



Results of space activities are just among us.
Space in your pocket!

2nd International Conference
Space Economy in the
Multipolar World

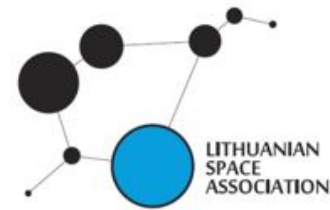
SEMWO 2011 November 16-18, Vilnius
www.space-il.eu

The poster features white silhouettes of various people and objects against a dark blue background with stars and satellite icons. The silhouettes include a man in a suit, a woman with a question mark, a cowboy, a child, an astronaut, and a woman with a shopping bag. There are also icons of a mobile phone, a basketball, and a shopping cart with stars.

SPACE ACTIVITIES OF LITHUANIA

Vidmantas Tomkus, Director
Lithuanian Space Association
18th July 2011, Riga

Mass Media about Space Activities in Lithuania



Secret facilities in Liepiškės, Vilnius district, LNK TV

J. Krilavičius. Vakaro žinios, July 21, 2009

Lithuanian Space Association (LSA)

11 Universities and R&D Institutions

10 Enterprises

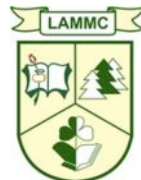


KLAIPĖDOS
UNIVERSITETAS

Nature
Research
Centre



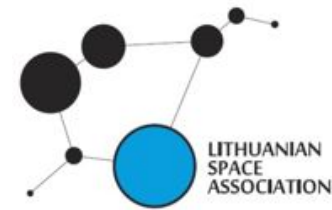
FIZINIŲ IR
TECHNOLOGIJOS MOKSLŲ
CENTRAS



BchI



Activities of Lithuanian Space Association



• Organiser of conferences “Space Economy in Multipolar World SEMWO”

• Strengthening of International Co-operation



• National co-ordinator of GNSS competition Galileo Masters

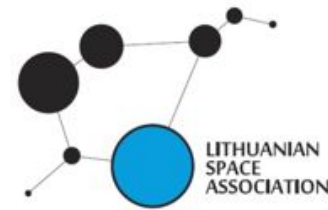


National winner – Žydrūnas Andruška, UAB „TOBE GPS“



GALILEO
Masters

Involvement in FP7 Space Projects



- **MYOCEAN.** The Environmental Protection Agency, EPA;
- **NORDICBALTSAT.** Kaunas University of Technology;
- **SUBCOAST.** Lithuanian Geological Survey under the Ministry of Environment;
- **COSMOS.** Agency for Science, Innovation and Technology;
- **GEOLAND 2.** AEROGEODEZIJOS INSTITUTAS, UAB



Products of AEROGEODEZIJOS INSTITUTAS, UAB

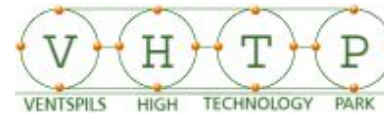
- X3-NOISE Aircraft External noise research network and co-ordination. Vilnius Gediminas Technical University;
- POL GMES Promoting of Polish participation in GMES. Ideal cabin environment. STREP. Vilnius Gediminas Technical University;
- SKY-SCANNER Development of an Innovative LIDAR Technology for New Generation ATM Paradigms. Vilnius University;
- STAR NET – EC ICT Project – Support to Associate Countries and New Member States. Infobalt Association;
- Lithuanian astronomers participate in a number of international projects (CCD photometry of stars)

Top Down vs Bottom Up Approach



1) FP7-Space-2008/11-242427 project „**NordicBaltSat**”

Utilizing the existing and emerging potential of Nordic-Baltic dimension in critical satellite technologies and applications



2) National ESF Project “**SPACETECH**”

- Strengthening of International Co-operation of LSA
- Study on Strategic Research Agenda (SRA)
- Space Science and Technology Institute (SSTI)



