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Utilization of Simulation Software to Enhance the Learning Experience for Students at the Worldwide Campus

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2023 Academic Innovation Virtual Conference

- Roundtable Discussion: Utilization of simulation software to enhance the learning experience for students at the Worldwide Campus

- **Presenters:**

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Dr. Kimberly Luthi, Assistant Professor, College of Aviation

Dr. Yuetong Lin, Associate Professor, College of Aviation

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Introduction and Disclaimer

- The purpose of this presentation is to introduce benefits, best practices and examples of simulation software in online cours environments.

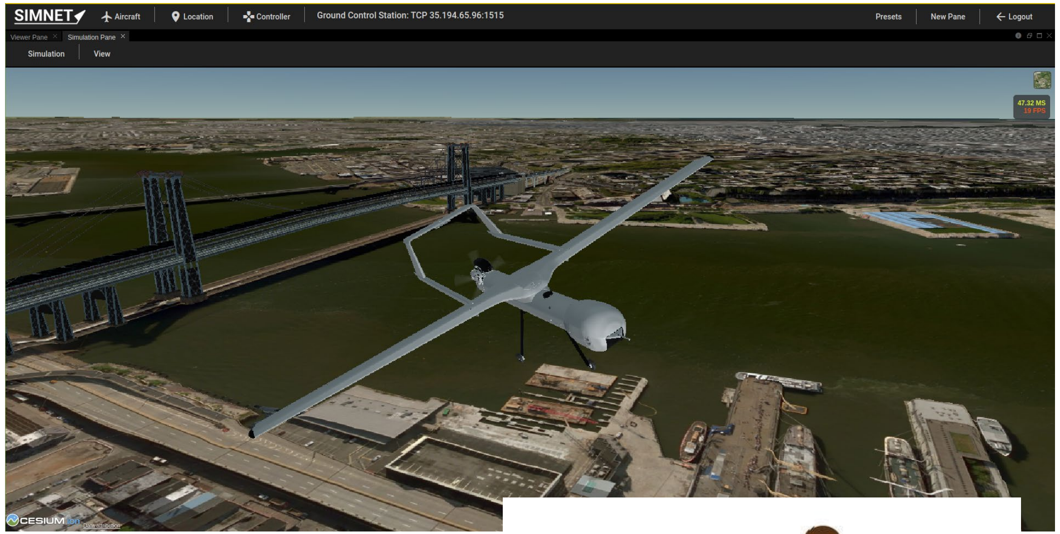
- The research team does not have any affiliation with the introduced software platforms.

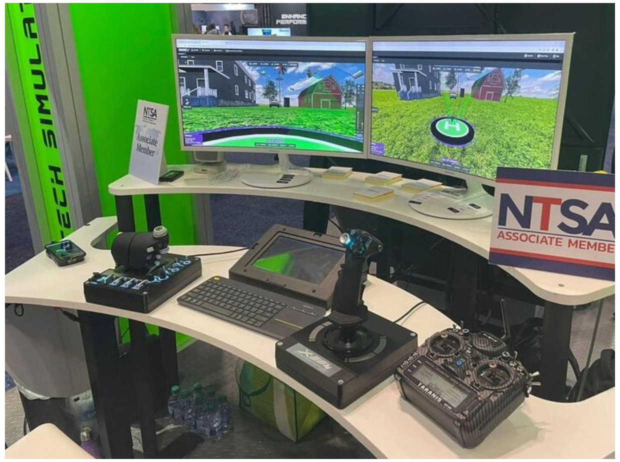
Overview

- 1.Background and conditions
- 2. Purpose and integration
- 3. Examples and best practices
- 4. Lessons learned and outlook

Benefits of Simulation Platforms

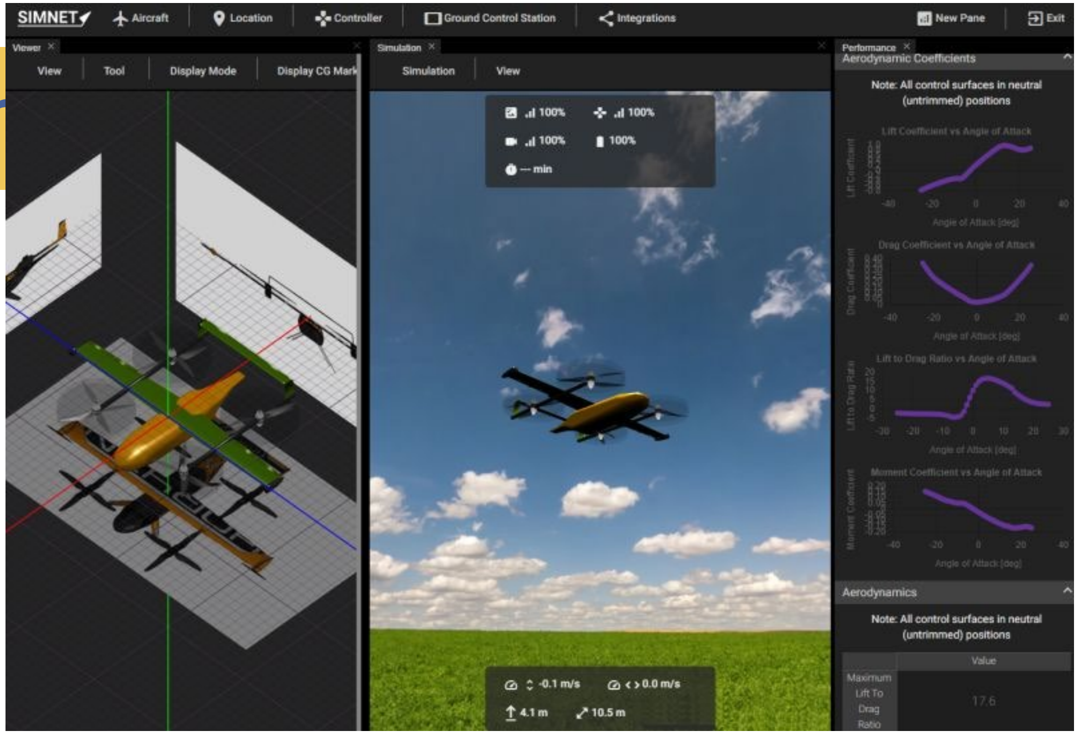
- Inquiry based learning
- Constructivist learning
- Creativity

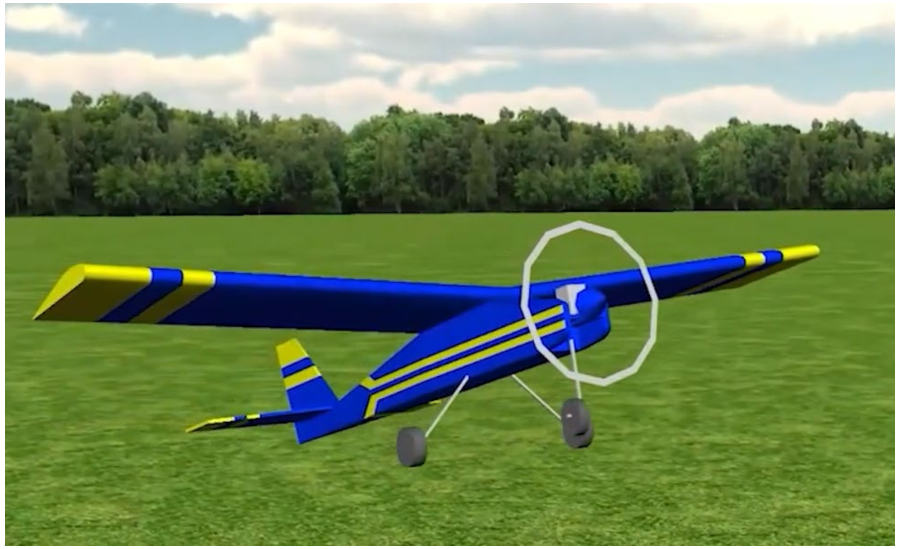


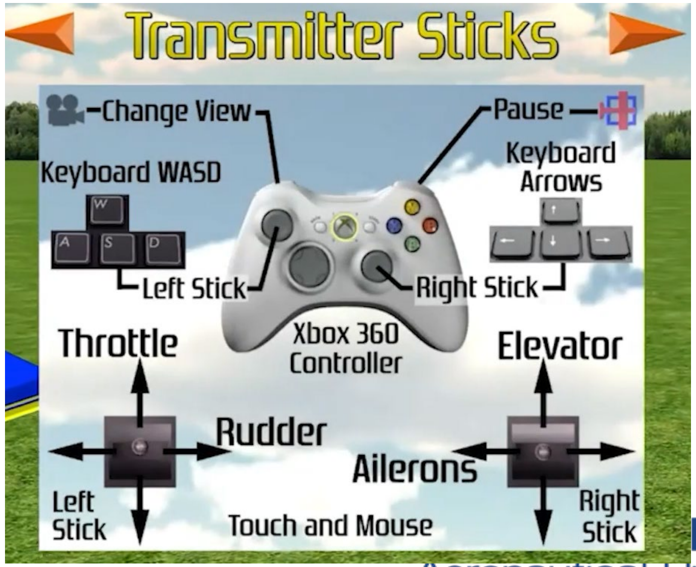


Benefits of Simulation Platform

- Visualization
- Problem solving; and
- Challengebased projects







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Conditions and Vetting Parameters

