NETCO Annual Conference – Aug 13, 2023

THE FUTURE OF SKILLS TRAINING: A BLENDED APPROACH IN HOISTING & RIGGING



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SPEAKERS



Ed Wisniewski
Chief Technology Officer,
NORCAT



Brandon Vance
Senior Consultant,
NORCAT Advisory

PROJECT TEAM

- NORCAT Studio – Andrew Kostuik
- NORCAT Advisory – Nick Beckett-Brown
- SME's – NORCAT and NETCO
- Trainers

NETCO CNMIE

IBEW - CECA | NATIONAL ELECTRICAL TRADE COUNCIL

FIOE - ACEE | CONSEIL NATIONAL DES MÉTIERS DE L'INDUSTRIE ÉLECTRIQUE

CECA
AEE

IBEW
CANADA

HOISTING AND RIGGING

- Course Development
- Technical Challenges and VR Development
- Integrating VR into the Curriculum
- Future of VR in Training
- Closing Remarks and Questions



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COURSE DEVELOPMENT



HOISTING AND RIGGING

- Critical, high-risk work activity
  - In 2021, 52 significant crane-related incidents were reported to the Ontario MLITSD
- Knowledge of Hoisting & Rigging equipment, materials, and safe work practices identified as an industry need
- Gaps in existing training (performing lifts)
- Desire for an immersive, interactive experience



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PROJECT KICK-OFF

- Identifying SMEs
- Planning Sessions / Workshops
- Resources, Imagery, Branding
- Learning Objectives and Exercises
  (Theory, Practical Skills)
- Identifying VR Assets
- Course Outline



COURSE OBJECTIVES

- Improve Knowledge, Competency, and Confidence in:
  - Relevant legislation
  - International hand signals
  - Hazards
  - Safe lifting practices
  - Fundamentals of ropes, knots and hitches
  - Rigging hardware and devices
  - Safe rigging practice
  - Cranes
  - Lift planning
- **Emphasis on performing lifts**



3 DAY COURSE

- **DAY 1**
  - Module 1: Legislation and International Hand Signals
  - VR Skill Building: Practice Hand Signals
  - Module 2: Hazards and Safe Lifting Practices
  - VR Skill Building: Determine Proper Lifting Points
  - Module 3: Natural and Synthetic Ropes, Knots and Hitches
- **DAY 2**
  - Module 4: Rigging Hardware and Devices
  - VR Skill Building: Equipment Inspections
- **DAY 3**
  - Module 5: Safe Rigging Practice, Cranes, and Lift Planning
  - VR Practical Lifting Scenarios



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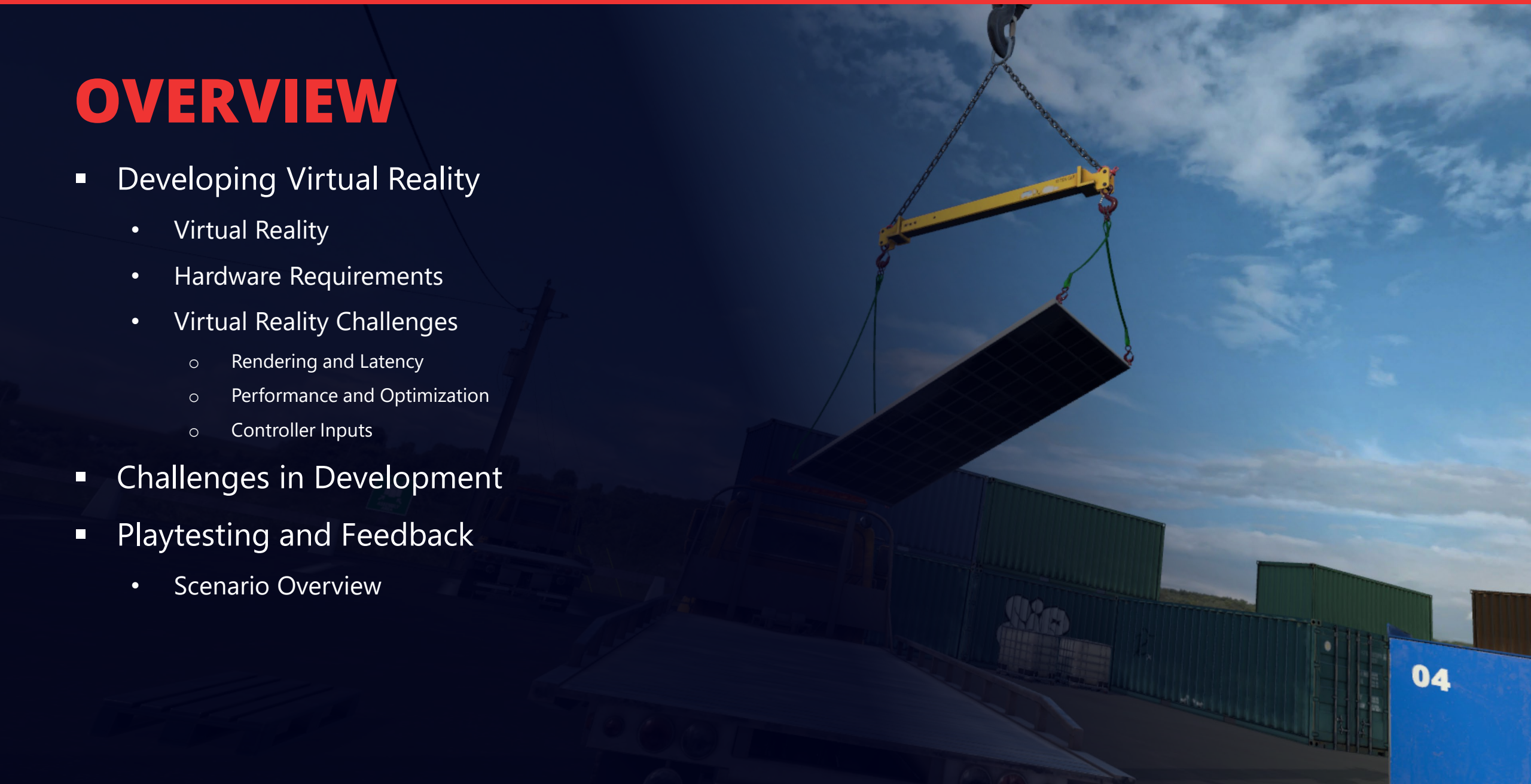


