



Issue 2 / October 2021

## *An Integrated System for the Complex Environmental Research and Monitoring in the Danube River Area*



# REXDAN

Contract no. 309/10.07.2020

SMIS Code 2014+: 127065

Project co-financed by the European Regional Development Fund through the Competitiveness Operational Programme 2014-2020 (COP)

Beneficiary: "Dunarea de Jos" University of Galati



## ***An Integrated System for the Complex Environmental Research and Monitoring in the Danube River Area, REXDAN***

Contract no. 309/ 10.07.2020, SMIS Code 2014+: 127065

Project co-financed by the European Regional Development Fund through the Competitiveness Operational Programme 2014-2020 (COP)

**Priority axis: 1.** Research, technological development and innovation (RTDI) to support economic competitiveness and business development;

**Investment priority: IP 1a:** Strengthening research and innovation (R&I) and infrastructure and building capabilities in order to develop R&I excellence, as well as promoting centers of expertise, especially those of European interest;

**Specific objective: SO1.1.** Increasing scientific capacity in the fields of smart specialization and health;

**Action: 1.1.1** Large R&I infrastructures;

**Area of intervention - 058** Research and innovation infrastructures (public)

**Beneficiary: “Dunarea de Jos” University of Galati**, based in Galați, Domnească Street, no. 47, Tel: (+40) 336 130 108; Fax: (+40) 236 461 353; e-mail: rectorat@ugal.ro; www.ugal.ro

**Project implementation period:** 10. 07. 2020 - 31. 12. 2023



## REXDAN EVENTS

### THE LAUNCHING CONFERENCE OF REXDAN GALAȚI, July 9, 2021

Organized in the Conference Center of Hotel *Ibis Style Dunărea Galați*, the launching conference of the project *An Integrated System for the Complex Environmental Research and Monitoring in the Danube River Area*, *REXDAN*, SMIS code 2014+: 127065 brought together members of the management and implementation teams and representatives of relevant European and national institutions in the field.

The official opening, made by Prof. Dr. Eng. Puiu Lucian Georgescu, Rector of “Dunărea de Jos” University of Galați, was followed by the presentations of Prof. Dr. habil. Cătălina Iticescu, project manager, Prof. Dr. habil Nicoleta Mișu and Prof. Dr. Mirela Voiculescu, members of the management team. The first section of the conference ended with the presentation of Prof. Dr. Eng. Leonard Domnișoru regarding the technical characteristics of the research ship *REXDAN*.

The event continued with the presentations of CS I Dr. Doina Nicolae and CS I Dr. Bogdan Antonescu, from INOE (National Research-Development Institute for Optoelectronics) and of Lect. Dr. Marius Mihai Cazacu from “Gheorghe Asachi” Technical University of Iași regarding the ACTRIS and ACTRIS-RO infrastructures, the MARS cloud monitoring station in Bucharest and RAPID-e, the first equipment used for studying the atmosphere.

The launching conference of the project *An Integrated System for the Complex Environmental Research and Monitoring in the Danube River Area*, *REXDAN* ended with the presentations of the Fix Research Centre laboratories made by members of the implementation team in three parallel sections: Section 1. Physical-chemical analyses, Section 2. Biodiversity, genetics and bathymetry and Section 3. Atmosphere and IT and with discussions and debates aimed at outlining the activities scheduled in the future stages of the project.



## REXDAN EVENTS

### THE FIRST STEP TAKEN IN BUILDING THE RESEARCH SHIP REXDAN GIURGIU, October 7, 2021

On October 7, 2021, the ceremony for laying the keel of REXDAN ship took place in Giurgiu. On this occasion, "Dunărea de Jos" University of Galați received the "birth certificate" of the largest research ship on the European Union inland waters. The ship will include nine modern laboratories in which academics and researchers from "Dunărea de Jos" University in Galați and researchers from specialized institutes in Romania and abroad will carry out their activity. The REXDAN ship, which will cover 2,000 km on the Danube navigable sector, is being built at Giurgiu Shipyard and will be completed in January 2023.



## REXDAN RESEARCH CENTER

The **REXDAN Research Center** includes 9 laboratories in which activities specific to the field of intelligent specialization *Energy, environment, climate change* will be carried out.

1. The Laboratory for Sample Conservation and Preparation (LP Fix);
2. The Chromatography Laboratory (LCR Fix);
3. The Instrumental Analysis Laboratory (LAI Fix);
4. The Spectrometry Laboratory (LSP Fix);
5. The Ecology Laboratory (LE Fix);
6. The Genetics Laboratory (LG Fix);
7. The Bathymetry, Hydrology, Topometry Laboratory (LBHT Fix);
8. The Climate Change Observation Laboratory (POSC Fix);
9. The Data Storage/ Processing Laboratory (IT Fix).