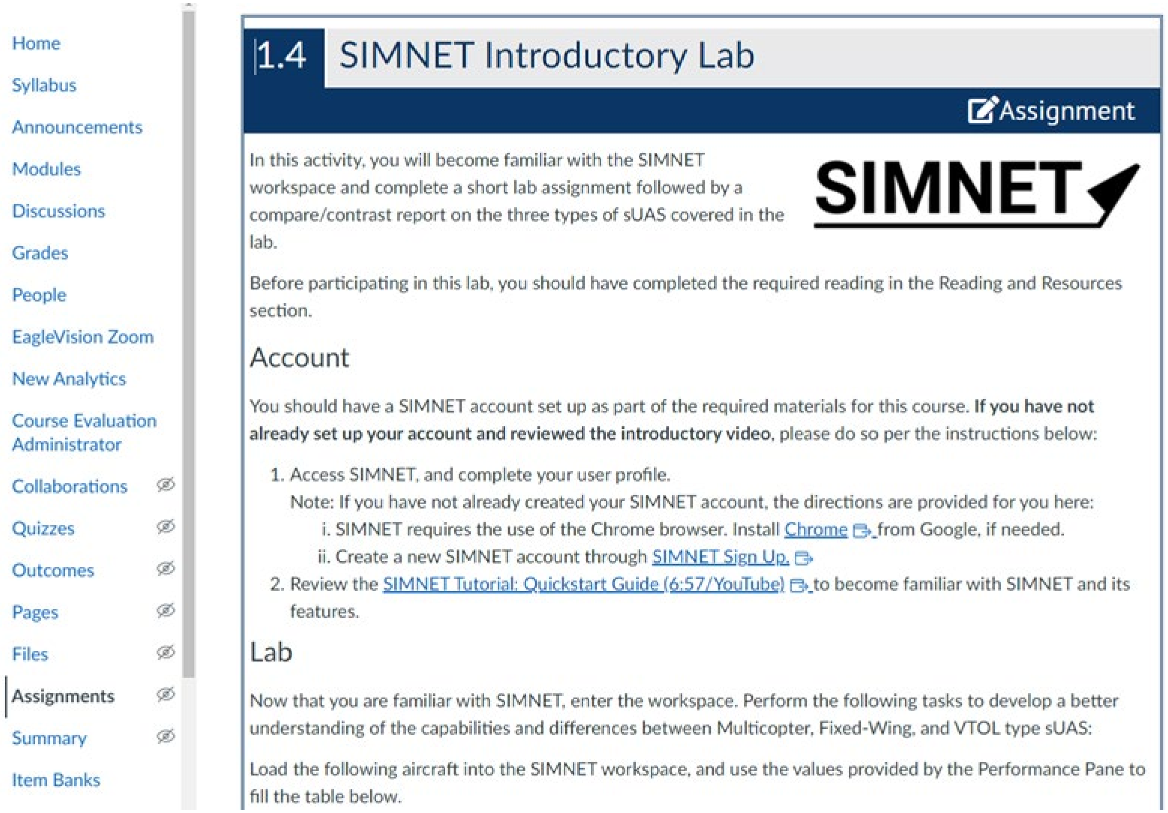
- Availability (region, OS)
- Applicability
- Download package or browser-based
- Onboarding and tutorials
- Affordability – Open Source or free trials available?
- Affordability – create accounts and purchasing models (e.g. 3 month license)
- Integrate in Master Textbook List as course material

Conditions and Vetting

- Coordinate with Academic Technology Dept. for evaluation
- Structured process for "request for a tool review" with AT
- Utilization as course material external to Canvas

Conditions and Vetting

- Activity/assignment creation



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Announcements
Modules
Discussions
Grades
People
EagleVision Zoom
New Analytics
Course Evaluation Administrator
Collaborations
Quizzes
Outcomes
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Assignments
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Item Banks

1.4 SIMNET Introductory Lab

Assignment

In this activity, you will become familiar with the SIMNET workspace and complete a short lab assignment followed by a compare/contrast report on the three types of sUAS covered in the lab.

SIMNET

Before participating in this lab, you should have completed the required reading in the Reading and Resources section.

Account

You should have a SIMNET account set up as part of the required materials for this course. **If you have not already set up your account and reviewed the introductory video**, please do so per the instructions below:

1. Access SIMNET, and complete your user profile.
   Note: If you have not already created your SIMNET account, the directions are provided for you here:
   i. SIMNET requires the use of the Chrome browser. Install Chrome from Google, if needed.
   ii. Create a new SIMNET account through SIMNET Sign Up.
2. Review the SIMNET Tutorial: Quickstart Guide (6:57/YouTube) to become familiar with SIMNET and its features.

Lab

Now that you are familiar with SIMNET, enter the workspace. Perform the following tasks to develop a better understanding of the capabilities and differences between Multicopter, Fixed-Wing, and VTOL type sUAS:

Load the following aircraft into the SIMNET workspace, and use the values provided by the Performance Pane to fill the table below.

~~The Environment~~ Setting the Scene

- Using screenshots and recordings as proof and evidence
- Using individual and group activities
- Sharing of results and peer review
- Creativity fosters the achievement of CLO's

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The Environment Setting the Scene

- Using screenshots and recordings as proof and evidence

Lab

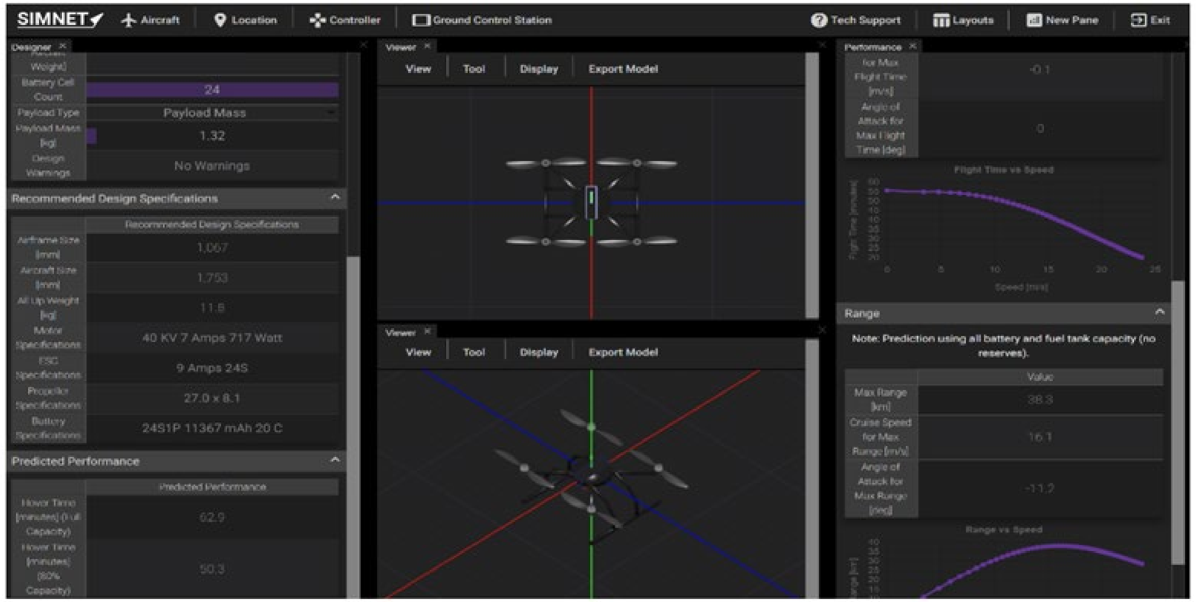
Now that you are familiar with SIMNET, enter the workspace. Perform the following tasks to develop a better understanding of the capabilities and differences between Multicopter, Fixed-Wing, and VTOL type sUAS:

Load the following aircraft into the SIMNET workspace, and use the values provided by the Performance Pane to fill the table below.

