**OPC UA** in Space a Success **Story** 







#### **Presented by**

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## **Airbus Defense and Space – TEXUS Research Rocket**

Airbus Defense and Space

#### AIRBUS

Part of the European Airbus Group

Airbus is Europe's largest aerospace company and one of the leading companies in the aviation industry worldwide

<u>TEXUS</u> – Technological Experiments in Zero Gravity Carries biological, material science, and physical experiments into space with zero gravity Longest-running rocket program for scientific experiments and technology testing in zero gravity

Today both the flight software on board the rocket and all ground systems communicate via OPC UA The entire data management and secure communication is optimized both during the rocket flight, before and afterwards





#### **Zero Gravity Experiments**



#### SIMONA

The Space Investigation of MONotectic Alloys experiment aims to analyze phase separation processes in a monotectic alloy in order to improve the models for the material behavior during segregation or mixing in melts.

#### 2 GECO

In the Gravity Elicited Calcium Oscillations experiment, scientists use a fluorescence microscope with a 3D scanning laser to observe living cells under microgravity conditions. In doing so, they capture 3D images to investigate changes in the calcium concentration

#### PHOENIX II

3

The aim is to investigate combustion processes in zero gravity and the spontaneous ignition of fuel droplets in order to increase combustion efficiency, particularly for more environmentally friendly engines and fuels. A better understanding of these processes could significantly increase their efficiency.

#### SAFARI

Researching the crystallization of liquid silicon under microgravity to develop more accurate predictions and models of its crystallization behavior. Silicon is crucial for solar cells; therefore, it is important to improve production to drive the green transformation.

#### 5 TOPOFLAME

This experiment investigates the behavior of a flame in microgravity by burning a fuel under constant gas pressure, similar to the conditions in spacecraft. The main aim is to improve safety on board spacecraft by investigating how fire spreads in microgravity.

#### 6 T-REX

Conducting biological studies on human cells, the so-called T lymphocytes. Research into the mechanisms of microgravity perception in mammalian cells.

Platforms for Zero Gravity Experiments

- > ESA ZARM Drop Tower Bremen (4.74 Seconds)
- > Airbus A310 ZERO-G (20 Seconds)
- > TEXUS Rocket (6 Minutes)
- > International Space Station (ISS)



### **TEXUS Research Rocket Flight**

Preparation time one year Rocket: 13 meters long, 2680kg Payload: 5.3 meter, Ø438mm 280kg Complete flight time 15 minutes Maximum Altitude 260 kilometers Zero gravity 6 minutes Save recovery of payload by parachutes and helicopter





#### **First OPC UA Integration Steps**





### **Second OPC UA Integration Step**





### **Quote from Program Manager at Airbus**



#### ANDREAS SCHÜTTE, Program Manager for Suborbital Missions at Airbus Defence and Space

"The adoption of OPC UA has been driven by two key factors: the Ethernet capability and the integrated data model within the server. Ethernet capability enables remote testing and operation, eliminating the need for physical presence. In addition, the embedded data model simplifies the completion of test modules by facilitating easy access and compilation of the required information."



### **Current use of OPC UA Client/Server and PubSub**





### **Unified Automation Products – C++ Based OPC UA SDK**

C++ Based OPC UA Server SDK

Step 1: Development of OPC UA Servers for Ground Adapters

**Step 2**: Integration of OPC UA Servers in Experiments and Flight Modules

Step 3: Addition of OPC UA PubSub Communication





### **Unified Automation Products – UaGateway**

Information Model creation with UaModeler and import to UaGateway TagFile

Aggregation of data from OPC UA servers and clients in central OPC UA Information Model in UaGateway

Conversion between OPC UA Client/Server and PubSub communication





### **Quote from Project Lead OPC UA Integration at Airbus**

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"OPC UA serves as a data highway known for fast, rich, controlled, and secure data transfer. The OPC Foundation always anticipates our needs, proving their proactive approach, such as with PubSub. In the three years leading up to the implementation, the collaboration with OPC Labs and Unified Automation has been instrumental in our progress and we are very pleased with the achievement of our efforts."



ENRICO NOACK, Engineer at Airbus Defense and Space



### **Benefits of OPC UA for TEXUS**

#### Performance of OPC UA at TEXUS

- With OPC UA, the number of data points per experiment increases from 64 to 4,000.
- OPC UA enables a better insight into the system, as comprehensive communication data can be transmitted in real time.
- System integration is simplified.
- Efficient troubleshooting is made possible, which was previously time-consuming and labor-intensive.
- If data communication fails, data is temporarily stored in the experiment module.

- Modules are autonomous and can control experiments independently.
- Basic experiments can also be carried out during communication interruptions.
- After module recovery, scientists have access to all experiment data.
- The integrity of the research results remains guaranteed.
- The housekeeping data collected on board is transmitted in real time to ground systems and devices.

**OPC UA** in Space a Success Story



Complete Success Story: opcfoundation.org > Resources > Material > Success Stories

#### **OPC UA IN RESEARCH ROCKET TEXUS**