# 1. THE LABORATORY FOR SAMPLE CONSERVATION AND PREPARATION (LP Fix)

### DESCRIPTION

The Laboratory for Sample Conservation and Preparation (LP Fix) is used for the medium and long term conservation of environmental samples and for their preparation for the qualitative and quantitative determination of pollutants. The preparation of environmental samples by using high performance equipment is essential for obtaining quality analytical results.

### SPECIFIC ACTIVITIES

- ✓ preliminary analysis of quality indicators for the conservation of environmental samples to be subjected to qualitative and quantitative chemical analyses, followed by the conservation of environmental samples;
- ✓ sample preparation for the determination of environmental pollutants by mineralization in order to determine the concentrations of heavy metals by spectral methods,
- ✓ extraction of toxic or potentially toxic organic compounds from the samples for further analysis by chromatographic methods;
- ✓ determination of quality indicators regarding hardness, alkalinity, CBO5, etc. for the water samples;
- ✓ obtaining the pure and ultrapure water necessary for the preparation of the chemical reagents used in the laboratory analyses and not only.

### RESEARCH DIRECTIONS

The equipment in the Laboratory for Sample Conservation and Preparation (LP Fix) will be used in all the research domains and subdomains implemented in the REXDAN Research Centre.

### EQUIPMENT

- ✓ magnetic stirrer with multipost heating;
- ✓ ultrapure water device with UV filter, final filter;
- ✓ distillation and deionization device;
- ✓ ultrasonic bath and water bath;
- ✓ analytical balance and technical balance;
- ✓ laboratory centrifuge with cooling system;
- ✓ laboratory freezer;
- ✓ laboratory oven;
- ✓ laboratory refrigerator;
- ✓ laboratory glassware washing machine;
- ✓ digital micropipettes;
- ✓ vibrating laboratory mill;
- ✓ chemical niche with exhaust system;
- ✓ laboratory press;
- ✓ extraction / purification system of samples by extraction;
- ✓ automatic titrator;
- ✓ CBO5 analysis system for 20-24 samples.



## 2. THE CHROMATOGRAPHY LABORATORY (LCR Fix)

### DESCRIPTION

The Chromatography Laboratory (LCR Fix) is devoted to the qualitative and quantitative analysis of volatile and non-volatile organic pollutants and of toxic cations and anions in liquid and solid environmental samples. The performance of the equipment in the laboratory supports high-resolution and exact mass identifications of compounds found in complex matrices.

### SPECIFIC ACTIVITIES

- ✓ analysis of pharmaceutical compounds from water, sediment and aquatic biota samples;
- ✓ analysis of halogenated disinfection by-products and chlorinated solvents in water;
- ✓ determination of polycyclic aromatic hydrocarbons from water and sediment;
- ✓ determination of organophosphorus pesticides from solid and liquid environmental samples;
- ✓ monitoring of ozone precursors, polar and non-polar volatile organic compounds, halogenated compounds and oxygenated volatile organic compounds (aldehydes and ketones) in ambient air;
- ✓ determination of pesticides and insecticides levels in water, sediment and biota;
- ✓ analysis of toxic ions in water samples;
- ✓ determination of organic pollutants in wastewater.

### RESEARCH DIRECTIONS

- ✓ biodiversity;
- ✓ water;
- ✓ sustainability;
- ✓ environmental chemistry;
- ✓ environmental toxicology;
- ✓ environmental biotechnology, bioremediation, biodegradation;
- ✓ soil science;
- ✓ natural resources management;
- ✓ biogeochemical cycles.

### EQUIPMENT

- ✓ gas chromatograph coupled to laboratory mass spectrometer (GS-MS)
- ✓ ion exchange chromatograph for the simultaneous determination of anions and cations (IC)
- ✓ liquid chromatograph coupled with high resolution and accurate mass spectrometer (LC-MS / MS)



## 3. THE INSTRUMENTAL ANALYSIS LABORATORY (LAI Fix)

### DESCRIPTION

The Instrumental Analysis Laboratory (LAI Fix) is devoted to applications which involve the use of various analytical methods (electrochemical, optical, spectrometric) for the in-situ and ex-situ experimental determination of a wide range of quality parameters specific to aquatic ecosystems.