Aircraft	UAS Type	Endurance [minutes]	Maximum Range [km]	Maximum Speed [km/h]
H140 Hexacopter	Multicopter			
Q400 Fixed Wing UAV	Fixed-Wing			
Q400 VTOL UAV	VTOL			

Prepare a one to two-page report that includes the results from the table above and compares the strengths and weaknesses of each UAS type in terms of performance. Tie this information in with the information presented in your readings about each UAS type in terms of its unique capabilities and/or shortcomings.

Your lab report may include screenshots if desired and does not need to be in APA format **with the exception of references provided at the end.** Be sure to review the SIMNET Lab Rubric to understand expectations for your



Introduction of Simulation Software

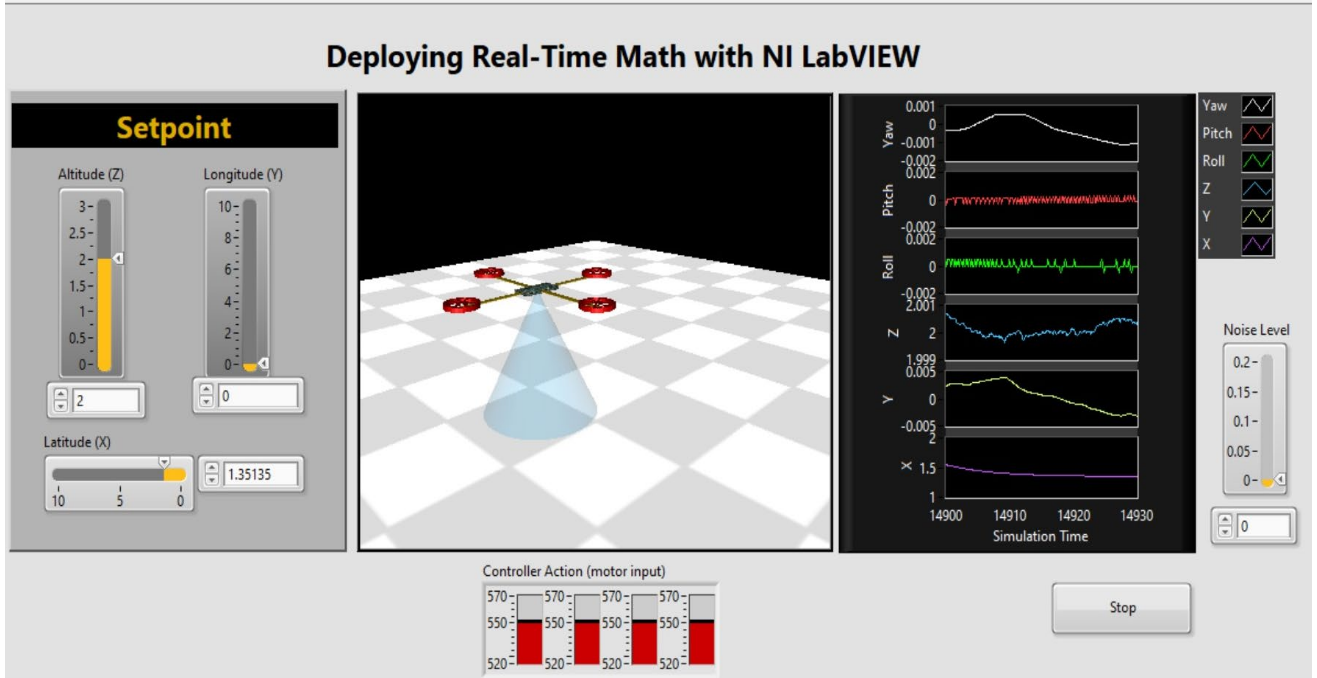
- LabVIEW
- MATLAB and SIMULINK
- SIMUAID/LOGICAID/VIVADO
- Multisim

