

VEC

VIRTUAL
ENGINEERING
CENTRE

Digital Tissue Group Presentation – Yang Zhang

September 2020

The Virtual Engineering Centre (VEC)

Pioneers in Industrial Digital Transformation

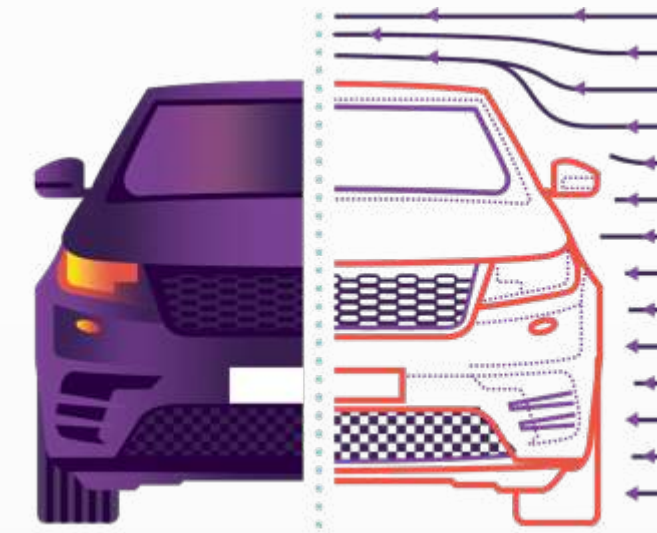
- The Virtual Engineering Centre (VEC) is a leading **Digital Engineering and Technologies Innovation Centre**, part of the University of Liverpool's Institute for Digital Engineering and Autonomous Systems (IDEAS).
- The VEC was **established over 10 years ago along with partners BAE Systems (Air), Airbus and National Nuclear Laboratory (NNL)** to support the exploration and adoption of **new digital and emerging technologies** within organisations and across the supply chain. The VEC has continued this mission over the years, establishing itself as a bespoke “off-site” R&D resource to enhance industry capabilities in the area of digital technologies to enhance capability and to support adoption within the workplace.
- The VEC has worked with many sectors over the last 10 years, including **Automotive, Aerospace, Energy (including Nuclear), Healthcare and Utilities**. Fully lifecycle focused, we work alongside Design, Manufacturing, Logistics and Training Departments, providing practical solutions, in collaboration with our client organisations and other technology partners (as appropriate) to leverage the maximum benefit from “off the shelf” technologies coupled with our bespoke development and data and systems integration expertise.



Our capabilities

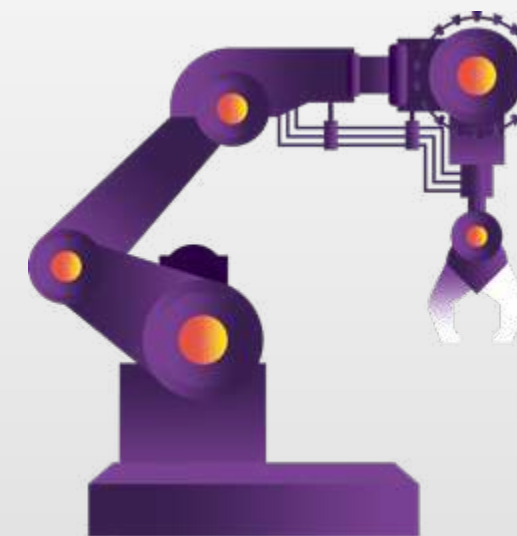
- **Advanced Modelling and Simulation**

We offer this service to our clients so they can build accurate models that represent the real world. These simulations offer a robust digital test-bed for companies to trial various scenarios using complex data.



- **Robotics and Autonomous Systems**

We provide an open-access environment for systems evaluation, integration and support. This allows for the testing of hardware and software for the development of a wide range subjects – connected to each other and/or their environment.



