



Overview of scientific results of the project

Reporting period **Nr. 8.**

01.02.2021. - 30.04.2021.

Project: Nr. 1.1.1.1/18/A/133 "Prototype development of transportable in multimodal traffic mobile space test facility "Metamorphosis".

Project promoters: Riga Technical University (Leading Partner), "CRYOGENIC AND VACUUM SYSTEMS" Ltd.

Overall Project Objective: To develop a prototype mobile test facility "Metamorphosis" (MSTF) transported in an intermodal traffic environment on the basis of industrial research and to raise MSTF Technological Readiness Level from TRL2 to TRL4 (under European Space Agency (ESA) scale) for further evolution of the project.

Project activities and accomplishments during the reporting period:

Activity 1. Design calculations and design documentation for the design elements of prototype:

Work 1.1. Calculation of the vacuum system

Vacuum system calculation and thermophysical calculation completed. The results of the calculations are used in the development and improvement of design documentation and in the production of prototype elements.

Work 1.2. Strength calculations

The strength calculation is complete.

Strength calculations are used in the development and refinement of design documentation and in the production of prototype elements.

Work 1.3. Development of a set of design documentation

On the basis of the results of the prototype vacuum system and strength calculations, the determination of the external appearance of the prototype construction elements, development of sketches for the creation of design documentation has been continued.

Work 1.4. Development of 3D CAD model of prototype construction elements

Based on the analysis of standards and industry methodologies in the field of 3D modeling of complex equipment and systems, as well as on the basis of previous calculations, work has continued on the development of a 3D model of prototype construction elements.

Activity 2. Prototype software development:

Work 2.1. The prototype work algorithm is complete.

Prototype work algorithms are used in prototype software and hardware development.

Work 2.2. Prototype software and hardware development

Based on the analysis of the tests carried out using the prototype parameters measuring method, as well as the analysis of vacuum and cryogenic diagrams of the prototype, a list of control system sensors with technical requirements was developed and the sensor interfaces were determined. A list of actuating mechanisms has been developed, their interfaces have been determined.

Based on the developed algorithm and lists of sensors and actuators, project partners develop hardware and software for the prototype control system.

Activity 3. Production of structural elements and assembly of prototypes

Work 3.1. Production of prototype construction elements

Completed actions:

-based on the developed technical requirements and the results of the Vacuum and Thermophysical calculation reports and design documentation developed by the leading partner, technical specifications were drawn up;

-analysis of the market for materials and components;

-procurement of materials and components for vacuum and control systems manufacture, their incoming quality control;

-prototype structural elements have been produced;

-pre-integration of the forevacuum and high vacuum subsystems has been completed.

Under development:

-manufacturing of the vacuum chamber, cryogenic shrouds and liquid nitrogen separator;

-as materials and components arrive, their incoming control is carried out;

-development and manufacture of control system elements.

Work 3.2. Improvement of prototype design elements according to test results

The tests of the elements of the forevacuum and high vacuum subsystems were carried out.

Based on the test results the modification of vacuum equipment cooling subsystem is under development. The equipment for current production control of the components and elements of the prototype have been designed and produced. Designed and produced control signals emulators for testing electro-pneumatic equipment and RS485/422/232/UART signal computer emulator for testing the elements of the Prototype.

Under development a data collection tool and software for prototype, which will ensure the recording of loads and test results during the Prototype test under intermodal traffic.

Work 3.3. Work has begun on the integration of the vacuum chamber structures with sealed connections, pneumatic, cryogenic and electrical feedthroughs.

Activity 4. Industrial research and prototype testing

Work 4.1. Prototype structural stability tests under operating conditions

Work continues on the development of a testing program and methodology, prototyping and testing of electrical circuits, incoming control of materials and components. Electrical and pneumatic tests are being carried out, leakage testing, mutual collection of the received and manufactured prototype elements.

Work 4.2. Testing of the prototype after completion of the test results of the prototype construction under operational conditions

To prepare for tests, an appropriate program is being developed, as well as a tool for data collection is being developed, and software is being developed that will ensure the recording of loads and test results.