NORDICBALTSAT Project

Survey Results in Lithuania

- Majority of responding Lithuanian organizations public institutions, reflected in emphasis on research and pure science
- Large majority of organizations in Technology with focus on space segment
- **Technology**
 - **Ground segment:** Three organizations, one with capability of precise 3D measurement of parabolic antennas, another operating a ground station, and the third engaged in space law
 - **Space segment:** Weighted toward analysis, modeling and metrology, tribology. Lasers and ultrasound techniques also represented
 - **Manned Spaceflight:** Health monitoring, life sciences modeling, space fitness research, food storage and smart foods for space use
- **Downstream**
 - **Interactive:** Wide variety of research disciplines, with interest in doing science in space, from cosmology to life sciences and astronautic medicine. Public institutions influence reflected in large fraction of interactive organizations
 - **Distribution:** Dominated by GIS applications

NORDICBALTSAT Top 10 hits in ESA Technology Tree

- The technology areas, on all three ETT levels are dominated by space segment technology with automation as largest area like:
 - piezoelectric systems, ultrasonic testing, sensors and biosensors, vibration testing, new materials and coatings, mechatronics
 - Very strong laser industry, which should be able to participate in space systems
 - Downstream areas are science of the universe, satellite communications and navigation
- Expertise partly confirmed in survey:
 - Academic overweight might imply long way to implementation/manufacturing
 - Broadband com is interpreted as ground based or know-how based
 - Some areas seem more on conceptual stage (space debris de-orbiting, nano-launchers)

ELLP Synergies and EU Critical Technology Mapping

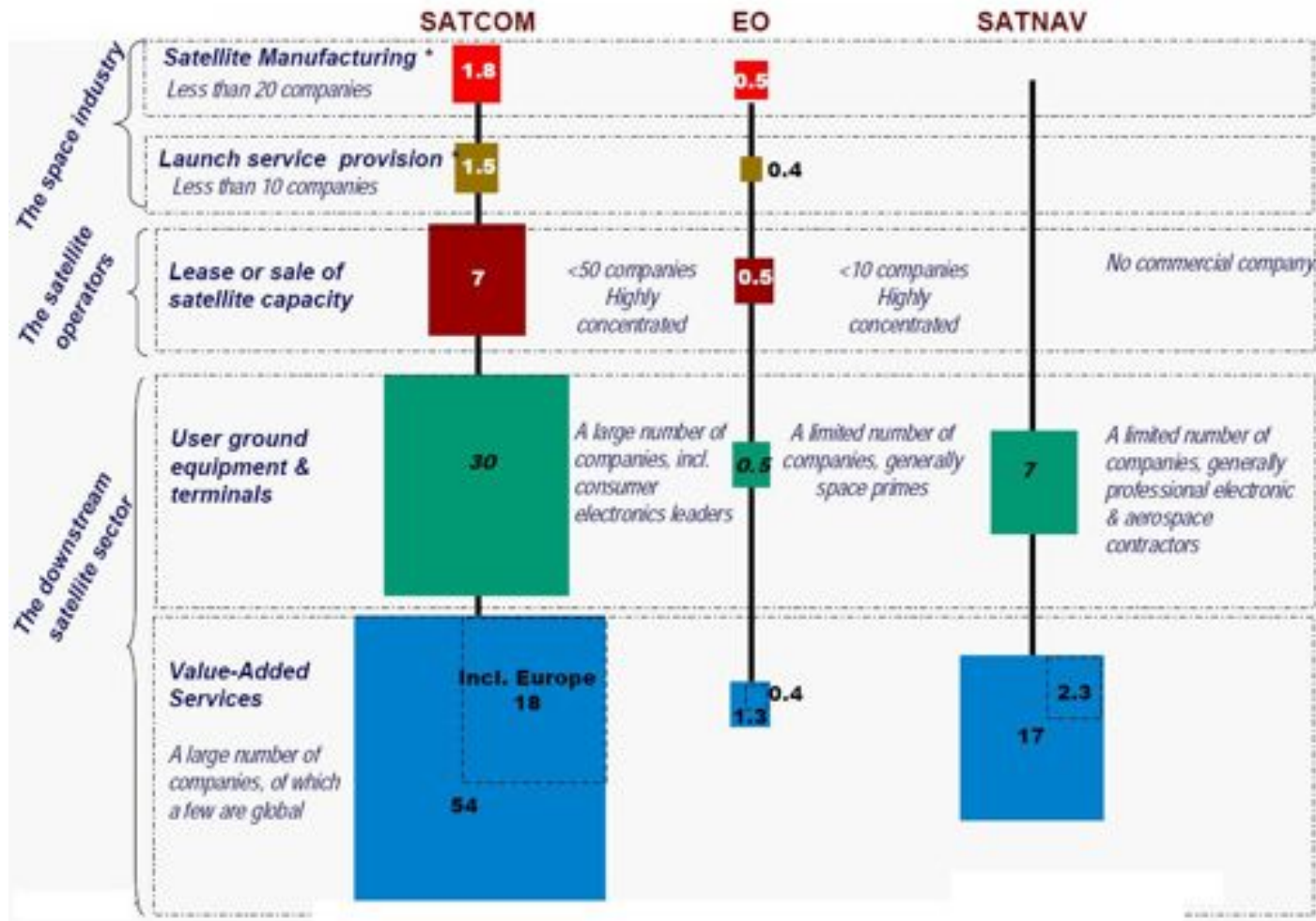
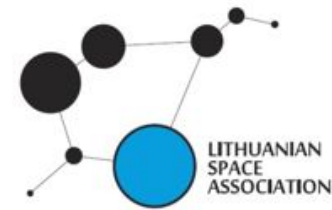
- The strongest ELLP aggregated ETT areas are mechanisms, sciences, materials, software, structure and data systems