### SPECIFIC ACTIVITIES

- ✓ complex analyses of air, water and soil samples;
- ✓ direct determination of compounds in the samples to be analyzed;
- ✓ determination of inorganic and organic pollutants in water (heavy metals, pesticides, nutrients
- ✓ online and real-time monitoring of Danube water quality);
- ✓ in-situ and ex-situ monitoring of aquatic ecosystem quality;
- ✓ elaboration of statistical models and algorithms for estimating and monitoring the global water quality index (WQI);
- ✓ algorithmization of physical, chemical and biological parameters for determining quality classes for surface aquatic ecosystems;
- ✓ development of electrochemical biosensors detecting pesticides;
- ✓ development of electrochemical biosensors for detecting hormones, antibiotics, toxic cations and toxic anions.

### RESEARCH DIRECTIONS

- ✓ biodiversity;
- ✓ water;
- ✓ sustainability;
- ✓ environmental chemistry;
- ✓ environmental toxicology;
- ✓ environmental biotechnology, bioremediation, biodegradation;
- ✓ soil science;
- ✓ natural resources management;
- ✓ biogeochemical cycles.

### EQUIPMENT

- ✓ mercury analyzer;
- ✓ elemental TOC analyzer with nitrogen and phosphorus modulus;
- ✓ multimodal microplate reader;
- ✓ laboratory multiparameter;
- ✓ advanced electroanalytical system, the potentiostat / galvanostat type;
- ✓ fixed online water quality monitoring station;
- ✓ laboratory turbidimeter.



## 4. THE SPECTROMETRY LABORATORY (LSP Fix)

### DESCRIPTION

The Spectrometry Laboratory (LSP Fix) is devoted to the quantitative determination of organic and inorganic pollutants in liquid and solid environmental samples. The technical performance of the equipment (sensitivity, accuracy and resolution) ensures high-quality and reliable results.

### SPECIFIC ACTIVITIES

- ✓ analysis of nutrients in water samples;
- ✓ analysis of heavy metal concentrations in water, sediments, aquatic vegetation, benthic invertebrates and fish by using various analytical methods;
- ✓ identification, characterization and quantification of microplastics in water, sediment and aquatic biota;
- ✓ studying the distribution of emerging micro-pollutants in the biotic and abiotic components of aquatic ecosystems;
- ✓ determination of heavy metal concentrations in wastewater and treated water;
- ✓ determination of physico-chemical properties of soils;
- ✓ monitoring of soil quality;
- ✓ quality assessment and management of sewage sludge;
- ✓ ecological reconstruction.

### RESEARCH DIRECTIONS

- ✓ biodiversity;
- ✓ water;
- ✓ sustainability;
- ✓ environmental chemistry;
- ✓ environmental toxicology;
- ✓ environmental biotechnology, bioremediation, biodegradation;
- ✓ soil science;
- ✓ natural resources management;
- ✓ biogeochemical cycles.

### EQUIPMENT

- ✓ inductively-coupled plasma mass spectrometer with speciation (ICP-MS speciation);
- ✓ laboratory total reflection (TXRF) X-ray spectrometer for solid and liquid samples;
- ✓ UV / VIS NIR laboratory spectrophotometer;
- ✓ FT-IR laboratory spectrometer with microscope.





### DESCRIPTION

The Ecology Laboratory (LE Fix) is devoted to the integrated monitoring and evaluation of the ecological status of water bodies. Research on the qualitative and quantitative analysis of biological quality indicators (macroinvertebrates, macrophytes, phytoplankton, chlorophyll a, fish) and on the impact and ecological risk caused by anthropogenic activities on aquatic biota will be conducted in this laboratory.

### SPECIFIC ACTIVITIES

- ✓ monitoring the water quality of the Danube and of its tributaries by using bioindicators (macroinvertebrates, macrophytes, phytoplankton, chlorophyll a, fish);
- ✓ study and biological and ecological analysis of invasive species;
- ✓ assessment and monitoring of the quality of aquatic ecosystems related to the Danube (in-situ and ex-situ);
- ✓ environment and biodiversity management;
- ✓ modeling of ecological processes and ecological statistics;
- ✓ water resources management;
- ✓ plant and animal taxonomy.

### RESEARCH DIRECTIONS

- ✓ ecology;
- ✓ biodiversity;
- ✓ environmental management and protection;
- ✓ ecosystems;
- ✓ the water;
- ✓ ichthyology;
- ✓ ecotoxicology;
- ✓ invasive species;
- ✓ plant ecophysiology;
- ✓ histology.