Our capabilities

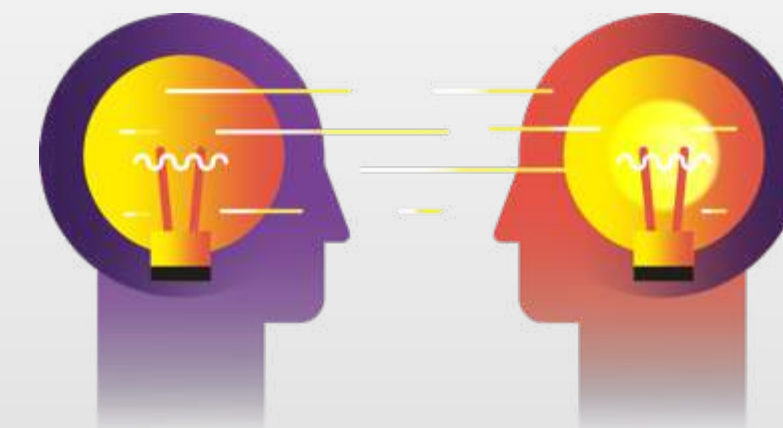
- **AI and Data Analytics**

We help organisations to unlock the value in their data and to use those insights to drive improvements. We create algorithms to understand data and visualise complex scenarios.



- **Digital Transformation**

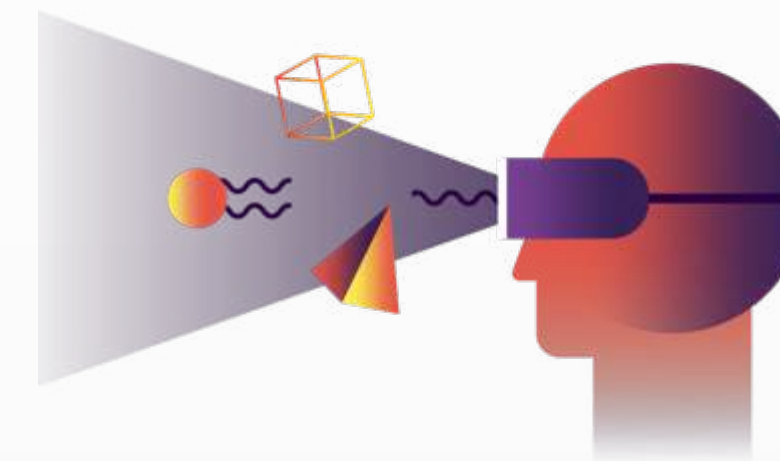
We are the pioneers in digital transformation and are the partners for the LCR4.0 brand projects where in the latest projects supported over 300 manufacturing SMEs, transformed through the adoption of digital technologies.



Our capabilities

- **Advanced Visualisation**

We enable our clients to develop a deeper understanding of their data, processes and products through the use of advanced immersive simulation techniques; including VR, AR, MR, and multi-sensory feedback.



- **Digital Twin**

We develop integrated systems architecture to support the realisation of Digital Twinning which help our clients innovate faster. We have been sitting in the digital space for over a decade now, growing with the requirement of disruptive innovation and technology within this field.



Our clients

We have co-developed and embedded solutions for a wide range of organisations to support their capability including:

- Digital Manufacturing Integrated Solutions
- Immersive Environment Developments
- Virtual Training Simulators
- Bespoke Digital Design Toolsets
- Data Analytics and Digital Tracking Systems
- Systems Architecture for Digital Twin Development

Our clients include:

Jacobs

 **Sellafield Ltd**



NATIONAL NUCLEAR
LABORATORY 

HITACHI

 **edf**

 **Alder Hey Children's**
NHS Foundation Trust



Growing Autonomous Mission Management Applications

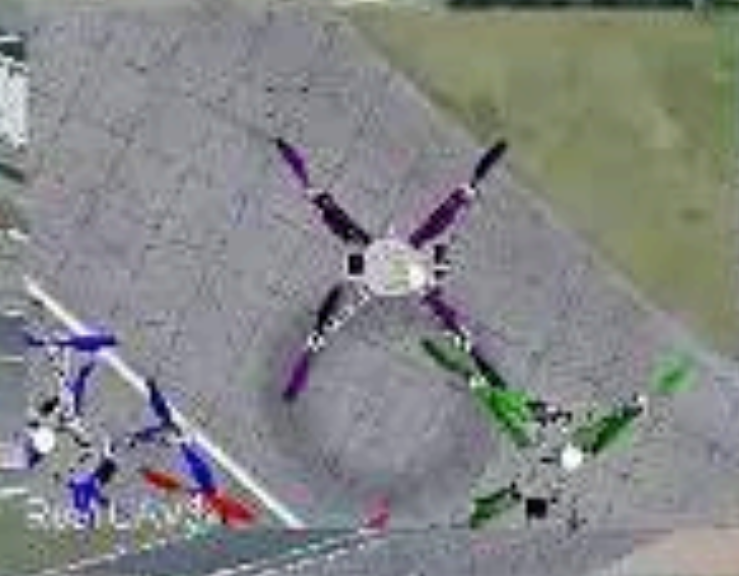
Growing Autonomous Mission Management Applications

3 year autonomous systems SME support programme aimed at driving SME engagement and developing technology within the emerging autonomous systems markets

The Great Circle Co-Evolving Mission Planner

- 4 UAS was deployed in a filming scenario at the Silverstone race track.
- 2 synthetic UAVs were produced by BAE Systems
- 2 real platforms will be provided and operated by the University of Manchester (UoM) and flown in a safe area.
- UAS transmitted their position, energy and health state data.
- CEMP receives data from the simulated UAVs and the real UAVs and generate the optimised route plans for each vehicle.

