The following European Defence Fund calls for proposals align with the research and innovation focus areas of Bay Zoltán Research Institute

- **2.1.2. EDF-2024-RA-DIGIT-ASMEP**: Automated structural modelling for effect prediction
- **2.3.2. EDF-2024-LS-RA-DIS-NT:** Non-thematic research actions targeting disruptive technologies for defence
- **2.7.1 EDF-2024-LS-RA-SMERO:** Non-thematic research actions by SMEs and research organisations
- **2.8.1 EDF-2024-LS-DA-SME-NT**: Non-thematic development actions by SMEs

Bay Zoltán Research Institute is a prominent player in Applied Research with an extensive portfolio and a proven track record. The competencies and experiences related to these calls are demonstrated in the table on the other side. Please turn the page.

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Proposal	Capacity	Previous related projects	Infrastructure
2.1.2. EDF-2024-RA-DIGIT-ASMEP: Automated structural modelling for effect prediction	Application of modern theoretical and practical numerical modelling methods Software development Machine vision 3D modelling, model analysis	EURATOM - ENTENTE, APAL Horizon Europe - ZEVRA GINOP – Grape Pruning robot	Mechanical Materials Testing Laboratory - accredited, CIP Non-destructive Material Testing Laboratory Material Development Laboratory - RKI Software Centre - RKI Structural Testing Laboratory Digital Reality Laboratory
2.3.2. EDF-2024-LS-RA-DIS-NT: Non-thematic research actions targeting disruptive technologies for defence	Artificial intelligence and robotic autonomous systems Digital modelling, digital twinning AI, machine vision, data analysis Sensing - Measuring and monitoring the physiological and cognitive state of the client Health IT solutions	Smart Resilience - Increase the resilience of critical infrastructure by modelling crowd movement and optimising evacuation Autonomous Healthcare Robot - Developing an autonomous healthcare robot BalanceScale - Development of a real-time personal health assessment tool	Software Centre - RKI Digital Reality Laboratory Manufacturing simulation software Sensor fusion, IoT tools Route planning, geospatial information systems, indoor navigation systems
2.7.1 EDF-2024-LS-RA-SMERO: Non-thematic research actions by SMEs and research organisations	Artificial intelligence and robotic autonomous systems Digital modelling, digital twinning AI, machine vision, data analysis Sensing - Measuring and monitoring the physiological and cognitive state of the client Telemedicine solutions Health IT solutions	Smart Resilience - Increase the resilience of critical infrastructure by modelling crowd movement and optimising evacuation Autonomous Healthcare Robot - Developing an autonomous healthcare robot BalanceScale - Development of a real-time personal health assessment tool	Software Centre - RKI Digital Reality Laboratory Manufacturing simulation software Sensor fusion, IoT tools Route planning, geospatial information systems, indoor navigation systems
2.8.1 EDF-2024-LS-DA-SME-NT: Non-thematic development actions by SMEs	Artificial intelligence and robotic autonomous systems Digital modelling, digital twinning AI, machine vision, data analysis Sensing - Measuring and monitoring the physiological and cognitive state of the client Telemedicine solutions Health IT solutions	Smart Resilience - Increase the resilience of critical infrastructure by modelling crowd movement and optimising evacuation Autonomous Healthcare Robot - Developing an autonomous healthcare robot BalanceScale - Development of a real-time personal health assessment tool	Software Centre - RKI Digital Reality Laboratory Manufacturing simulation software Sensor fusion, IoT tools Route planning, geospatial information systems, indoor navigation systems

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Other military connected competences in Zoltan Bay:

- **Modernisation of the armed forces:** continuous modernisation of the equipment and technological infrastructure. This involves the acquisition and development of modern weapons systems, vehicles and other military equipment.

1. **Tool development:**

Development of hardware and software for custom electronic devices with embedded microcontrollers or microprocessors, such as metering data acquisition systems, sensors, special measuring devices, IoT (Internet of Things) devices, and control systems.

2. **Technology and materials development:**

The development of advanced materials (metals, ceramics, composites) and thin films with specific properties to meet specific needs; thermoplastic polymer products and lightweight metal foams with high energy absorption, and good mechanical, insulating properties. Development, optimisation and scaling-up of various industrial and manufacturing technologies.

3. **Modelling directions:**

Our modelling solutions offer comprehensive services in product design and reliability, including 2D and 3D modelling, motion simulations, fracture mechanics and fatigue analysis. Our simulation expertise extends to process modelling of metals and plastics, such as welding, heat treatment and material forming.

- **Product design and reliability**
  - 2D, 3D modelling
  - Motion simulation
  - Fracture mechanics and fatigue analysis
  - Vibration and acoustic simulations
- **Metal simulations**
  - Welding technology
  - Heat treatment modelling
  - Material forming technology modelling
- **Plastic technology simulations**

4. **Production and logistics simulations**

To increase the efficiency of military development, a thorough analysis and optimisation of production and logistics processes is essential. Our state-of-the-art simulation

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technologies enable the modelling of real-time situations and dynamic interactions of complex systems, supporting strategic decision-making and successful execution of operations. Our advanced geospatial tools ensure the development of optimal routes and resource utilisation, thereby increasing the efficiency of logistics chains and operations. Our services contribute to the success of military operations and the optimal use of resources.

