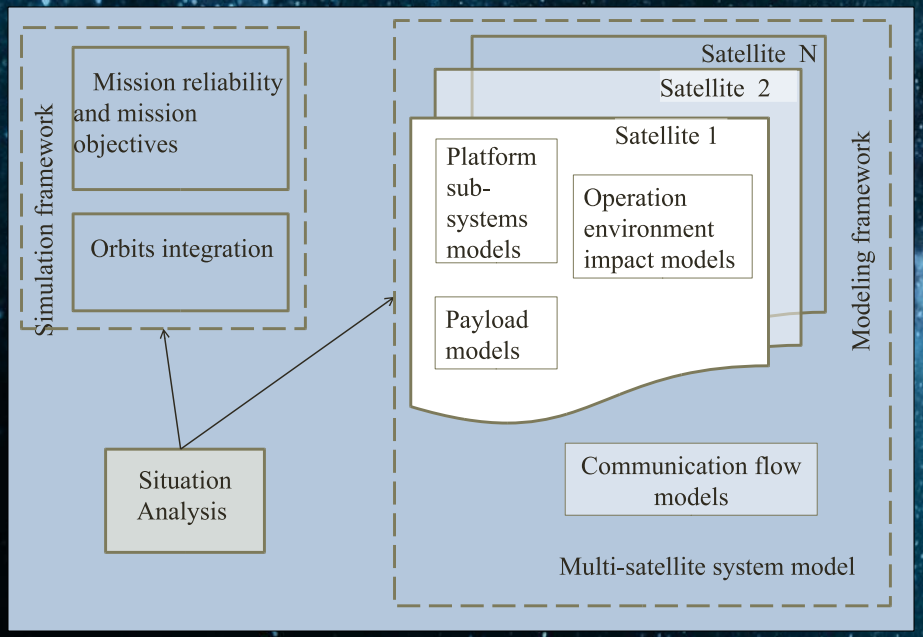
The novel meta-lenses are to be used in the design of advanced new space based remote sensing imaging systems



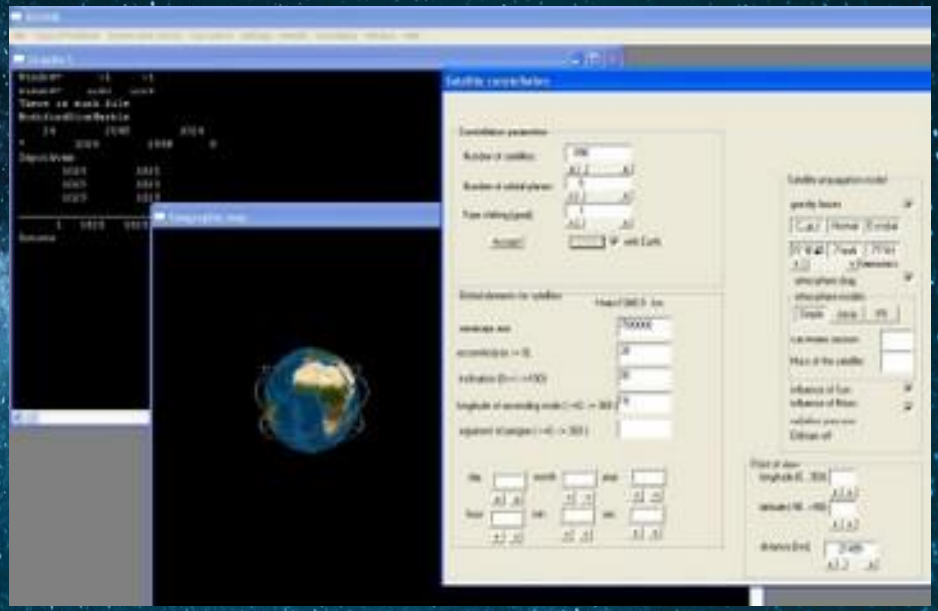
Actual multi-spectral image (in artificial colours) o the Mars moon Phobos, achieved during the international Phobos space mission of 1988. The image is from a dedicated design of a remote sensing imaging spectrometer, largely developed by Bulgarian scientists from SRTI-BAS.
New image sensors using meta-optics are to be developed for remote sensing missions of Earth and Solar system bodies.

Model Based System Engineering (MBSE) software instruments for multi-physics multi-satellite and flexible space missions analysis and payload operation scheduling

Contact: Dr. Atanas Atanassov, at_m_atanassov@yahoo.com, SRTI-BAS



Basic functional modelling and simulation elements of a software tool for analysis of a multi-satellite system.