The Great Circle Co-Evolving Mission Planner



Terminal Area Ground Operations demo



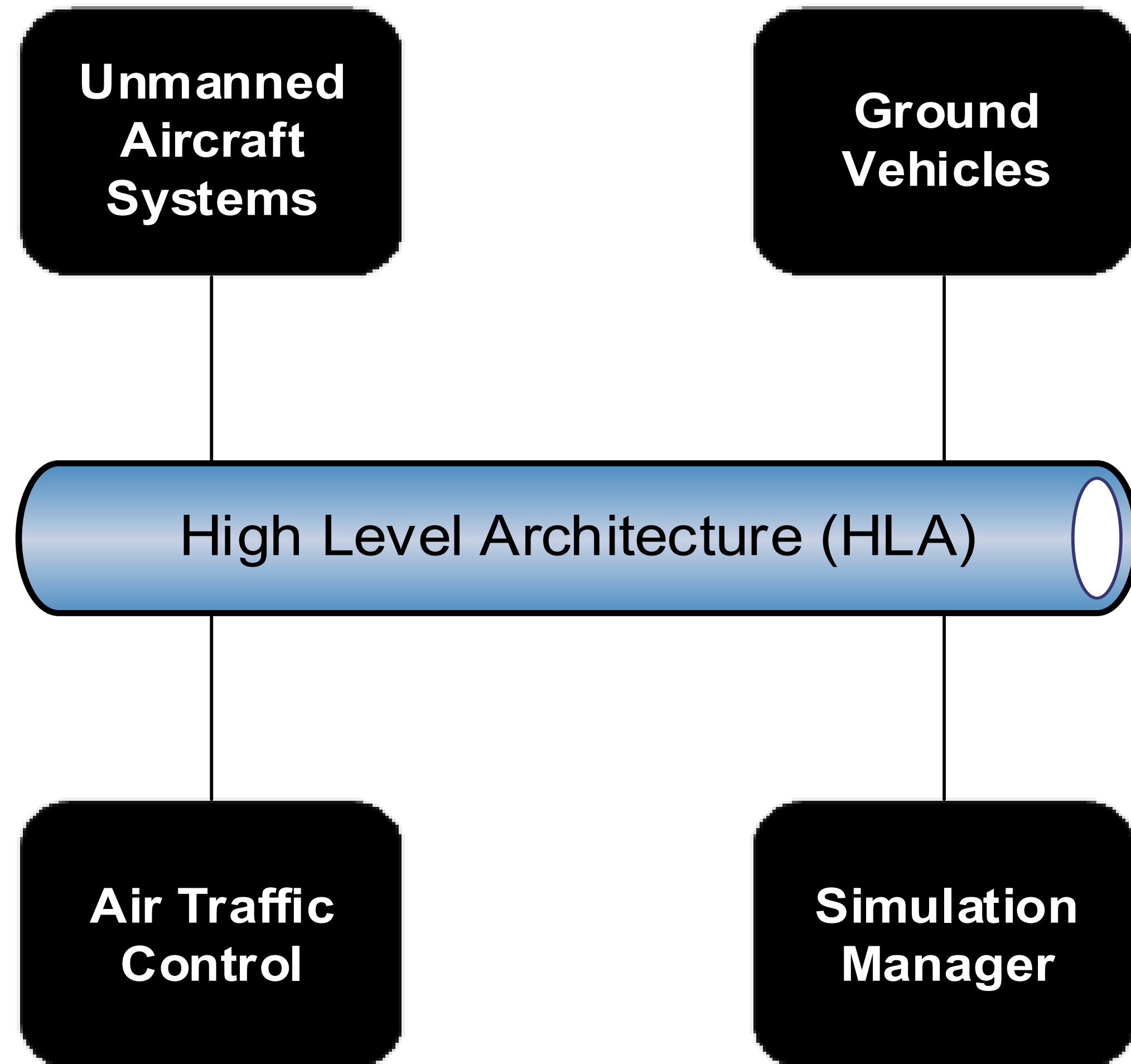
Aims and Objectives

- Facilitate the testing and evaluation of autonomous systems
- Create a virtual Testbed is developed by VEC

The testbed allows:

- Distributed and Remote Simulations
- Injecting physical entities into the virtual environment
- Realistic Testing and Evaluation