Opportunities and Threats of co-operation with ESA

FP7-Space-2008/11-242427 project „NordicBaltSat”

- Utilizing the existing and emerging potential of Nordic-Baltic dimension in critical satellite technologies and applications
- **All covered technology areas would be useful in common projects, but not all are viable in the ESA framework**, e.g. in “overcrowded” technology areas, e.g. on-board computers and software
- **All need national/regional funding to be developed or adapted to ESA conditions.**
 - Established space companies are not keen on added competition
 - Few competitors on system level, competition increases further down in supply chain
- There are **opportunities for a national industry in ESA** if, e.g.:
 - A **national/regional programme** efficiently develops, prepares and uses national capabilities
 - Competitive **cutting-edge technology can be developed/provided**
 - **Cost-efficient solutions** can replace Prime/next level contractor’s previously preferred supply of equipment/services

Space Value Added Chain



Turnover in 2010

SATCOM Lithuania

- VIASAT – 11.6 M€

- Satgate – 9.8 M€

Terra – 8.7 M€

EO Lithuania

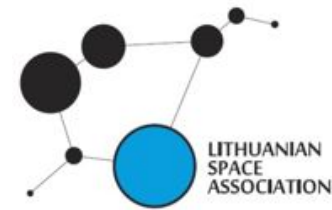
Aerogeodezijos

instiutas – 1.2 M€

SATNAV Lithuania

Space market turnover 2008 m. billions US dollars, Euroconsult 2009

International Co-operation



EUROPE

- European Space Agency
ESTEC/ESRIN
- SSC, Sweden
- NAROM, Norway
- Aalborg University, Denmark
- Von Karman Institute, Belgium
- Delft University, Netherlands
- Surrey University, SSTL, UK
- Bremen, Berlin TU, Germany



USA

- NASA Ames,
- NASA
Goddard
- Caltech, JPL
- Calpoly, San
Luis Obispo
- FAA
- FCC
- Iridium LLC
- Globalstar LLC



RUSSIA

- Lavochkin Association
- MAI
- MTU Bauman
- Samara Aerospace Uni.
- Omsk Aerospace Univ

UKRAINE

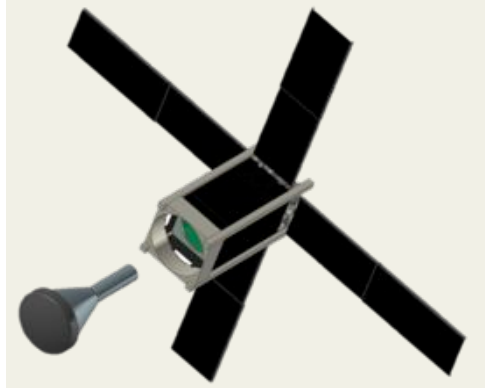
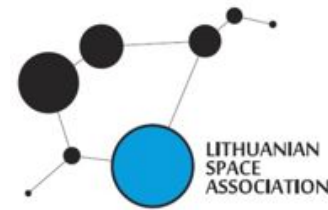
- Yuzhnoe Design Bureau