Example definition of a satellite constellation within the developed dedicated simulation environment

GEO Communication Products and Services

Contact: Mr. Plamen Petkov, inquiries@bulgariasat.com

BulgariaSat

www.bulgariasat.com

Bulgaria's first geostationary communication satellite BulgariaSat-1

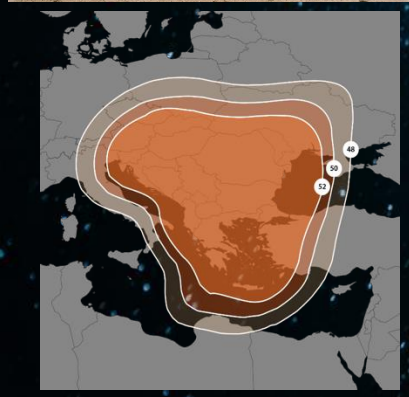
BulgariaSat-1 provides reliable satellite communications solutions to broadcast, telecoms, corporate and government customers in Europe , Middle East, Africa, Caucasian region

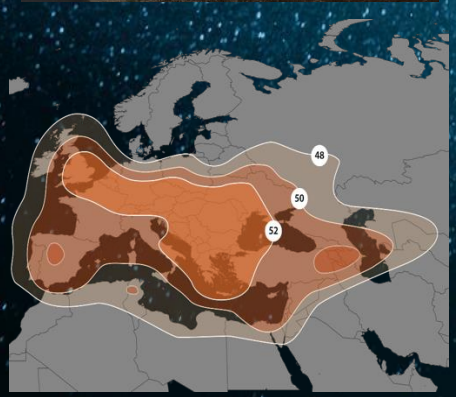
Payload: 30 Ku-band BSS transponders and 2 Ku-band FSS transponders

Standard: DVB-S/S2/S2X

Services:

- Direct-To-Home (DTH) TV
- VSAT Communications
- Corporate Networking
- Occasional Use & SNG



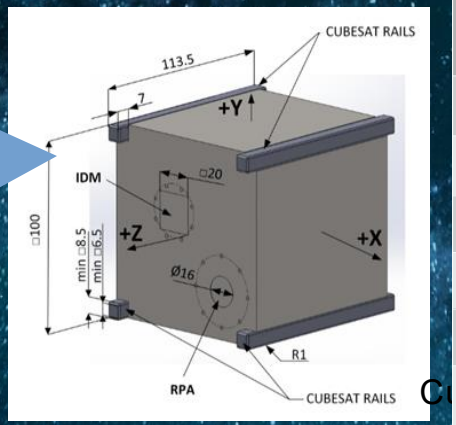


Ion Drift Meter and Radio-Frequency Mass-Spectrometer (IDM/RFMS) payload for ionosphere EO applications using cubesats

Contact: Dr. Ludmil Bankov, ludmil.bankov@gmail.com

The 'BULGARIA 1300' research satellite of the 1980's, and one of its payloads – the IDM/RFMS device as mounted on the outer surface (shown in the circle).

A sketch of the newly designed IDM/RFMS CubeSat module (Z-axis along satellite velocity vector)



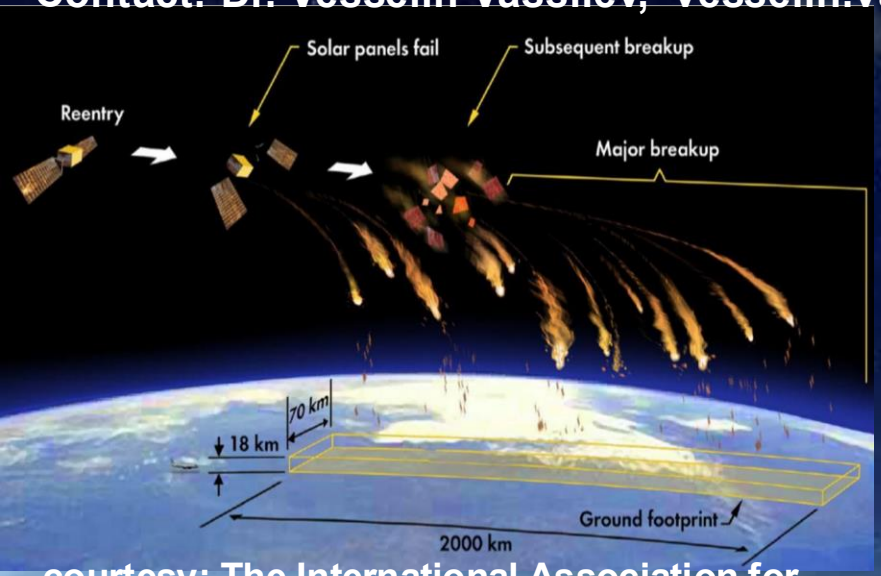
The expected performance of the new 1u cube-sat IDM/RFMS module

IDM/RF Parameter	Abr	Range	Sensitivity	Accuracy	Orbital resolution
Ram Ion Drift Velocity	$V_{d\parallel}$	± 5000 ms^{-1}	~50 ms^{-1}	~5%	500m
Transverse Ion Drift	$V_{d\perp}$	± 5000 ms^{-1}	~5 ms^{-1}	~5%	500m
Ion Density	n_i	10^6 – 10^{12} m^{-3}	$10^6 m^{-3}$	~2%	<10m
Ion Mass Spectrum	m_i	1-56 amu	M/ΔM ~ 60	~2%	500m
Ion Temperature	T_i	300°-10000°K	~25°K	~5%	500m
Ion Density Irregularities	$\Delta n_i / n_i$	0.1-100%	0.02%	~2%	<10m

The new 2023 IDM/RFMS payload Development by Microplus- A Ltd., *under an ESA – PECS contract, is substantially smaller (1u form factor), and is having much improved characteristics compared to the* 1980's design.