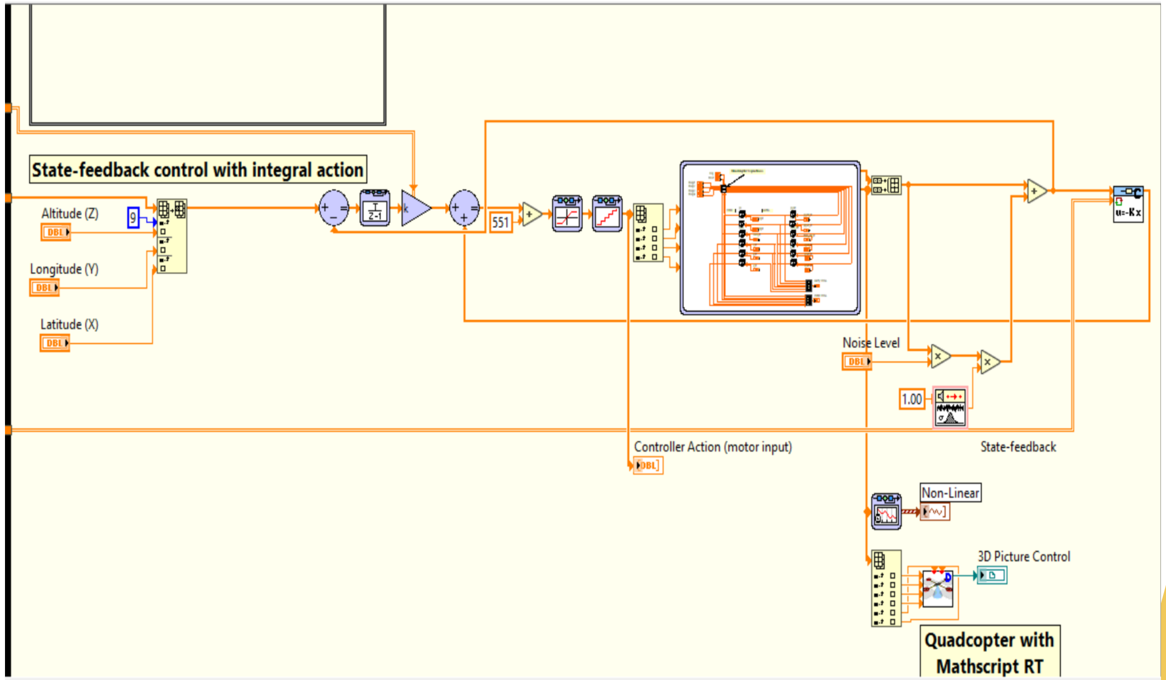
- SIMNET AERO
- WeBots
- AutoCAD Fusion

Simulation Software for Engineering

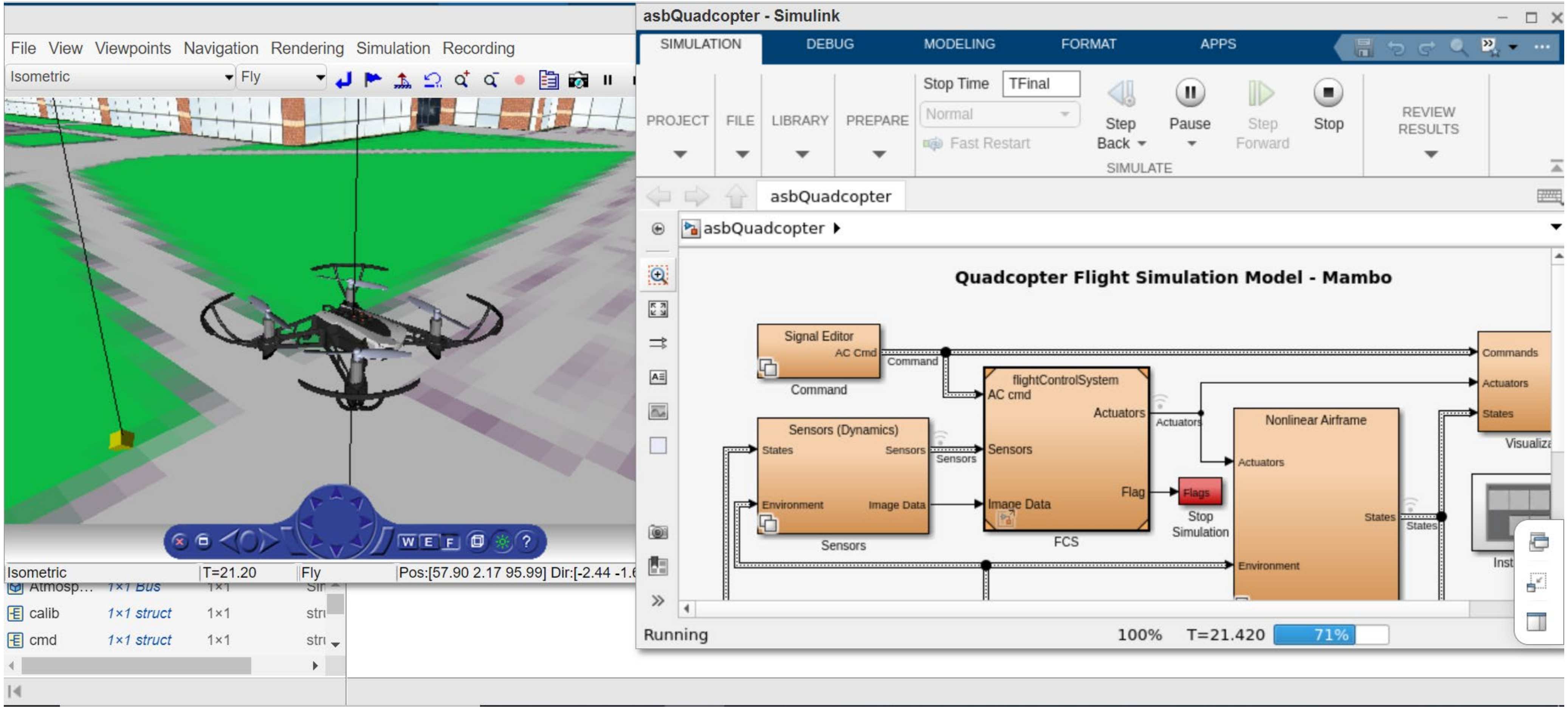
LabVIEW

- Quadcopter Dynamics and Control