Japan
China
India





Activities of Space Science and Technology Institute

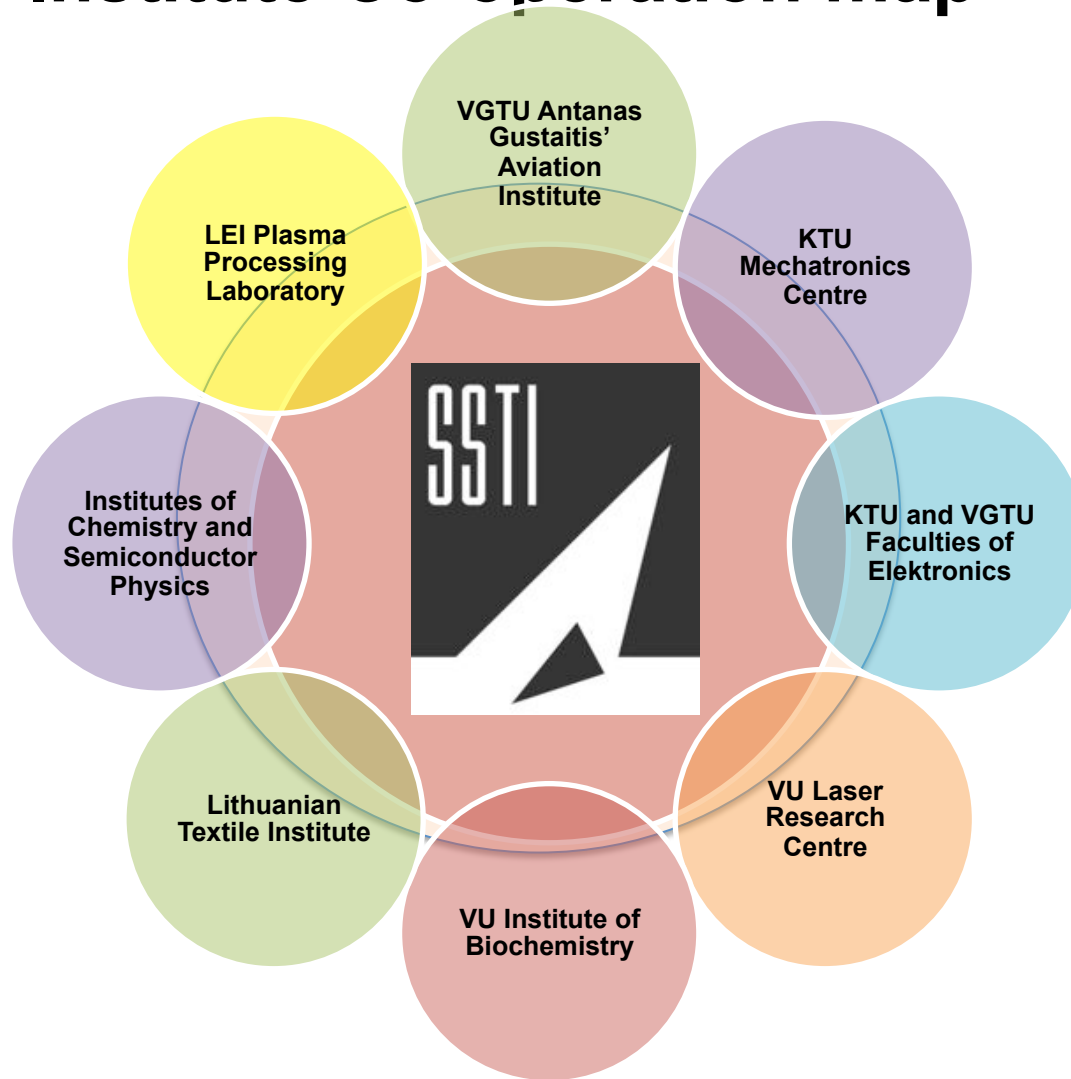
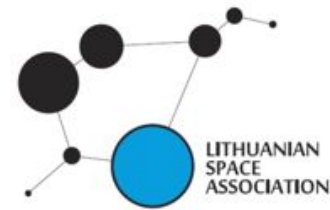


- Unmanned Aerial and Space Vehicles
 - liquid propellant micro engines
 - Orientation thrusters, incl. MEMS
 - Thermo-aerodynamics and Thermal protection systems
 - OBC and ITC systems
 - Systems integration and in-flight tests
 - Bio-pharmacological gravitational tests