### EQUIPMENT

- ✓ transmitted light microscope;
- ✓ digital camera research stereomicroscope;
- ✓ invertoscope with camera and software;
- ✓ vacuum pump;
- ✓ filtration system with 1-6 stations;
- ✓ laboratory centrifuge;
- ✓ sedimentation chamber.

## DESCRIPTION

The Genetics Laboratory (LG Fix) will include areas suitable for the analyses performed, physically delimited between them, depending on the equipment or techniques used:

- ✓ pre-PCR and nucleic acid extraction laboratory;
- ✓ amplification laboratory;
- ✓ electrophoresis and video documentation laboratory.

## SPECIFIC ACTIVITIES

- ✓ studying the profile of the species which develop in the researched area;
- ✓ documenting the adaptation of species to changes in environmental conditions;
- ✓ documenting the effects of environmental pollution on species;
- ✓ monitoring water and soil quality, sewage sludge, water, soil and air pollution.

## RESEARCH DIRECTIONS

- ✓ artificial reproduction of different species of fish (sturgeons, esocidae, siluridae, cyprinids);
- ✓ genetic improvement and selection;
- ✓ impact assessments and environmental assessment.

## EQUIPMENT

- ✓ tissue homogenization system;
- ✓ UV / Vis micro-volume spectrophotometer;
- ✓ PCR hood and PCR equipment;
- ✓ RT-PCR system;
- ✓ rapid system for nucleic acid electrophoresis;
- ✓ DNA sequencing system and analysis of DNA fragments by microcapillary electrophoresis;
- ✓ DNA concentrator;
- ✓ ultrafreezer;
- ✓ bactericidal lamp mounted on a mobile support.



## 7. THE BATHYMETRY, HYDROLOGY, TOPOMETRY LABORATORY (LBHT Fix)

### DESCRIPTION

The Bathymetry, Hydrology, Topometry Laboratory (LBHT Fix) is devoted to a series of innovative and advanced research activities in the field of surveying for terrestrial and aquatic areas. The equipment included in this laboratory will be used both for collecting, acquiring and recording of raw data on the field and for storing, processing and modeling the collected data.

### SPECIFIC ACTIVITIES

- ✓ terrestrial monitoring;
- ✓ analysis of hydro-morphometric changes;
- ✓ determination of land settlement;
- ✓ hydrological analysis of river flows;
- ✓ determination of alluvial deposits;
- ✓ monitoring quality hydromorphological elements for classifying the ecological status of canals and lakes;
- ✓ analysis of climatic factors influence on ADCP measurements;
- ✓ GIS use for urban development;
- ✓ creating geospatial databases regarding terrestrial and bathymetric measurements;
- ✓ sediment transport;
- ✓ modeling of pollutants transport in rivers and lakes;
- ✓ water flow modeling in canals and rivers;
- ✓ determination of flood risks and hazards;
- ✓ GIS use for geographical hazards;
- ✓ special applications of photogrammetric exploitation;
- ✓ spatial monitoring through UAV technologies;
- ✓ multispectral spatial analysis;
- ✓ techniques for making MDTs by using UAVs.

### RESEARCH DIRECTIONS

- ✓ civil engineering;
- ✓ agriculture, forestry and rural areas;
- ✓ history and archeology.

### EQUIPMENT

- ✓ portable interferometric multifunctional bathymetric research system;
- ✓ fixed hydrometric station for monitoring water parameters;
- ✓ systems for sediment analysis in suspension in water;
- ✓ drone (UAV) with lidar system;
- ✓ electronic topographic leveller with all accessories included;
- ✓ total 3D scanning station;
- ✓ basic terrain and rover GPS set with rugged tablet field notebook;
- ✓ RTK repeater with GSM and radio modems;
- ✓ road profile system;
- ✓ mobile scanner with camera and capture distance up to 100 m.



## 8. THE CLIMATE CHANGE OBSERVATION LABORATORY (POSC Fix)

### DESCRIPTION

The Climate Change Observation Laboratory (POSC Fix) is devoted to quantitative and qualitative determinations of air quality and climate change.

### SPECIFIC ACTIVITIES

- ✓ air quality determinations;
- ✓ determinations of weather parameters;
- ✓ aerosol determinations;
- ✓ cloud determinations;
- ✓ mixture layer determinations.

### RESEARCH DIRECTIONS

- ✓ earth and atmospheric sciences;
- ✓ air pollution;
- ✓ satellite observations;
- ✓ remote sensing.