TECHNICAL CHALLENGES AND VR DEVELOPMENT

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OVERVIEW

- Developing Virtual Reality
  - Virtual Reality
  - Hardware Requirements
  - Virtual Reality Challenges
    - Rendering and Latency
    - Performance and Optimization
    - Controller Inputs
- Challenges in Development
- Playtesting and Feedback
  - Scenario Overview

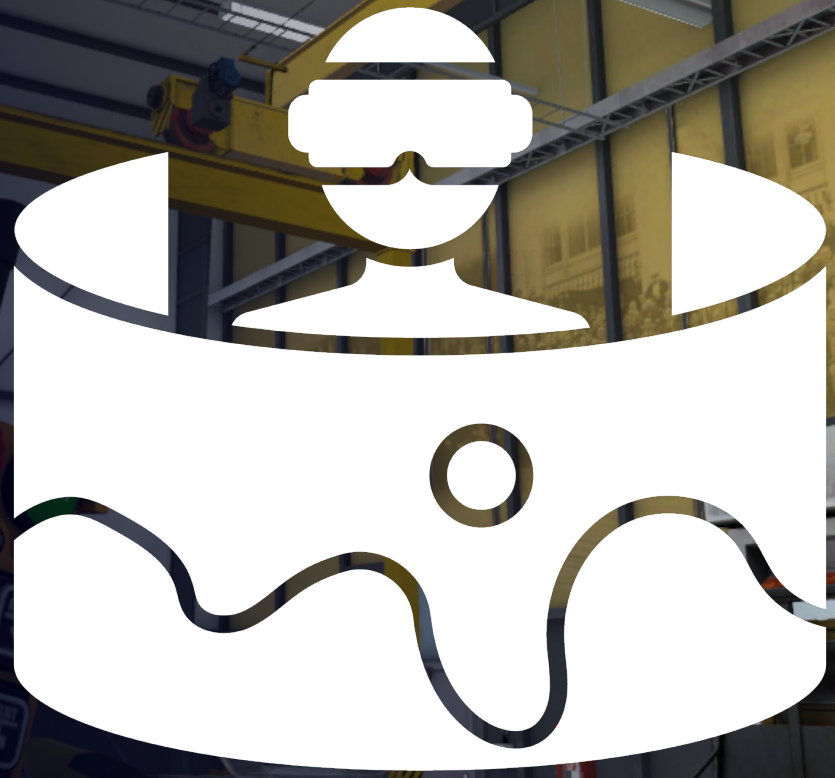


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VIRTUAL REALITY

Virtual Reality (VR) refers to a simulated experience that can be similar to or completely different from the real world.

It utilizes technology to create immersive environments, where users can interact with 3D objects and environments using specialized hardware like VR headsets, controllers, gloves, and other sensors.