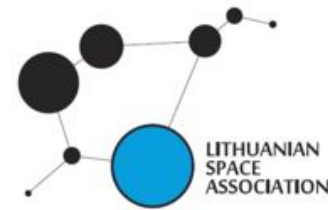


- Aerospace ITC systems
 - Take-up and Processing of Earth Observation data
 - Applications of Satellite Navigation
 - Broadband satellite telecommunications

Space Science and Technology Institute Co-operation map



Project of Lithuanian Nanosatellite



UAB „Konstravimo biuras“ - design of mechanical construction

KTU Mechatronics Centre piezoelectric nanoreaction wheels

UAB “Arcus Novus” – Onboard Computer System design

VGTU AGAI – aerodynamics and orientation thruster design

VU Institute of Theoretical Physics and Astronomy – algorithm of micro star sensor

Institute of Chemistry – galvanic nozzle and cathalyst coating

VGTU and KTU Faculties of Electronics - design of ICT systems

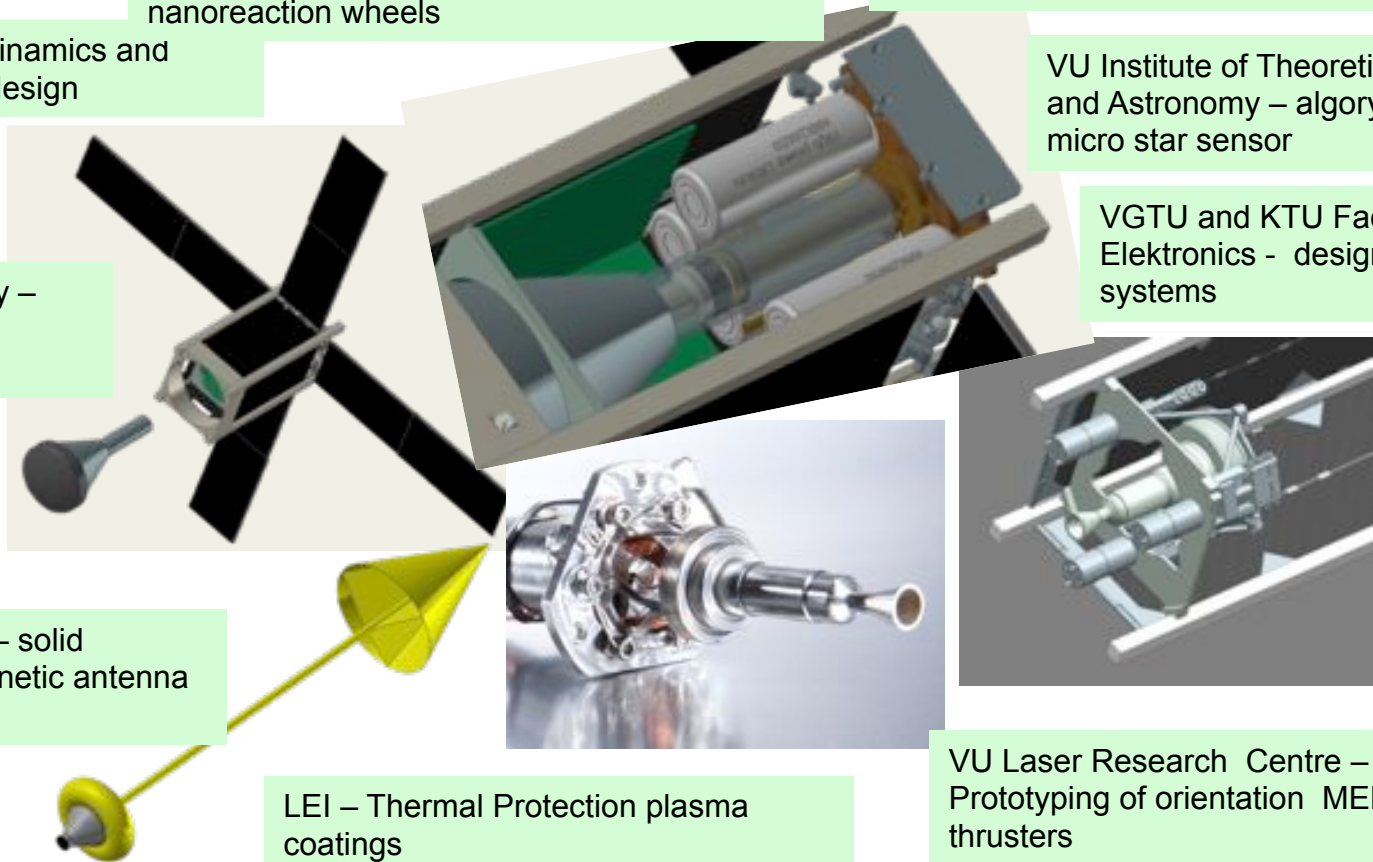
VU Faculty of Physics – solid dielectric and ferromagnetic antenna design