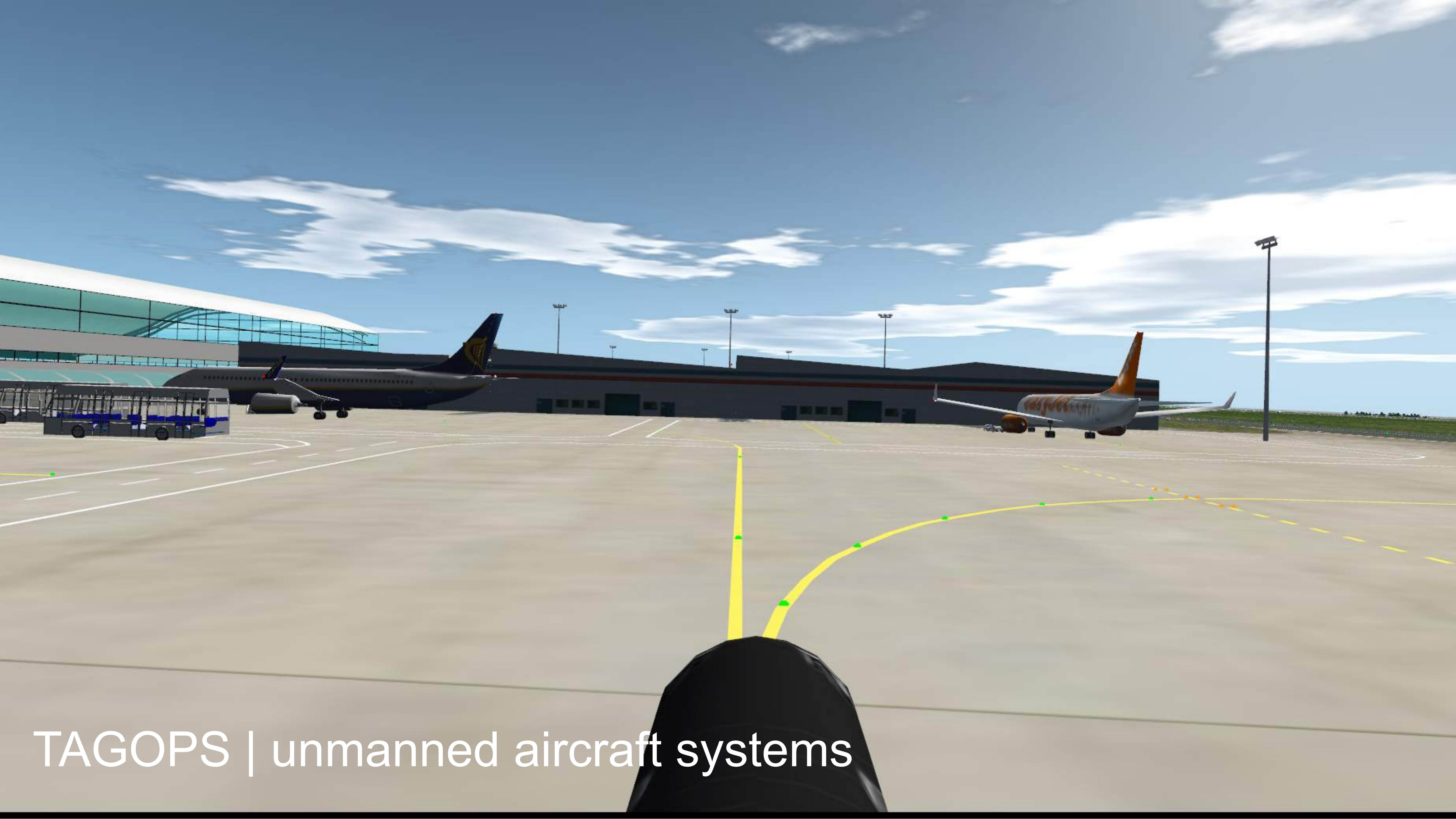
TAGOPS | simulation framework

- HLA is a standard for distributed simulation and is used by combining multiple simulations for a larger purpose.
- Simulation includes
 - Simulation Manager
 - Ground Vehicles
 - Air Traffic Control
 - UAS model
 - Rover Robot that represents a Bus





AGOPS | terminal area ground operations



TAGOPS | unmanned aircraft systems

An aerial photograph of an airport. In the foreground, there are green grassy fields and a multi-lane asphalt road. Beyond the road is a large, modern airport terminal building with a white roof and glass walls. Several aircraft are parked at gates or on the tarmac. To the left of the terminal, there's a smaller building and a lighthouse in the distance. The sky is clear and blue.

TAGOPS | air traffic control



TAGOPS | ground vehicles





Hartree Centre

Science & Technology Facilities Council

VIRTUAL ENGINEERING CENTRE

A Virtual Testbed for Autonomous Systems –
Terminal Area Ground Operations Demonstration



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Facilities Council

Distributed Mars Simulation

Aims and Objectives

This simulation was created to demonstrate a virtual space environment that can be used for,