HARDWARE REQUIREMENTS



Oculus/Meta Quest 2, 3 or Pro



Alienware Aurora Series



Alienware Laptop Series

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VIRTUAL REALITY CHALLENGES

- Rendering and Latency
- Performance and Optimization
- Controller Input



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RENDERING AND LATENCY

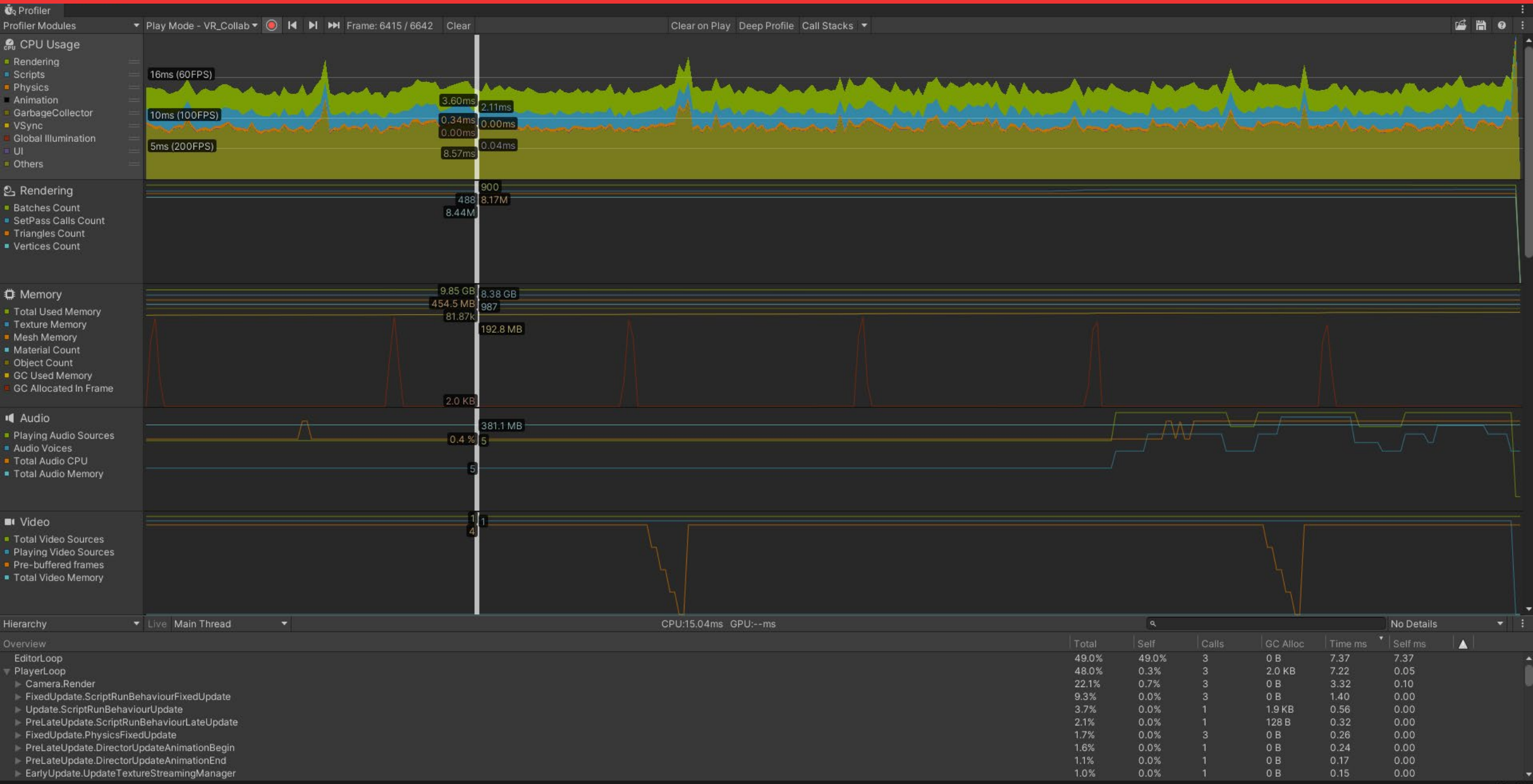
- Demanding Hardware Requirements
  - High Frame Rate
  - High Resolution
- Dynamic Scene Complexity
  - Real-time Interactions
  - Physics Simulations
- Techniques to Minimize Latency
  - Performance and Optimization



Technical Challenges and VR Development



Technical Challenges and VR Development



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PERFORMANCE AND OPTIMIZATION

- Graphics Optimization
  - Occlusion Culling
  - LOD (Level of Detail)
  - Limit Transparent Objects
  - Bake Lighting
  - Limit Draw Calls (Model Optimization)
  - Texture Optimization (Atlas)



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PERFORMANCE AND OPTIMIZATION

- Rendering Optimization
  - Single-Pass Rendering (Stereo)
  - Anti-Aliasing (4x)
  - Foveated Rendering
  - VR SDK Specific Optimizations
- Physics Optimization
  - Limit Collider Interactions
  - Optimize Physics Timestep
  - Layering (Physics)