LEI – Thermal Protection plasma coatings

VU Laser Research Centre – Prototyping of orientation MEMS thrusters

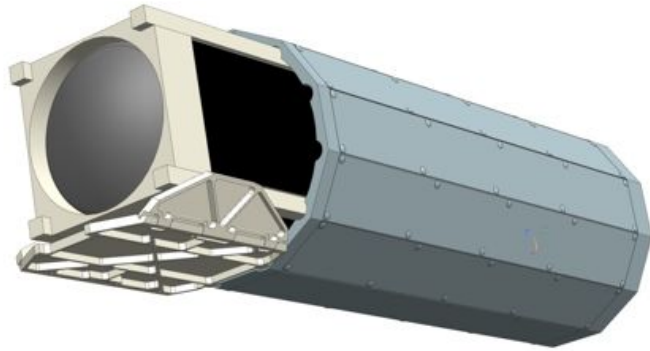
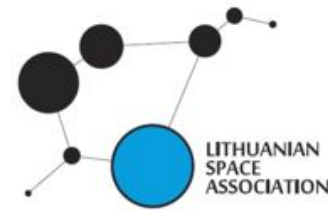
Lithuanian Textile Institute – Thermal protection textile materials

VU Institute of Biochemistry - biopharmacological experiments in microgravity





General Idea of the Project



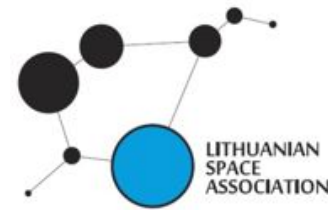
Idea – to design 2U – 3U type CUBESAT nano-satellite with a capsule capable of re-entering Earth atmosphere. It should consist of :

- Service module with active propulsion
- Research module – re-entry capsule with 100 g of scientific payload

1. Satellite under construction should consist of two parts – service module constructed of reliable components and reentry capsule capable of safe bringing down of 100 g of payload;
2. Special heat protection materials and shapes of capsule are investigated;
3. Special high thrust active propulsion system suitable for implementation on nanosats is being developed;
4. Soft landing and on-Earth position determination instrumentation is being prepared;
5. Approaches and technologies tested on the nano-sat under construction could later be implemented on other nano-satellites.



Satellite Thruster and Deceleration



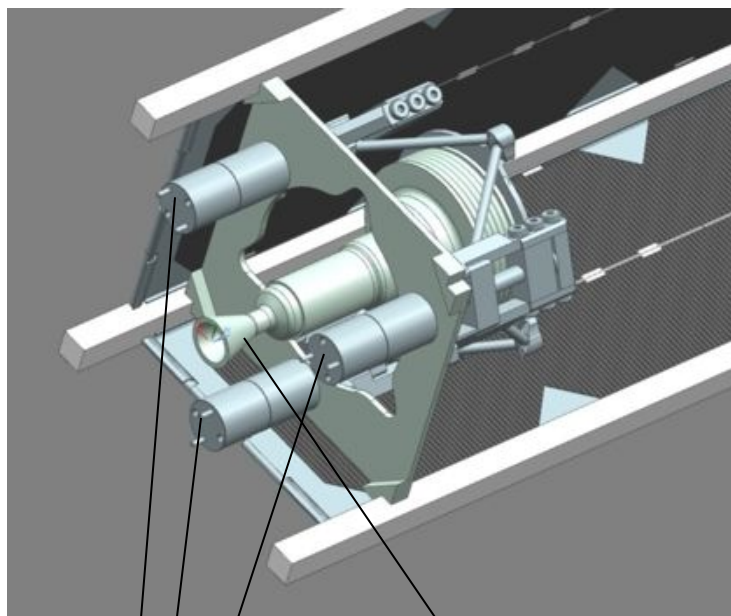
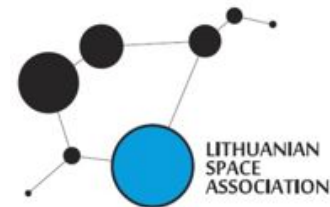
- Initial calculations and construction of low cost simple high power active thruster have been done.
- Mono-propellant 1 N rocket thruster is planned to be implemented