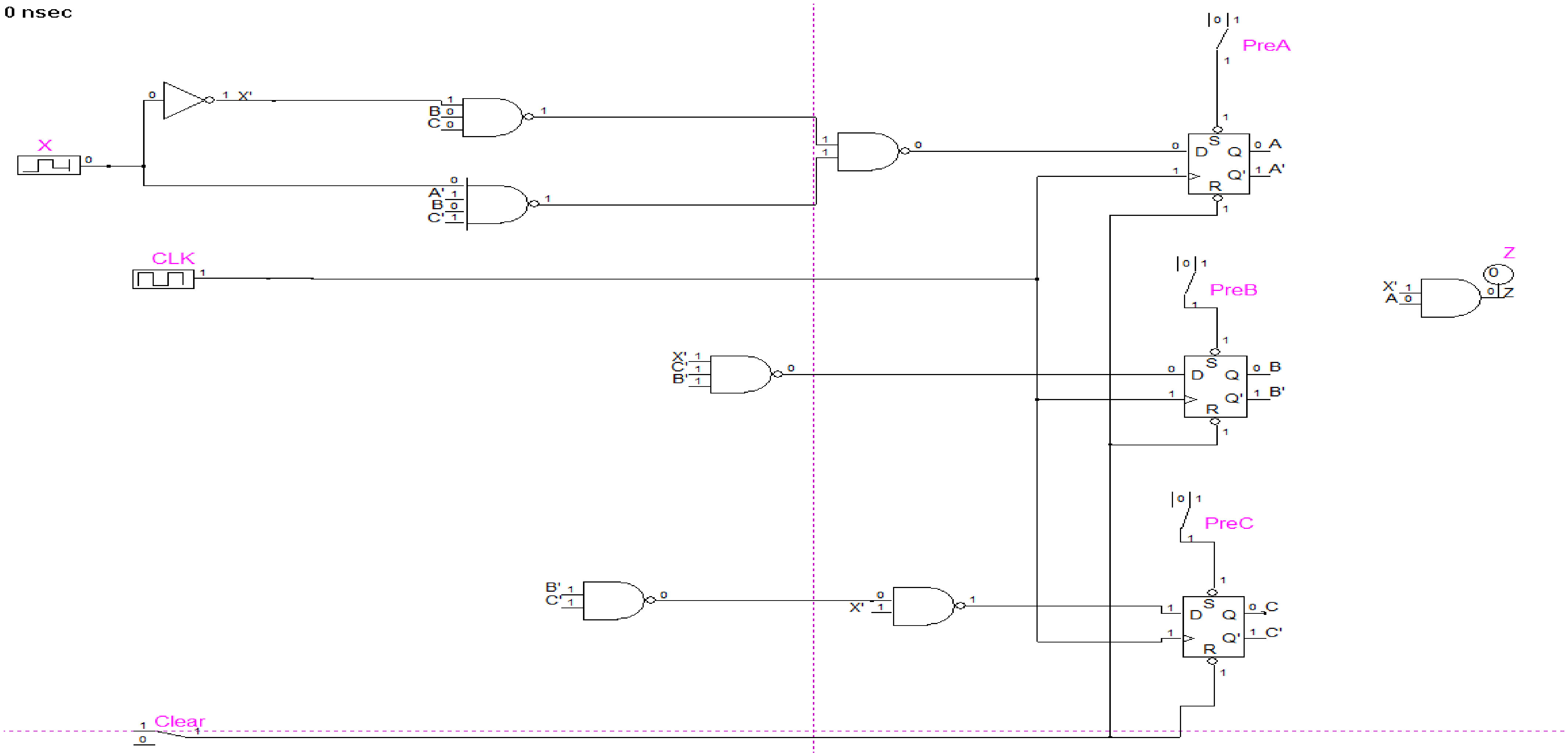




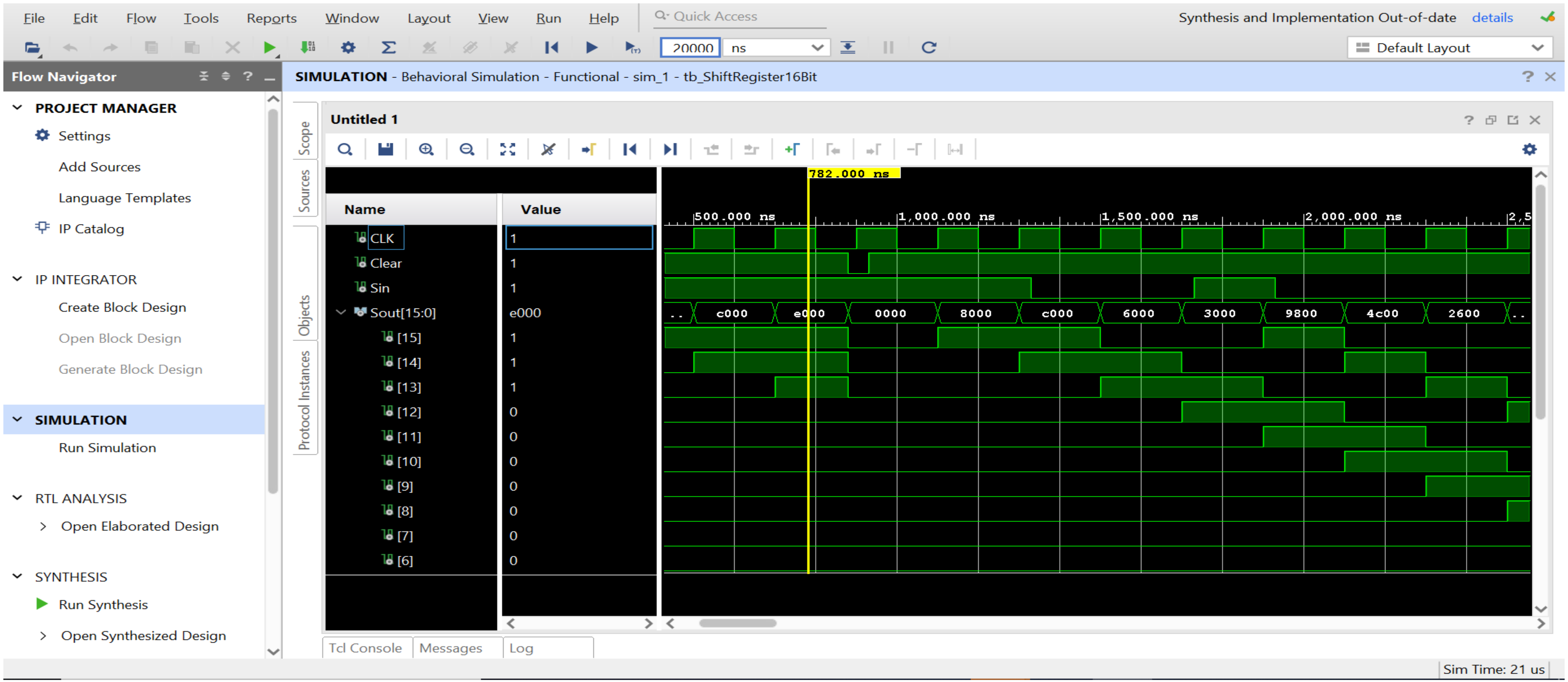
MATLAB/SIMULINK



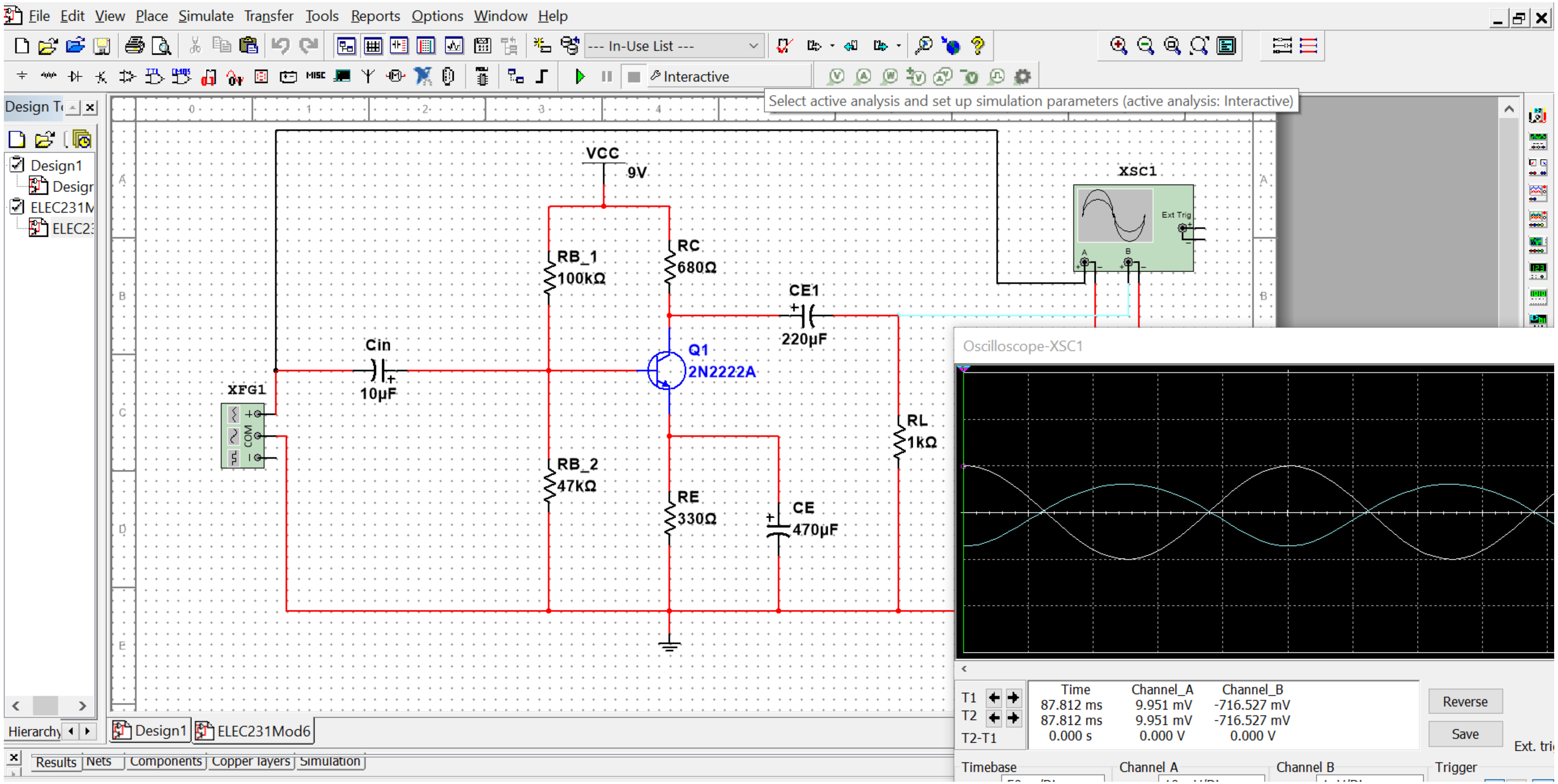
Digital Circuit Simulation Software SIMUAID