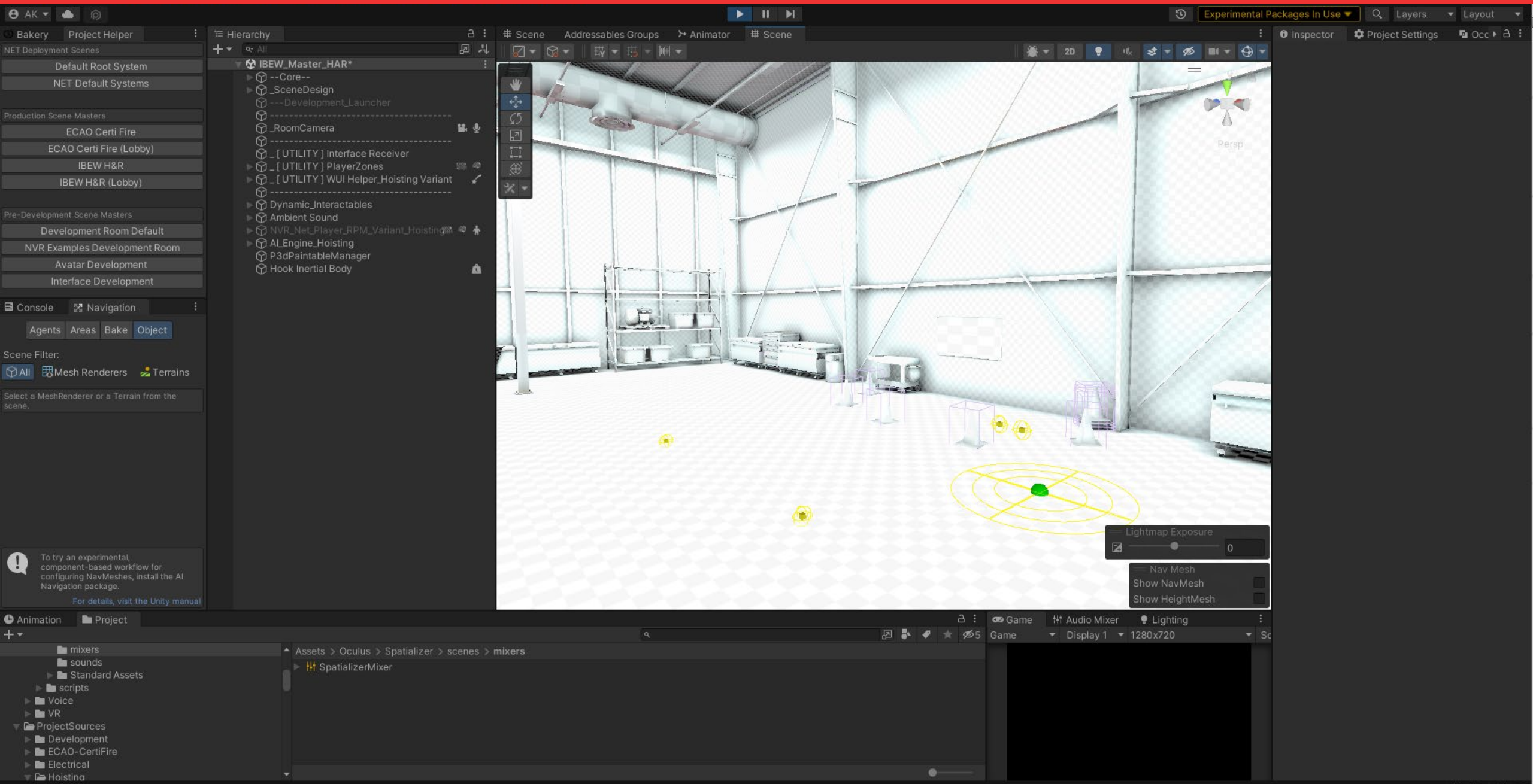
Technical Challenges and VR Development

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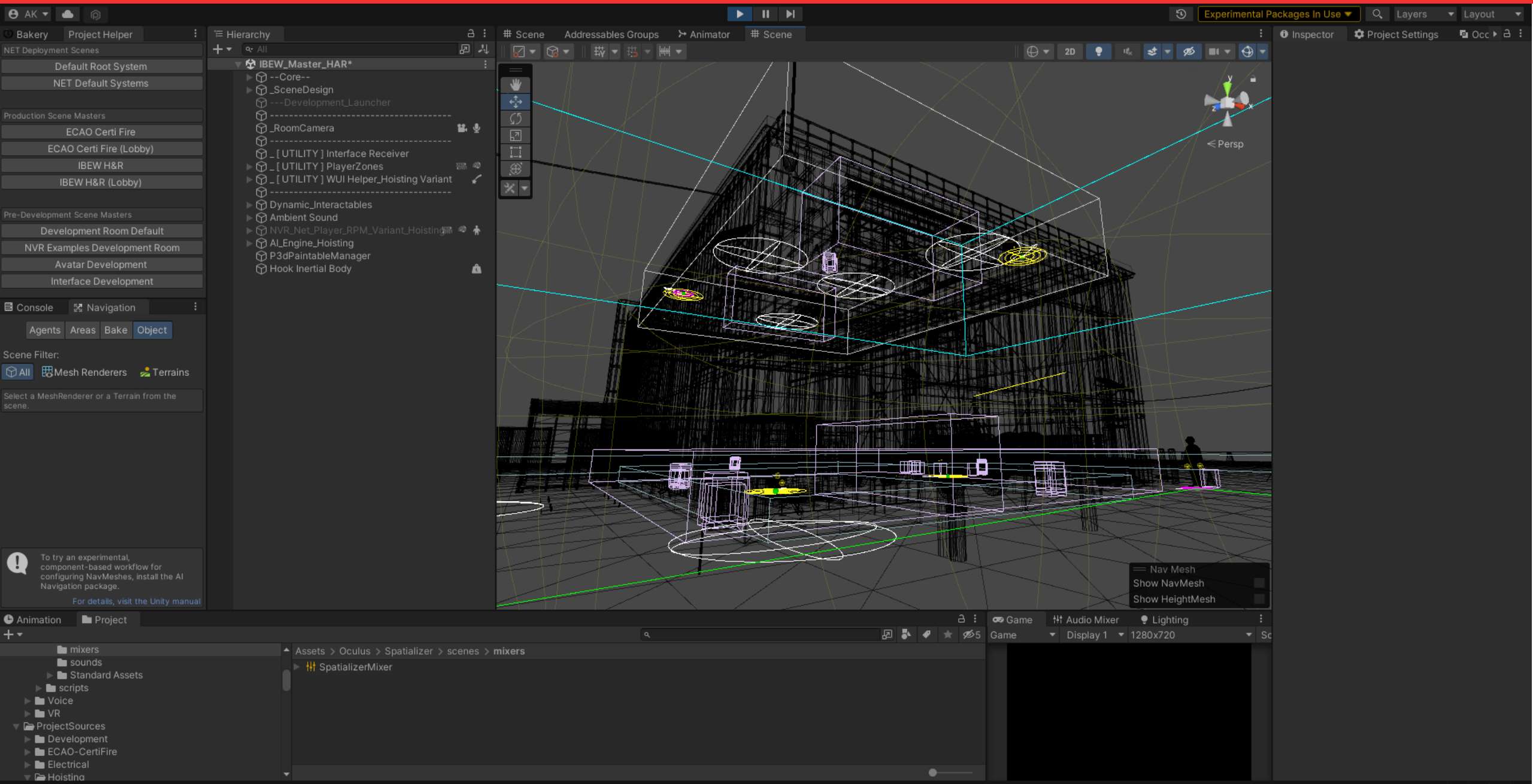
Technical Challenges and VR Development