- The thruster to be created (as a final product) should be capable performing during 15-20 min (for deceleration needed for deorbiting) , therefore budget materials and technologies have to be implemented to decrease the cost of the thruster.



Thrust Vector Control System

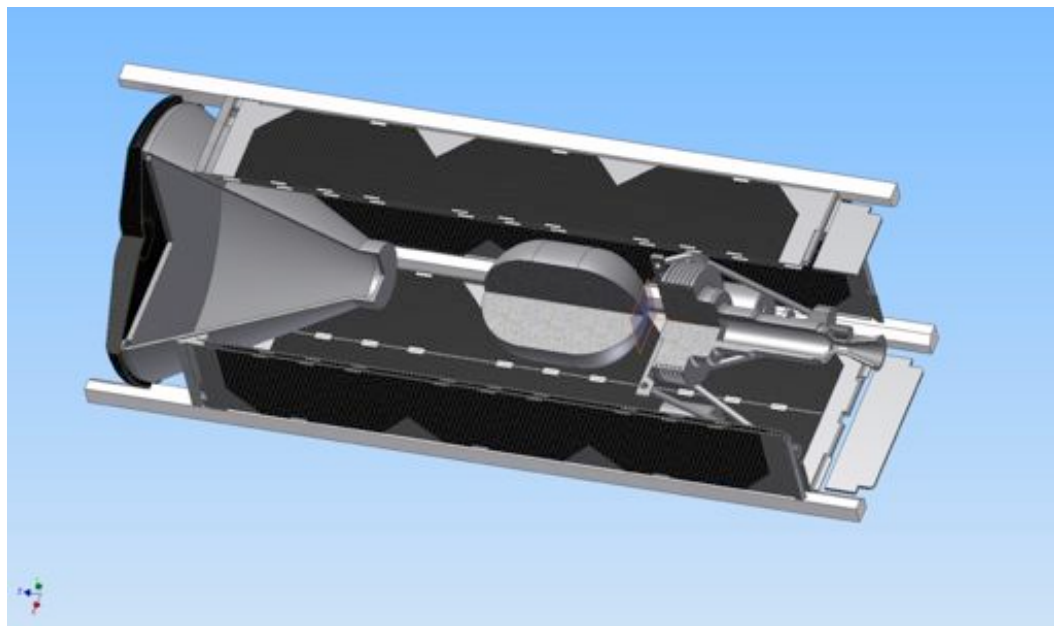


Step motors

Screw-nut gears

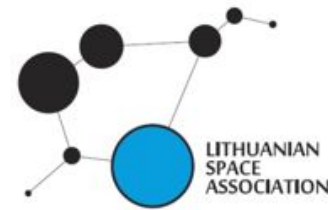
Thruster nozzle

- Thrust vector changing system relying on the screw-nut gear with step motors is under construction
- Orientation MEMS thrusters under consideration