Digital Circuit Simulation Software-Vivado



Circuit Simulation Software-Multisim

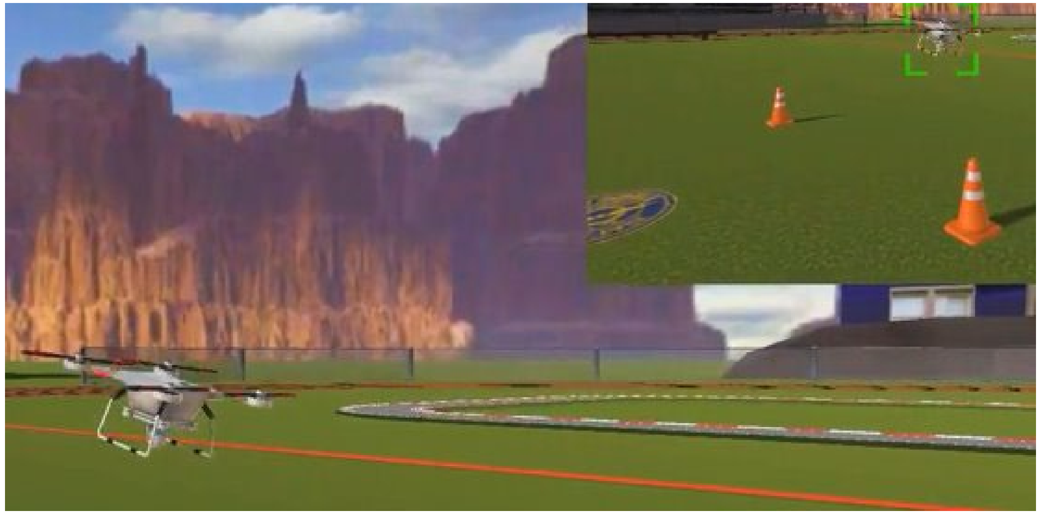


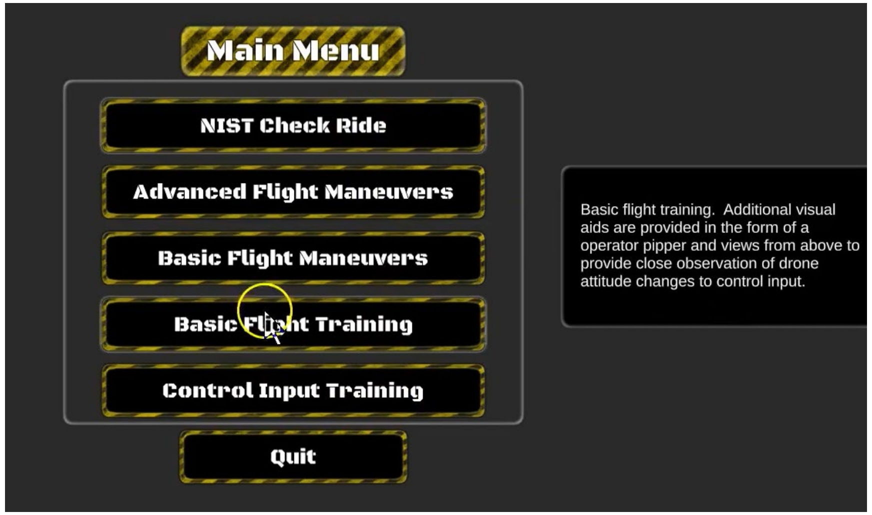
UAS Simulation Preparation

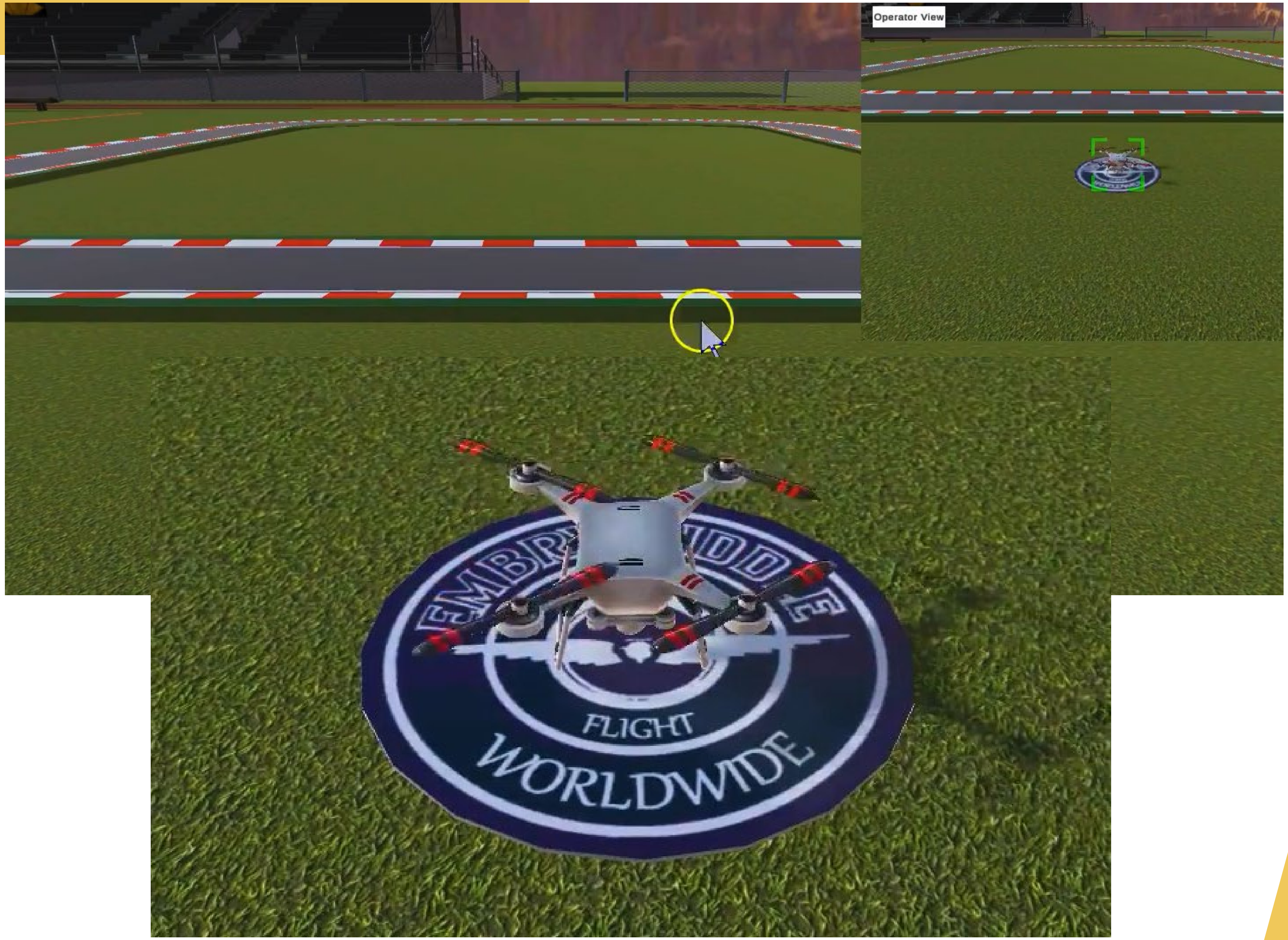
- Allows for effective operation and application of sUAS.
- Introduced via our Dept. Of Flight in the sUAS Ops Minor
- Supports learning of sUAS systems and operating requirements as well a navigational competencies.
- Offers practice on scenario-based modeling to improve students' airmanship skills and understanding of course material.

*See AIR RT Session "Integrating VR into the Asynchronous Learning Environment" Dr. Sanders, Dr. Marcham, Dr. Thirtyacre, Mr. Delcastillo

Simulation Preparation







ERUPTSim was ERAU WW developed. The flight simulator (Unity-engine) offers training remote pilots of drones/sUAS.

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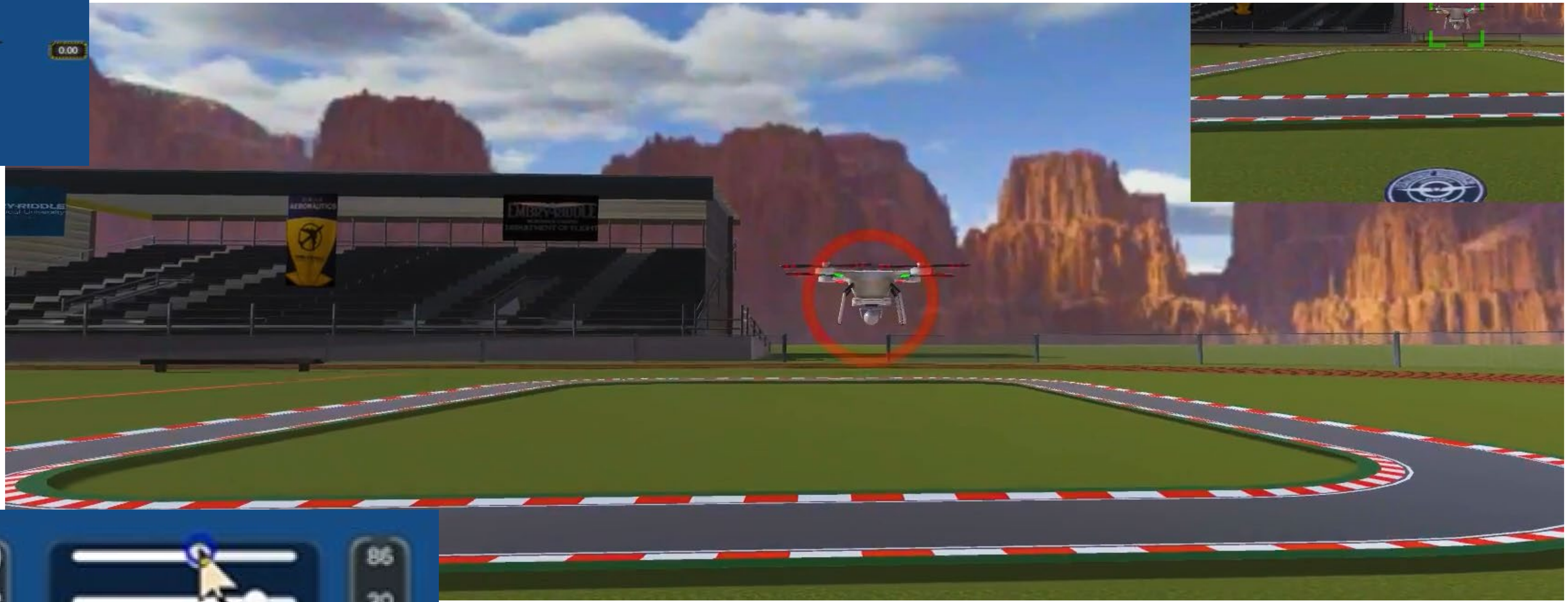
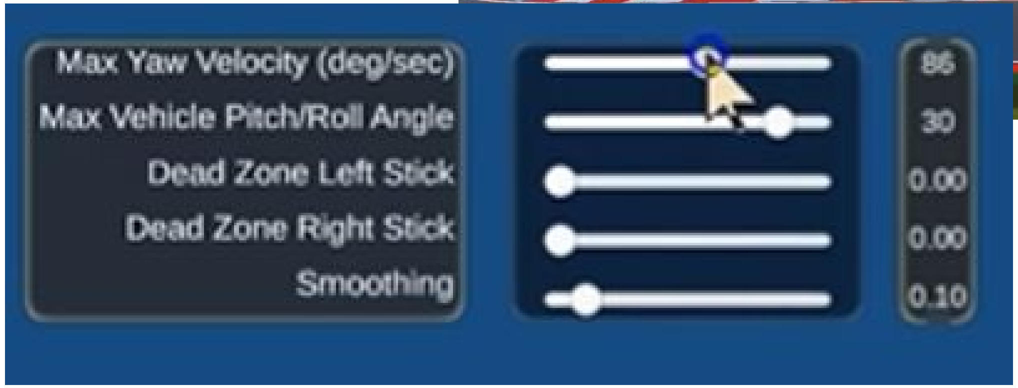
Simulation Preparation