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Technical Challenges and VR Development

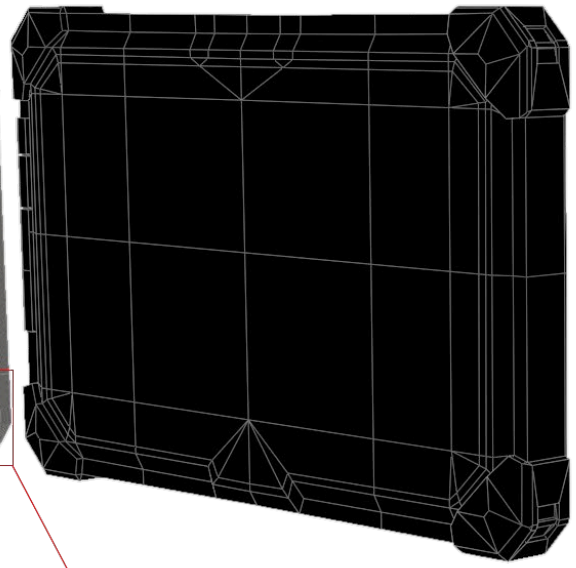
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Technical Challenges and VR Development

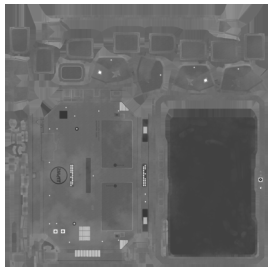
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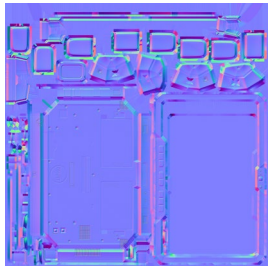