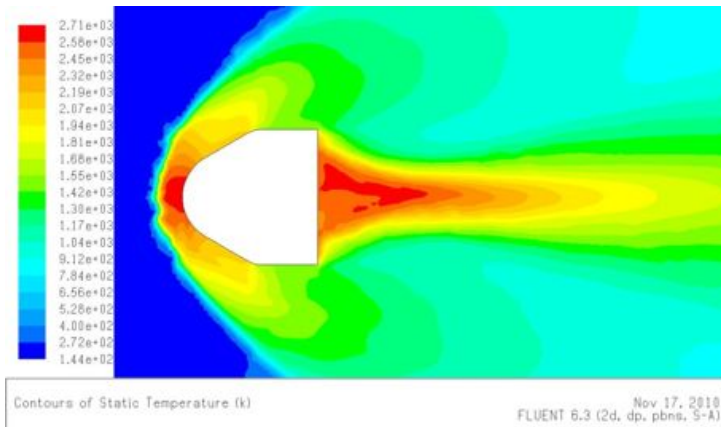




Landing of Re-entry Capsule

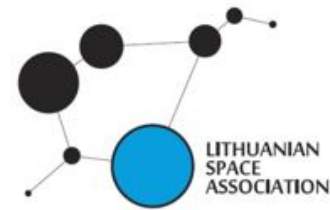


- Soft landing by means of special parachute is planned.
- Parachuting system should both provide soft landing and floatation in case of water landing.
- Position determination of capsule should be done by GPS receiver and mobile satellite modem.



Cansat competition Norway – 2011

In-flight tests Lithuania 2011-12



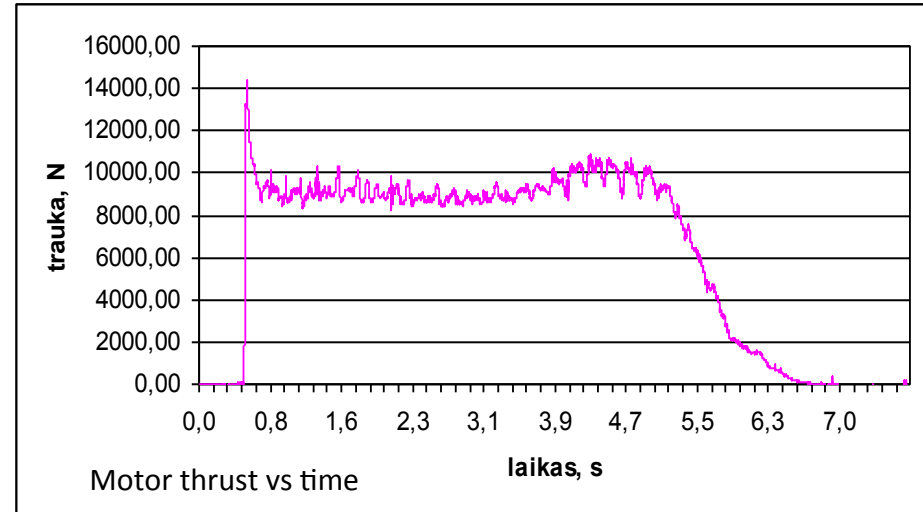
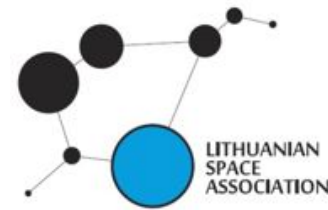
- UAV



- UAV

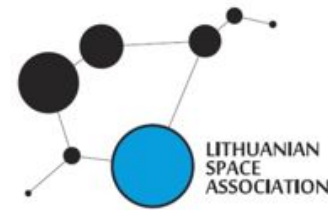
- Cansat
- Eggsat - Rocketry challenge
- Rocket Battle – Planetary Rover event

VERTICAL TEST OF SOLID ROCKET MOTOR "KTU GTI -160" OF INSTITUTE OF DEFENCE TECHNOLOGY OF KTU



Impuls, Ns	47400
Thrust, N	8700
Thusting time, s	5,44
Specific impulse, s	182
Motor lenght, m	1.55
Motor diameter, m	0,16
Motor mass (without propellant), kg	21,4
Total motor mass, kg	47,0

Goals and Opportunities of Lithuanian Space



- Strengthening of National Space Technology development and systems integration in Lithuania, e.g. – in Unmanned Aerial and Space Vehicle Technology domain, comprising satellite telecommunication, Earth observation, satellite navigation and development of components and systems of UAV's and nanosatellites
- Special attention has to be paid to development of: MEMS microsensors and microactuators, thermoaerodynamics and hot structures, high thrust monopropellant engines, design of re-entry modules.
- Development of scientific and commercial payload components and systems.
- Implementation of strengths and competencies available locally, especially in the field of Applied science.
- Co-operation with European Union (especially with smaller, regional partners), European Space Agency (ESA) and European Defence Agency (EDA) in development of European Critical technologies.
- Co-operation with US and other Space faring nations (e.g. in Space transport domain)

THANK YOU!

Vidmantas Tomkus

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