National Space Debris Re-entry Risks Assessment portal(s) - in development

Contact: Dr. Vesselin Vassilev, vesselin.vassilev@castra.org

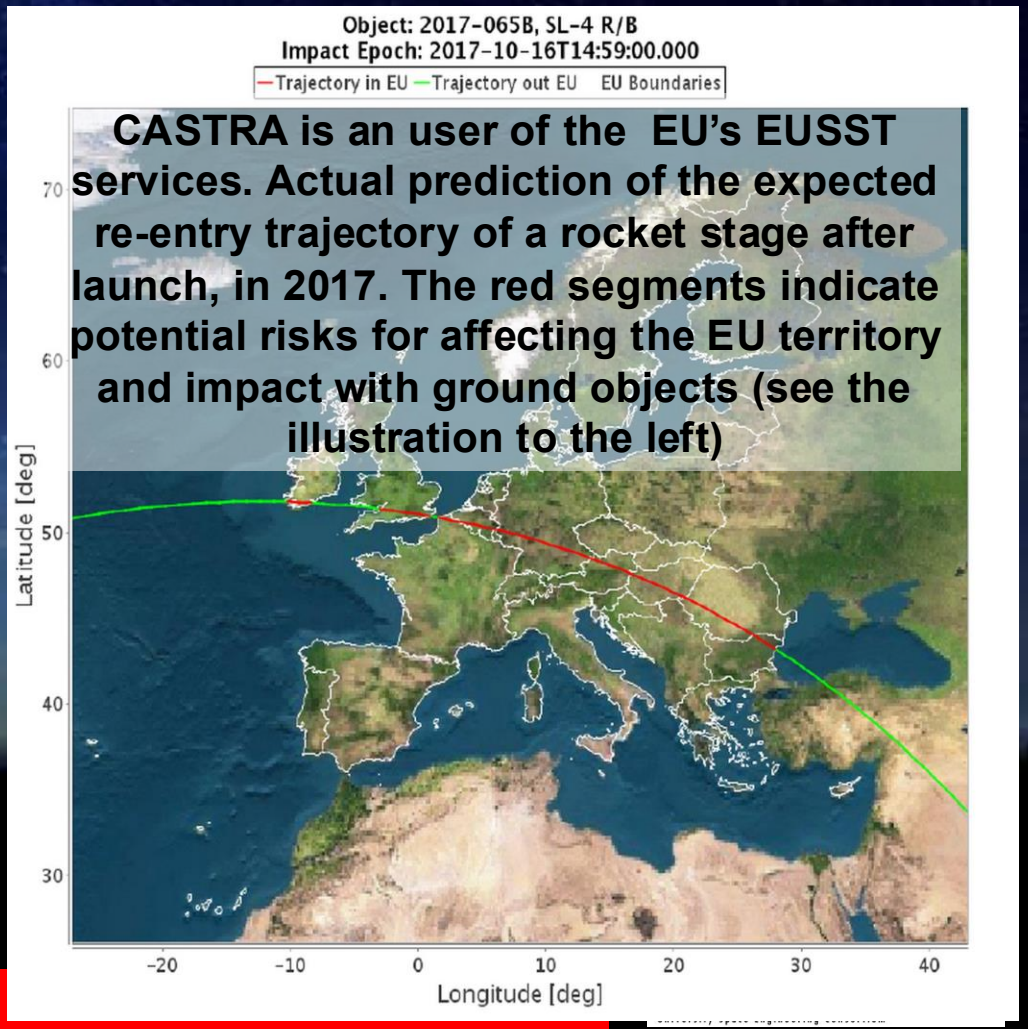


courtesy: The International Association for the Advancement of Space Safety (IAASS)

Space debris re-entries pose increased risks to people on Earth.

The Image shows a piece of a SpaceX capsule, which crashes to Earth in Australia in 2022.

https://www.bbc.co.uk/news/world-australia-62414438)



CASTRA is an user of the EU's EUSST services. Actual prediction of the expected re-entry trajectory of a rocket stage after launch, in 2017. The red segments indicate potential risks for affecting the EU territory and impact with ground objects (see the illustration to the left)

Activities for 2025 and beyond

- *Attracting more universities as active members*
- *Supporting the evolution of the Bulgarian National Space Program*
- *Supporting the growth of Aerospace Engineering University Programs*
- *Inspiring students for scientific work*
- *Involving students in practical aerospace projects*
- *Attracting funding from companies*

Let’s get in contact!

NIKOLAY TOMOV
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BULSIM Chairman
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