- o event-driven process simulation
- o agent-based simulation studies
- o system simulations
- o Geospatial-based route planning and resource allocation studies

5. Material testing options:

We offer a wide range of material testing solutions, including a variety of mechanical and fatigue tests, fracture mechanics analysis, and non-destructive and thermal testing. Tests are carried out on metals, plastics, composites, ceramics and glass in temperatures ranging from -150 to 1400 °C

- o Tensile, compression, bending, torsion tests (including mini tensile tests)
- o Axial, torsional and biaxial fatigue tests
- o Fracture mechanics tests
- o Structural fatigue tests
- o Load tests on structures
- o Impact testing (including instrumented)
- o Drop tests (also instrumented)
- o Hardness tests
- o Surface roughness determination
- o Specific gravity measurement
- o Abrasion tests (sliding or sliding-rolling tests)
- o Welding technology tests
- o Biomechanical tests
- o SmallPunch (SP) tests
- o Metallographic tests
- o Layer thickness measurement
- o Material composition tests
- o Non-destructive testing
- o UH test design with CIVA software
- o Residual stress determination
- o Strain measurement with stamp
- o Temperature measurements (determination of temperature distributions)

Material grades that can be tested: metals, plastics, composites, ceramics, glass
Test temperatures for mechanical tests: -150...1400 °C

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- **Military personnel development**: Training and retraining of soldiers and increasing the number of personnel. This includes improving the living and working conditions of soldiers.

1. **Scene technology:**

   o 3d whole body scanner (continuous physical fitness assessment, body composition /muscle mass, visceral fat, water/ supplemented); posture, spine, body composition assessment, fitness tracking. Fast, accurate testing)
   o digital biomarker tests. Aim: disease detection with machine vision, detection of early conditions
   o 3D multimodal wound scanner (3d model, thermo image, photo). AI-based processing integrated in mobile phones with status tracking
   o Dehydration condition detection (can often occur in uniforms, with weapons), continuous monitoring of temperature under clothing (using smart suit, smart fabric)
   o use of robots (e.g. in field hospitals: floored tents, containers, or healthcare in railway wagons)
   o healthcare processes (based on workflows, worklists), (integration of devices from different digital devices but with standardised outputs, avoiding multiple data inputs)

2. **Fatigue test:**

   Fatigue is a complex phenomenon that has a significant impact on the physical and mental performance of soldiers. It increases the risk of errors, reduces reaction time and affects decision-making. The different types of fatigue - physical, mental, and emotional - need to be considered separately as they affect performance differently.
   Several methods are available to assess fatigue, such as questionnaires, physical and cognitive tests, and physiological parameters (heart rate, blood pressure). Determining the level of fatigue allows to ensure the necessary rest time, optimise performance and reduce the risk of errors and injuries.
   Our main area of research is the rapid detection of mental fatigue by analysing the equilibrium parameters of the human body. For this purpose, we use our proprietary Balance Scale tool, which is stimulated by a VR environment. Measuring fatigue can be particularly useful in assessing stress tolerance, for example in truck drivers, emergency response teams, drone pilots and commanders.

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3. **Smart clothing:**

   Development of smart clothing that continuously measures the vital parameters of soldiers, in which BZN participates under the guidance of the University of Pécs.

- **Defence industry development**: To support and develop the national defence industry, including the involvement of Hungarian companies in the production and development of military equipment.

1. **Laser technologies:**

   Laser cutting, welding, micro-machining and additive manufacturing of flat sheets, tubes, profiles, three-dimensional or axisymmetric metal parts; welding, perforating and surface modification of metal foils and plastics.

- **Infrastructure development**: Development and modernisation of military bases, training centres and other facilities.

1. **Soil remediation procedures:**

The Bio Division of the Bay Zoltán Research Centre offers innovative bioremediation technologies that effectively address environmental pollution without the need for soil extraction. These processes allow the environment to be restored and pollutants removed with the highest efficiency. The use of these methods minimises physical intervention, reduces costs and provides a sustainable solution. They contribute to improving soil and water quality in an environmentally friendly way. They provide modern, science-based solutions to a large part of the remediation problem.

2. **Developing mobile hydroponics systems:**

BZN will use its experience in hydroponic crop production to develop a mobile, scalable system to produce fresh vegetable crops (e.g. lettuce) for military contingents, camps and other local food supply sites.
The system's modular design makes it easy to transport and install, and its automatic irrigation and nutrient supply functions ensure a continuous supply of fresh produce with low manpower requirements.
Integrated solar panels and water recycling technologies ensure energy-efficient and sustainable operation.

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3. Energy container

TOSOT-Powered by BAY is a complex building service and energy solution with a unique smart control system, where the building services, electrical, energy control and IT components are designed to:

o The most energy-efficient equipment should be integrated into the energy network of buildings;

o It has fast feasibility and wide modularity, it can be operated as an island-like carbon-neutral energy system with the addition of "eTOSOT" electrical energy storage and solar PV;

o The state-of-the-art Powered by BAY energy control system enables the most efficient use of electrical energy;

o The TOSOT- Powered by BAY smart control systems allow for the replacement of natural gas fired equipment in such a way that existing systems can be retained as a complete secondary heating system;

o The system features building services and electrical quick-connect solutions that enable energy conversion in as little as a few hours;

o The system has remote access, allowing remote monitoring and central control from an integrated dispatch centre;

o The TOSOT-Powered by BAY software enables 365 days of programmable energy network operation control.

Certifications:

- MSZ EN ISO/IEC 17025:2018
- MSZ ISO/IEC 27001:2014
- MSZ EN ISO 9001:2015