### EQUIPMENT

- ✓ ceilometer;
- ✓ cloud radar;
- ✓ radiometer;
- ✓ concentration and particle identification analyzer;
- ✓ laboratory weather station.



## 9. THE DATA STORAGE / PROCESSING LABORATORY (IT Fix)

### DESCRIPTION

The Data Storage/ Processing Laboratory (IT Fix) is not an independent unit, but a set of IT equipment (laptops, desktop computers, printers, plotters, 3D printers, video projectors, electric generators) organized according to the needs of each workspace (office, research laboratory, conference room, working room for researchers).

### SPECIFIC ACTIVITIES

- ✓ receiving, collecting and storing data from the research ship;
- ✓ raw and advanced data processing by using softwares dedicated to research equipment and basic softwares for data processing (Matlab, Excel, etc.);
- ✓ running numerical and graphic simulation models;
- ✓ obtaining finite results (graphs, statistical calculation) for participation in conferences, symposia, workshops, etc.;
- ✓ making reports, maps;
- ✓ making consumables, accessories for research equipment by using 3D printers;
- ✓ printing flyers, posters, posters, reports, etc. (from A0 to A4 format).

### RESEARCH DIRECTIONS

The equipment included in the Data Storage/ Processing Laboratory (IT Fix) will be used in all the research domains and subdomains which will be implemented in the *REXDAN* Research Center.

### EQUIPMENT

#### • IT EQUIPMENT

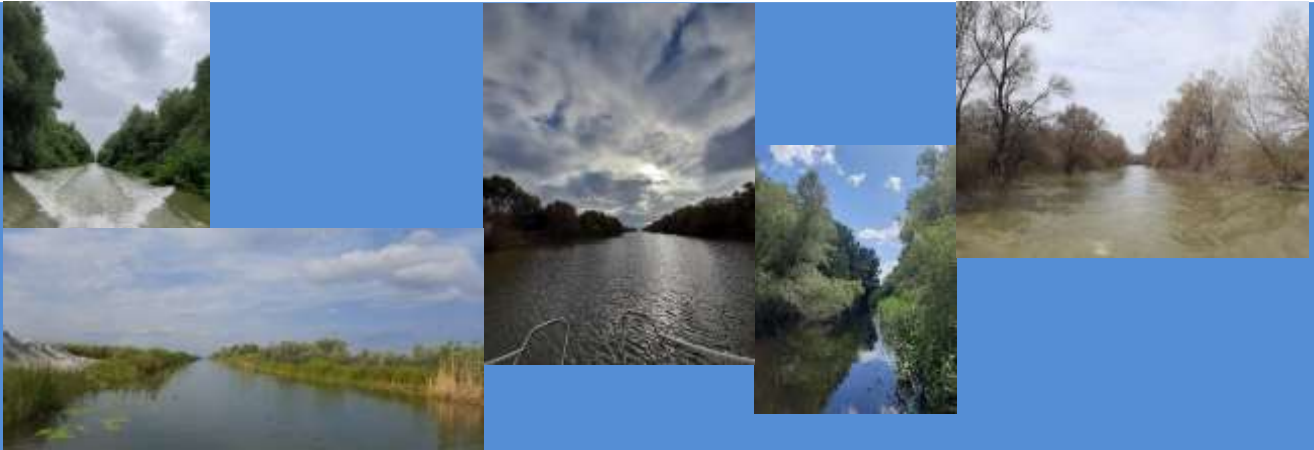
- ✓ waterproof and extreme field conditions laptop;
- ✓ 2 in 1 laptop;
- ✓ waterproof tablet;
- ✓ high-performance laptop for numeric and graphic modeling;
- ✓ all in one desktop computer for graphic and numeric modeling;
- ✓ all in one colour A3 printer;
- ✓ colour A4 printer;
- ✓ A0 plotter;
- ✓ 3D printer.

#### • SOFTWARES

- ✓ for the operation of laptops and desktops: Windows 10 license, Office license, antivirus license;
- ✓ for research (numeric and graphic modelling): CAD data processing program, *Matlab flood* simulation program, *Mike Flood* simulation software







[www.rexdan.ugal.ro](http://www.rexdan.ugal.ro)

*An Integrated System for the Complex Environmental Research and Monitoring in the Danube River Area - REXDAN*

Project co-financed by the European Regional Development Fund through the Competitiveness Operational Programme 2014-2020

"Dunarea de Jos" University of Galati

October 2021

The content of this material does not necessarily represent the official position of the European Union or of the Government of Romania.