RESEARCH, INNOVATION AND EDUCATION AS PILLARS OF FUTURE SECURITY

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CHANGING SECURITY ENVIRONMENT: FROM PHYSICAL BORDERS TO DIGITAL ECOSYSTEMS

- The nature of borders is changing rapidly
- Hybrid threats combine physical pressure, cyber interference, disinformation, technological misuse:
  - Instrumentalised migration
  - GPS jamming and spoofing in the Baltic Sea region
  - Cyberattacs against state systems
  - Increasing use of drones and autonomous platforms
- The border guard does not rely only on patrol vehicles, rahter on secure data flows, predictive analytics, interoperable systems

RESEARCH AS A PILLAR OF SECURITY

- Artificial intelligence and data-driven border management
- Cybersecurity and digital sovereignty
- Autonomous systems and maritime security
- Energy and infrastructure resilience

MUTUAL BENEFITS OF COOPERATION BETWEEN UNIVERSITIES AND SECURITY

- Research and Development
- Technology Transfer
- Innovation and Creativity
- Dual-Use Technologies
- Training and Education
- Human Capital Development
- Interdisciplinary Solutions
- National Security

TALLINN UNIVERSITY OF TECHNOLOGY

- Founded in 1918, TalTech is the sole technological university in Estonia. It is also the most international university in Estonia. Of the nearly 10000 enrolled students, approximately 10% come from nearly 100 different countries across the globe.
- TalTech is a research-based university offering Bachelor's, Master's and Doctorate degrees in **technology, applied science, IT, business and maritime studies**.
- As a leader in science, technology, and innovation, the school maintains constant interaction with universities around the world, bringing together scientists, students, and entrepreneurs.

OUR ROLE

- Our activities in developing security technologies began in parallel with the restoration of the Republic of Estonia
- The process of Estonia's accession to EU set an important goal of increasing our security capabilities, including promoting relevant research and development activities
- In this regard, Tallinn University of Technology has been actively engaged in security research and development since the early 2000
- Members of our university have successfully participated in both national and international research and development activities in the field of security

SECURITY R&D ACTIVITIES

- Researchers from Tallinn University of Technology have represented Estonia in international security-related research and development programs, including the Horizon Europe and the NATO Science for Peace and Security (NATO SPS).
- Our security research and development has covered a wide technological spectrum, including artificial intelligence and cybersecurity, CBRN, situational awareness, and telecommunications
- An interdisciplinary research and development approach is essential in addressing real-world security challenges

STRATEGIC RESEARCH AREAS

1. High-tech and clean industry and manufacturing
2. Clean, affordable and secure energy
3. Energy and resource efficient construction and renovation
4. Circular economy and valorization of local resources
5. Climate-neutral and smart cities and mobility
6. **Solutions for the defence sector**
7. Dependable IT solutions and artificial intelligence
8. **Data security and cybersecurity**
9. Health technologies and services
10. Healthy and sustainable food system
11. Smart maritime sector and sustainable marine environment
12. Innovative businesses, responsible economy and governance

RESEARCH AND DEVELOPMENT ACTIVITIES

European Defence Fund (EDF) and Horizon Europe R&D activities, including:

- Surveillance and Reconnaissance Techniques for Chemical and Biological Threats
- Space based Persistent ISR for Defence and Europe Reinforcement.
- 5th Generation connected and automated mobility cross-border EU trials
- ERA Chair in Maritime Cyber Security at Tallinn University of Technology

RESEARCH AND DEVELOPMENT ACTIVITIES

NATO Science for Peace and Security (NATO SPS) R&D activities, including:

- UAV Mosquito Fleet for Smart Swarm Operations
- Passive Radar Observation and Detection of UAVs via Cellular Networks
- Design First Responders Versatile Detection and Decontamination Methods
- Public Safety Communication in the Context of Terrorists Attacks

CENTRE FOR DEFENCE AND SECURITY TECHNOLOGIES

- In order to coordinate and promote interdisciplinary research and development activities in the field of defence and security, the Centre for Defence and Security Technologies was established at Tallinn University of Technology in April 2025:
  - is a form of cooperation and a platform for coordinated defence and security research and development
  - coordinates research and development cooperation between departments and research groups
  - creates opportunities and synergies for developing existing competences and creating new ones in the field of defence and security
- The main goal is to increase scientific capacity in the field of defence and security technologies

CENTRE FOR DIGITAL FORENSICS AND CYBER SECURITY

- The Centre's research covers areas in network security, digital forensics, cyber operations, cryptography, cybersecurity education & human aspects, legal aspects of cyber security.
- A number of large-scale projects are ongoing, including cooperation on the creation of a European network of Cybersecurity centres and competence Hub for innovation and Operations, which delivers an organized and coordinated approach to improve proactive cyber defence of the EU.

- Speakers at the conference:
  - Prof Rain Ottis, *Cybersecurity in the Age of Artificial Intelligence*
  - Prof Risto Vaarandi, *Artificial Intelligence in the Security Operation Centre*

EMBEDDED AI RESEARCH LABORATORY

- The Embedded AI Research Lab focuses on developing and optimizing machine learning solutions in the embedded systems (edge computing). The laboratory collaborates internationally with research teams and companies from the maritime and autonomous vehicles.
- Development of a drone hardware platform to perform localization experiments in GNSS denied environment with precise localization reference information, also used in a NATO funded project “UAV Mosquito Fleet for Smart Swarm Operations”.

- Speaker at the conference: Nazrul Nazeer, *From Launch to Mission Completion: Fully Autonomous Aerial Operations*

CLOSING REMARKS

- Although technology is essential, it does not secure borders – people do

- Talent – the most strategic asset:
  - One of the greatest responsibilities of academia is education

THANK YOU!

TALLINN UNIVERSITY OF TECHNOLOGY

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