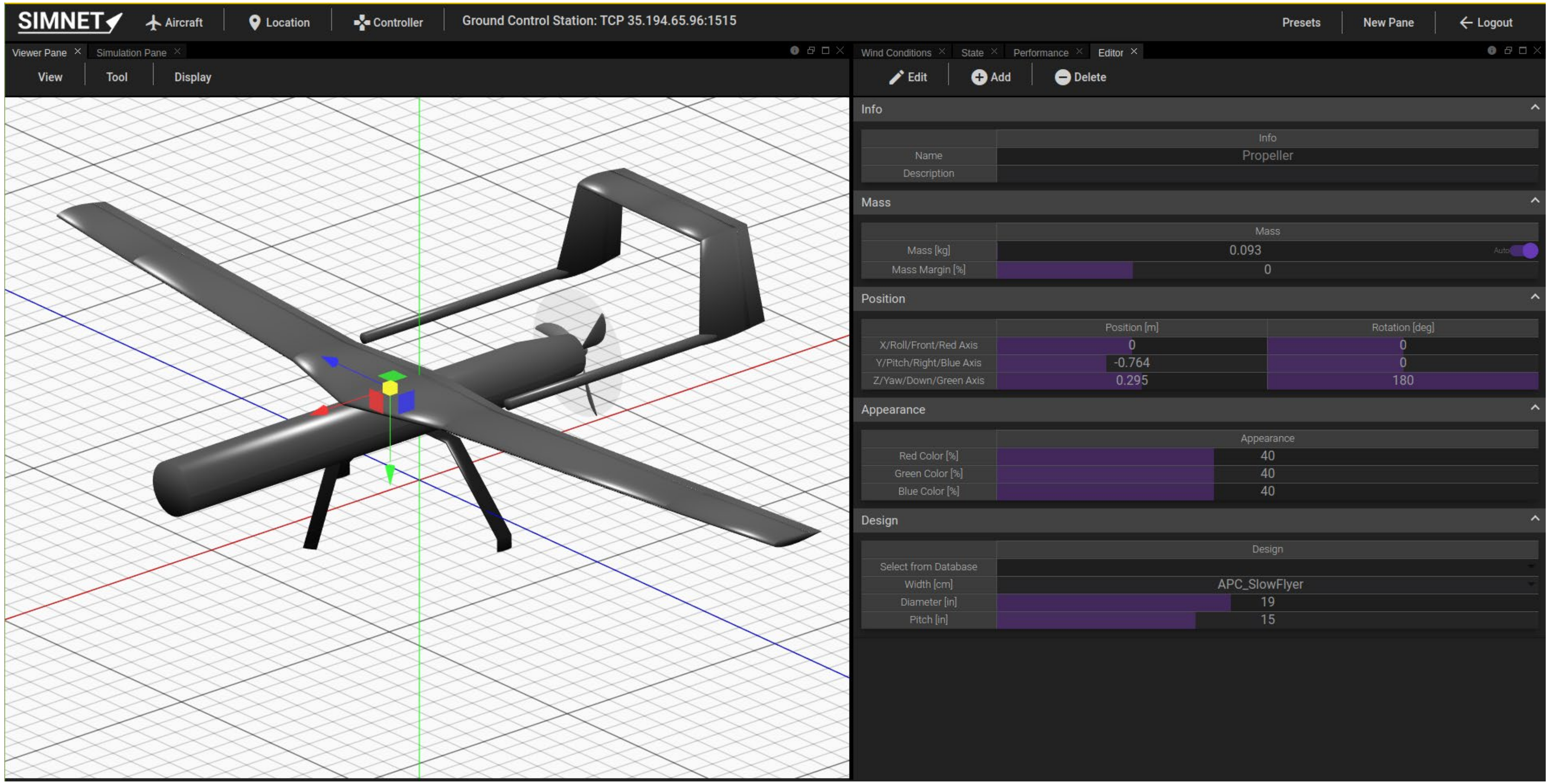
ERUPTSim: Works on computer, laptop and in VR environment (Oculus Quest) and is compatible with Windows and Mac.

SIMNET AERO

SIMNET AERO

- Design, analysis, and simulation of multicopter, fixed-wing, and VTOL drones.
- Configurator – create, design and engineer an sUAS.
- Simulator – sUAS flight simulation with QGroundControl.
- Mission Planning.

SIMNET AERO



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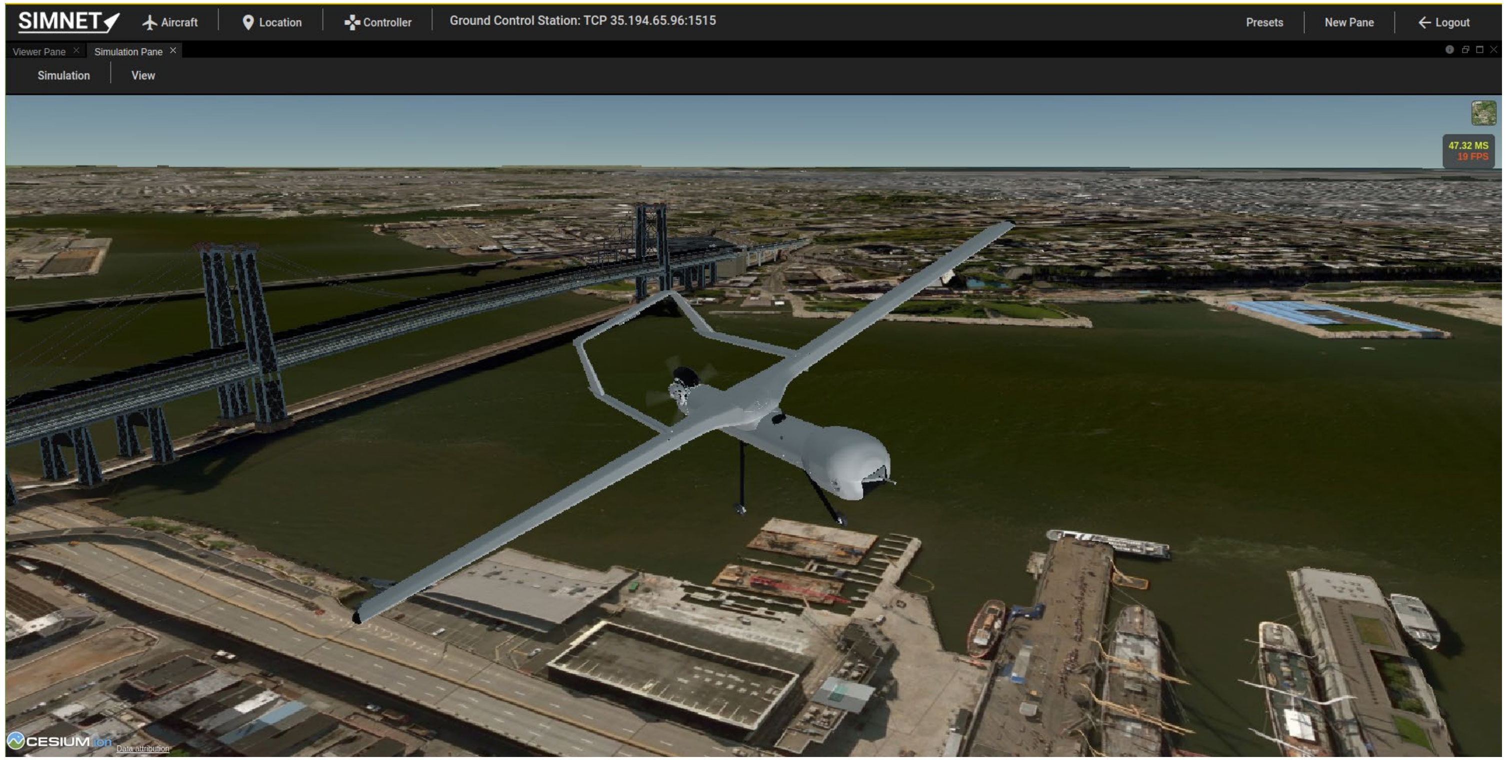
SIMNET AERO

- Works as course material in BSUSA
- 3-month software license
- purchased through the bookstore



AutoDesk Fusion 360

AUTODESK®
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AutoDesk Fusion 360