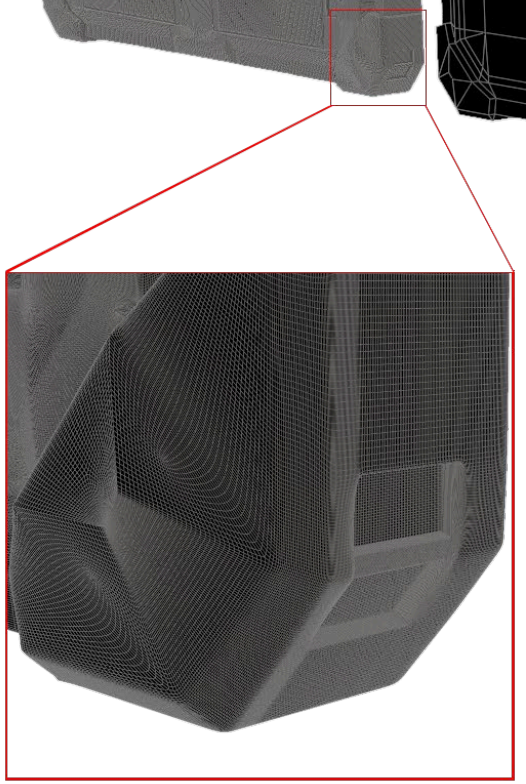


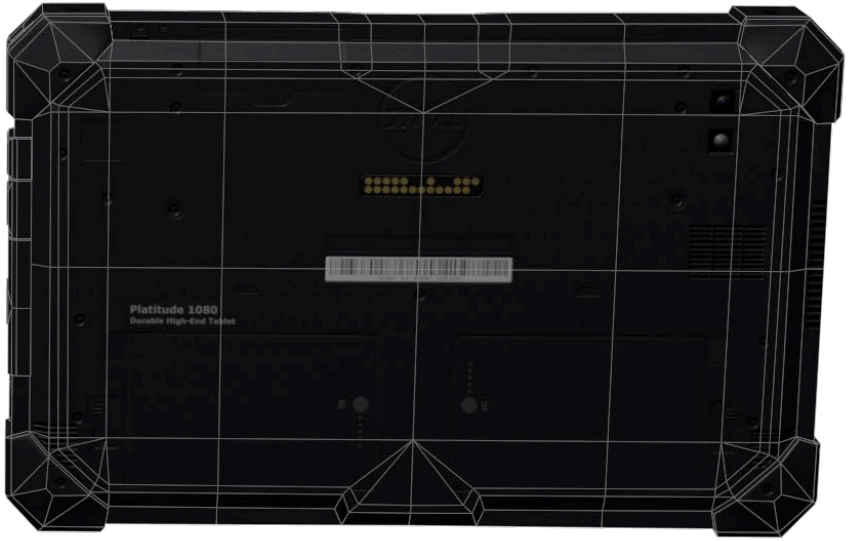


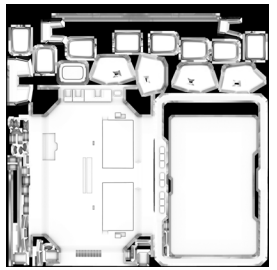






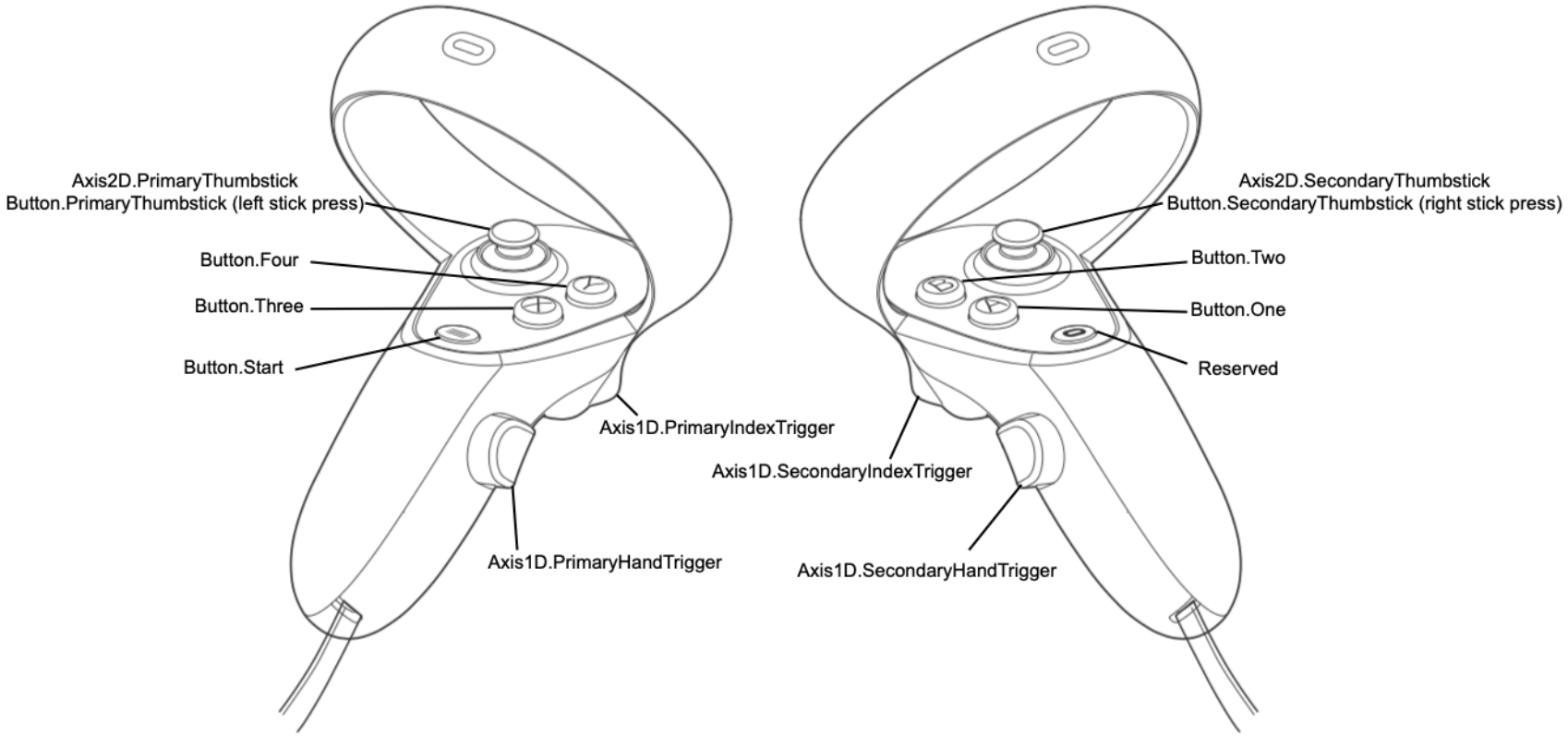






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CONTROLLER INPUTS



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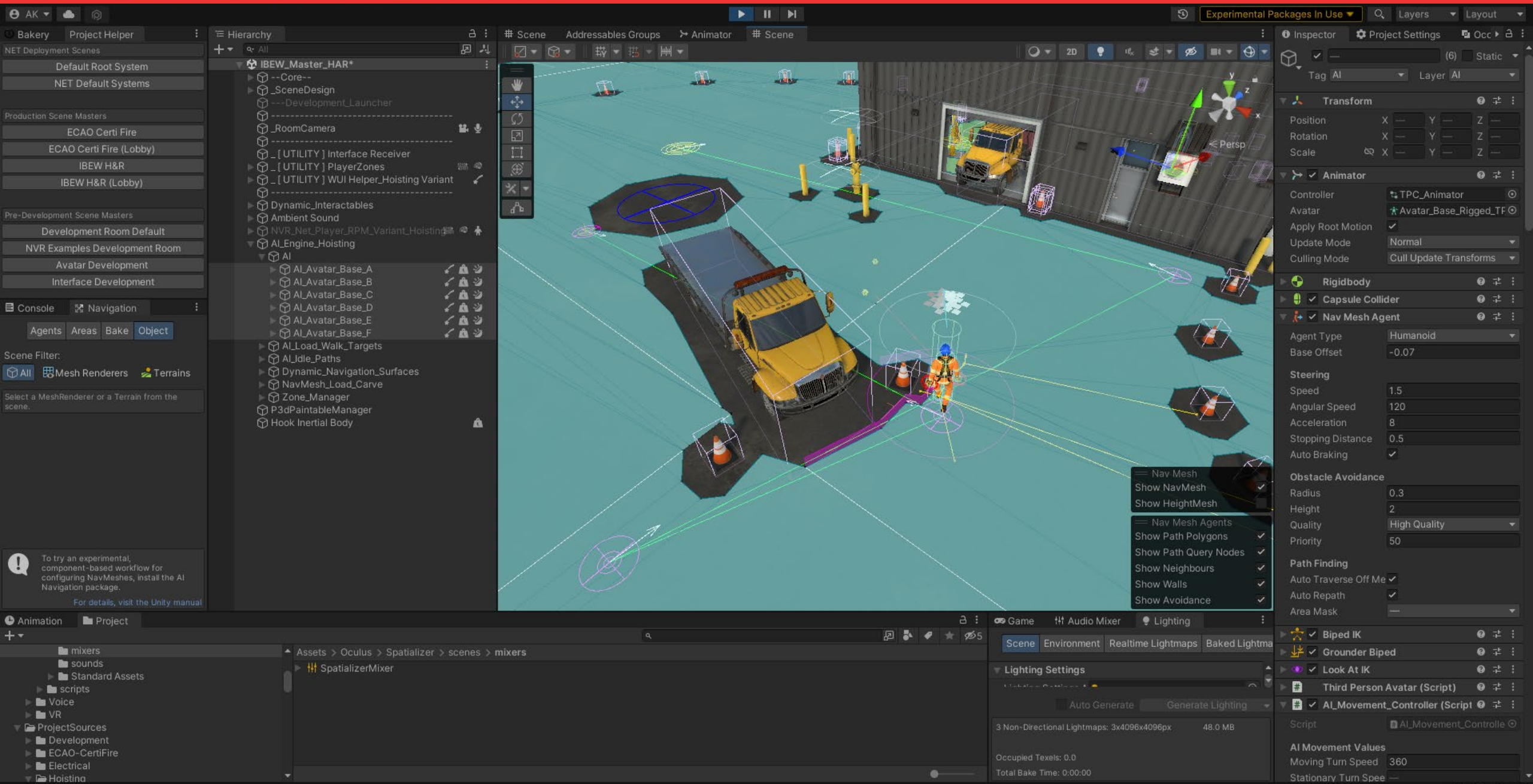
CHALLENGES IN DEVELOPMENT

- Limitation of Translating Course Material
- Hardware Limitations
- Discovery and Iteration
- Physical Fidelity
- Environmental Complexity
- Balancing / Optimizing Physics Simulations
- AI Systems
- QA / Issue Tracking / Bug Fixing