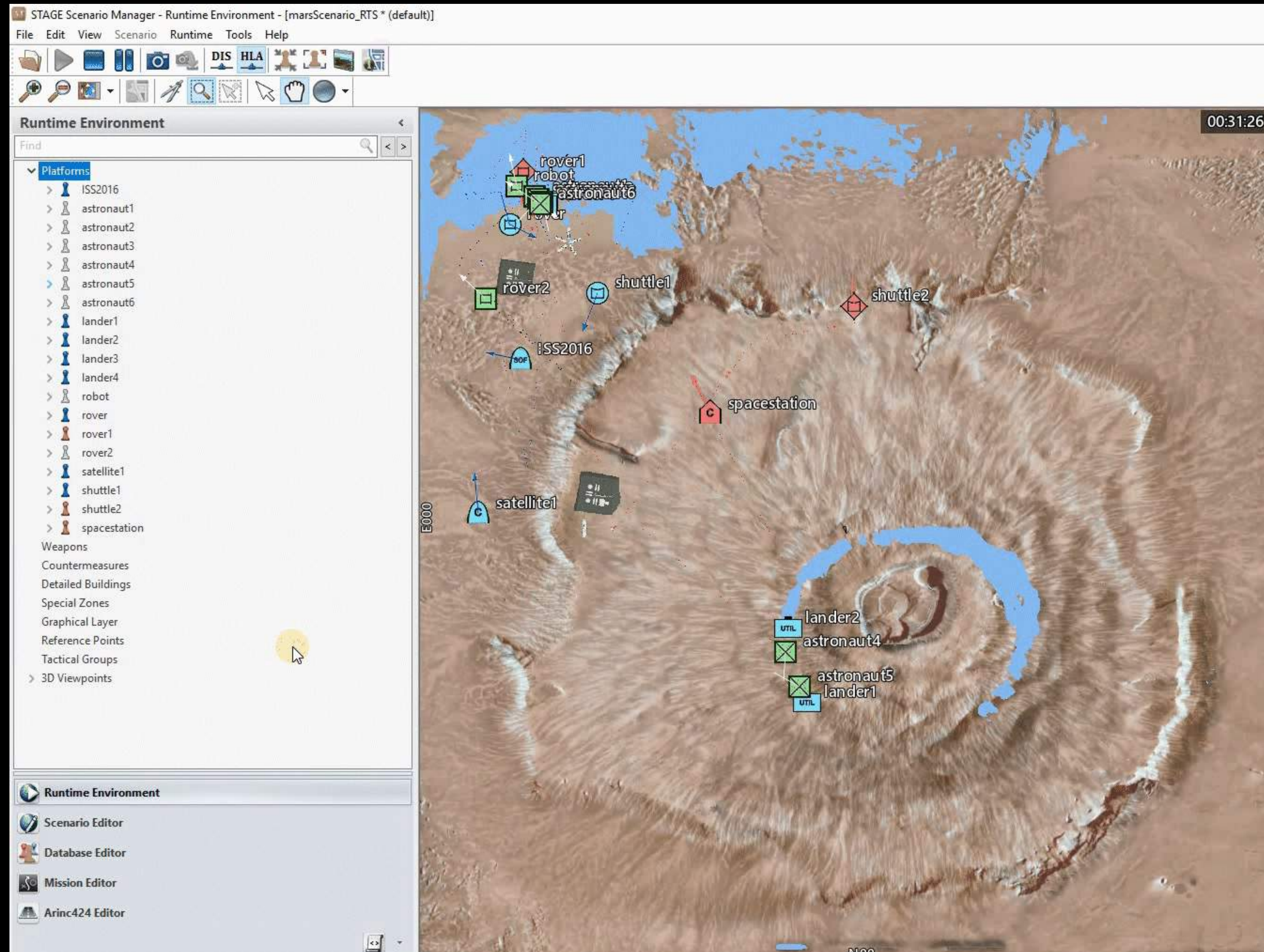
- Space robots testing
- Collaborated testing between different organisations
- Supporting synchronous communication during the simulation.

High Level Architecture (HLA)



- This architecture provides a standardized set of services through different programming languages.
- These services include information exchange, synchronization and federation management.
- The simulation is not restricted to different physical locations, IP addresses and programming languages.

Distributed Mars Simulation



Scenario Development

- Define, generate and simulate the virtual dynamic environment.
- This simulation focused on the path design of the landers, rover, spaceship and astronauts to simulate a working scenario on Mars.
- It can quickly integrate new objects, sensor, weapons and computer-generated forces.

Distributed Mars Simulation



Satellite view

Jaguar Robot



Environment Federate

- 3D Mars terrain was constructed from a 2D bird view of Olympus Mons on the planet Mars. It was original taken by NASA Viking 1.
- 3D models of building on Mars: there are several habitats and factories allocated on the Mars surface. They are purely simulation of the future view of what we could do on the Mars.
- 3D models of dynamic items on the Mars:
 - Landers: the model of Viking 1 spacecraft that was soft-land on Mars on July 20, 1976.
 - Rovers, shuttles and spaceships were borrowed from some of the Moon projects.
 - A model of Jaguar robot, which we have one in the simulation lab, is included in the simulation.

Distributed Mars Simulation



Rover Driving Federate

- A virtual VEC Rover controlled through Joystick (Mouse).
- The VEC Rover can observe the dynamic scenario
- A model of Jaguar robot is included in the simulation and it can be connected to the physical robot in the simulation lab. It can be used to test the physical functions of the robot under the simulated environment.

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Thank You