- CAD – Computer Aided Design
- Portfolio of AutoDesk

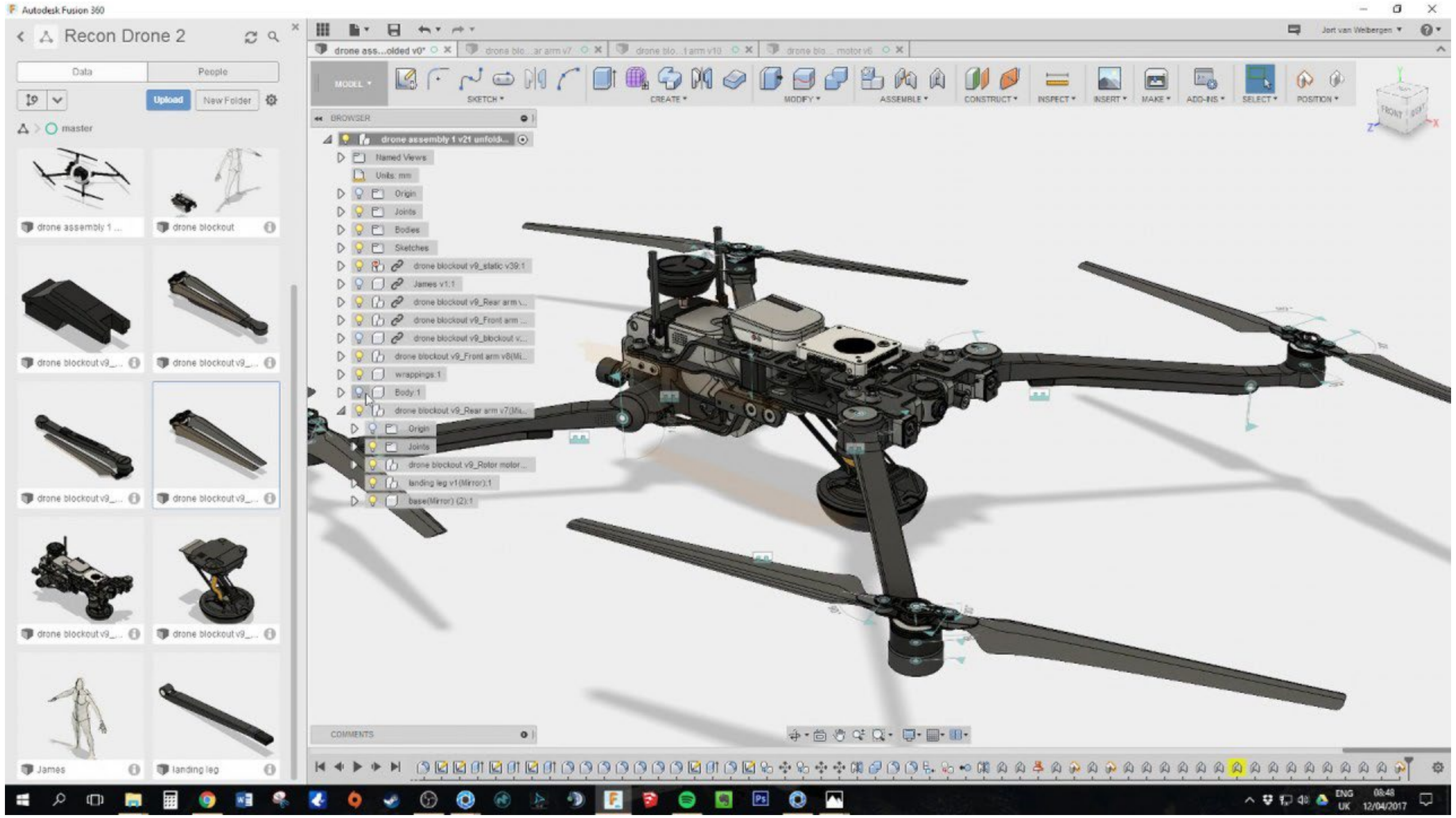
- Tool for object generation, engineering, and industrial design
- Students and educators can get free one year educational access to Autodesk products and services, renewable as long as you remain eligible.

AutoCAD Fusion 360

- Forms
- Sizes
- Joints
- Actuators
- Locomotion
- Sensors

AutoCAD Fusion 360

- Uncrewed and robotic systems
- All Domains
- Shapes
- Elements
- Sizes

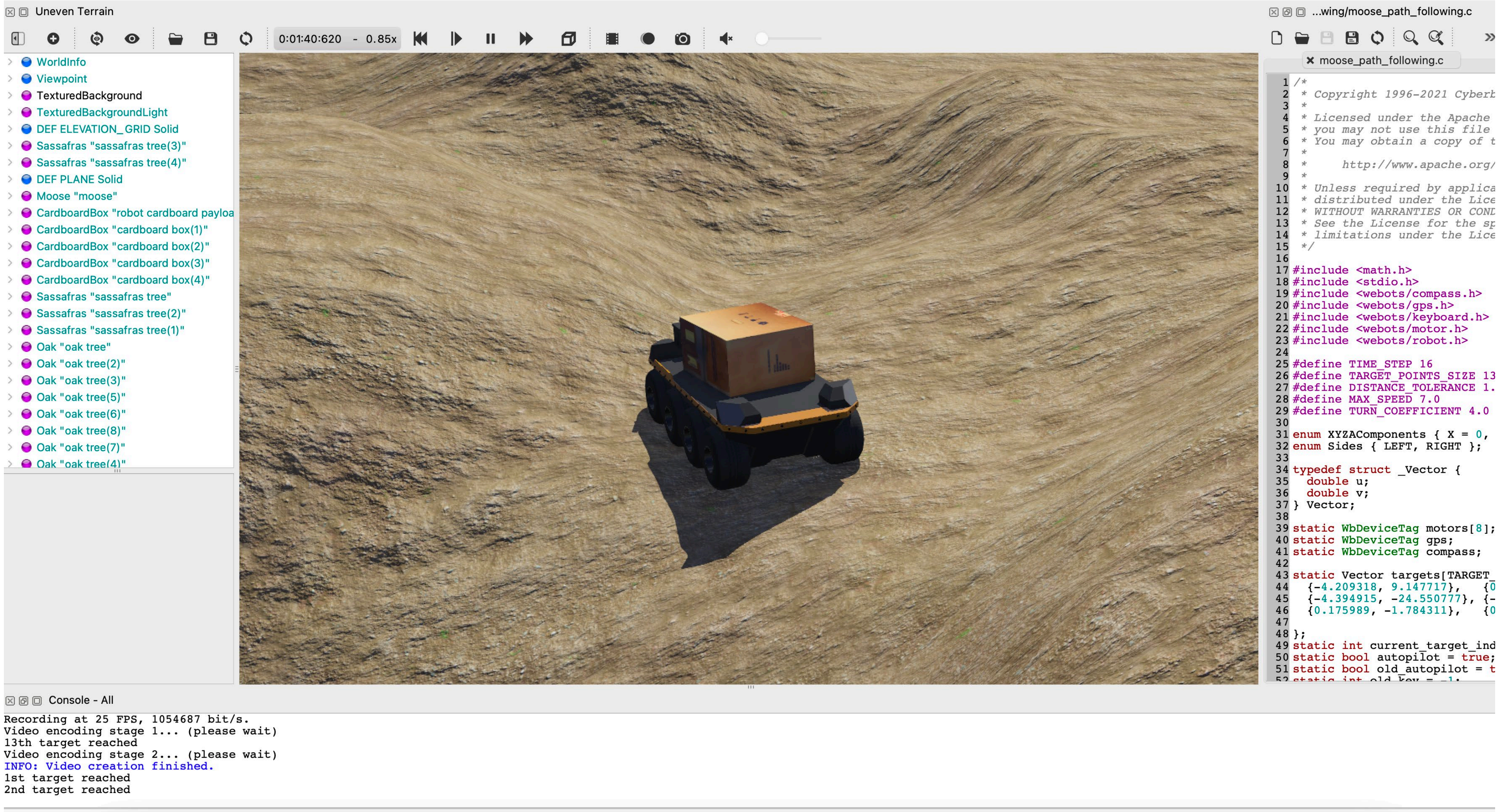


Cyberbotics WeBots - Robots in Virtual Worlds

Webots™

fast prototyping and simulation of mobile robots

Cyberbotics WeBots Robots in Virtual Worlds



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Cyberbotics WeBots - Robots in Virtual Worlds

- WeBots is an open-source three-dimensional mobile robot simulator.
- It was originally developed as a research tool to investigate various control algorithms in mobile robotics.
- minimal knowledge is needed in mobile robotics, in C, C++, Java, Python or MATLAB programming, and in VRML97 (Virtual Reality Modeling Language).
- Free for download.
- Excellent User Guide for Robotics Introduction.

Cyberbotics WeBots - Robots in Virtual Worlds

Future Outlook

- Drone technologies will increasingly be used as a tool to enhance teaching and learning effectiveness.
- New software will increase student engagement in project-based learning in STEM education to address programming aspects and application of UAS for the collection of remote sensing data.
- Additional considerations for faculty training and professional development will be needed to address training on new systems as well as ongoing changes in policy and regulations.

LessonsLearned

- Very good feedback from students
- Engaging and creative learning environment
- Students can explore, trial, and improve
- Compare results in the classroom or discussion board

- **Constructivist learning is an excellent plagiarism prevention.**

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Thank you

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