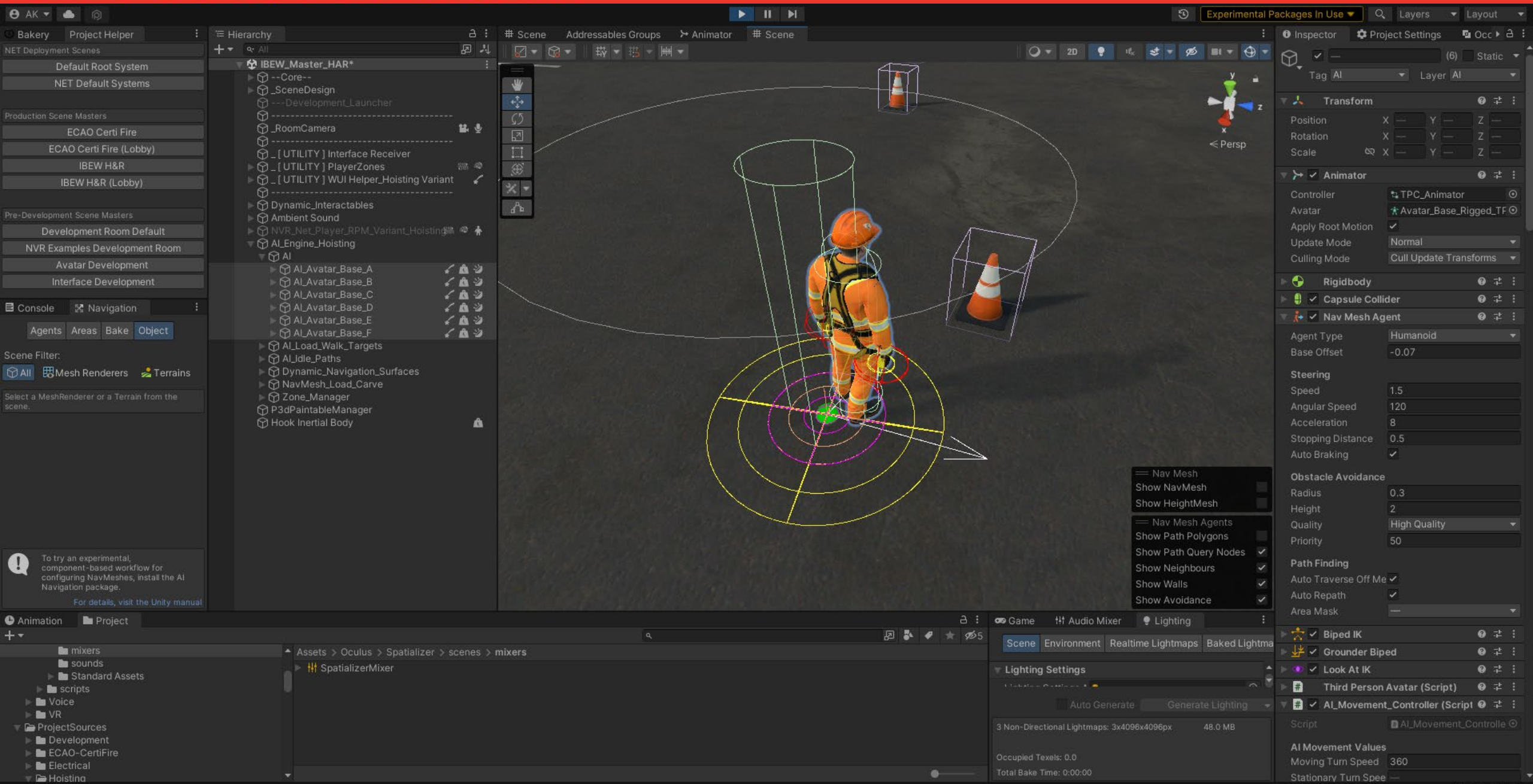
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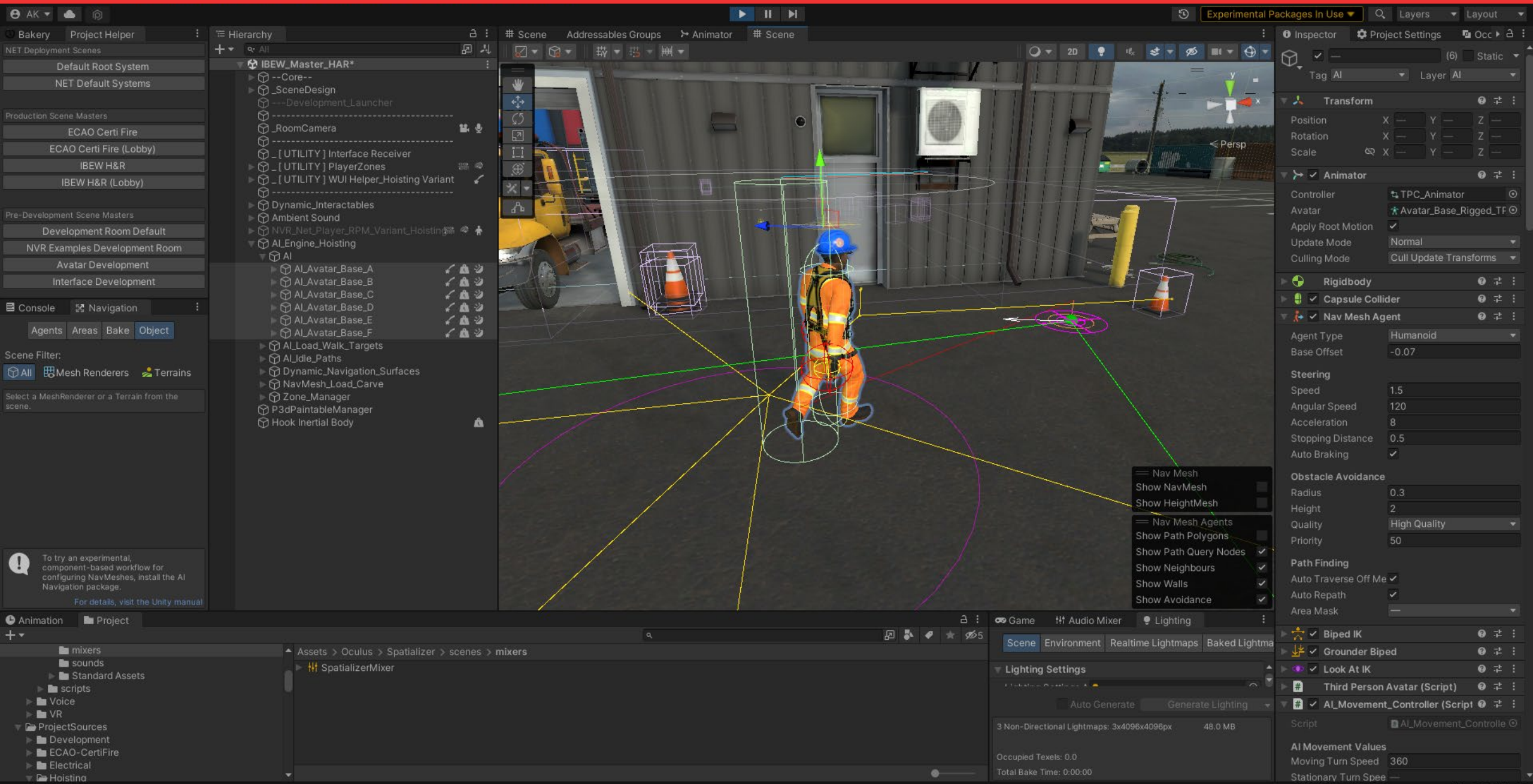
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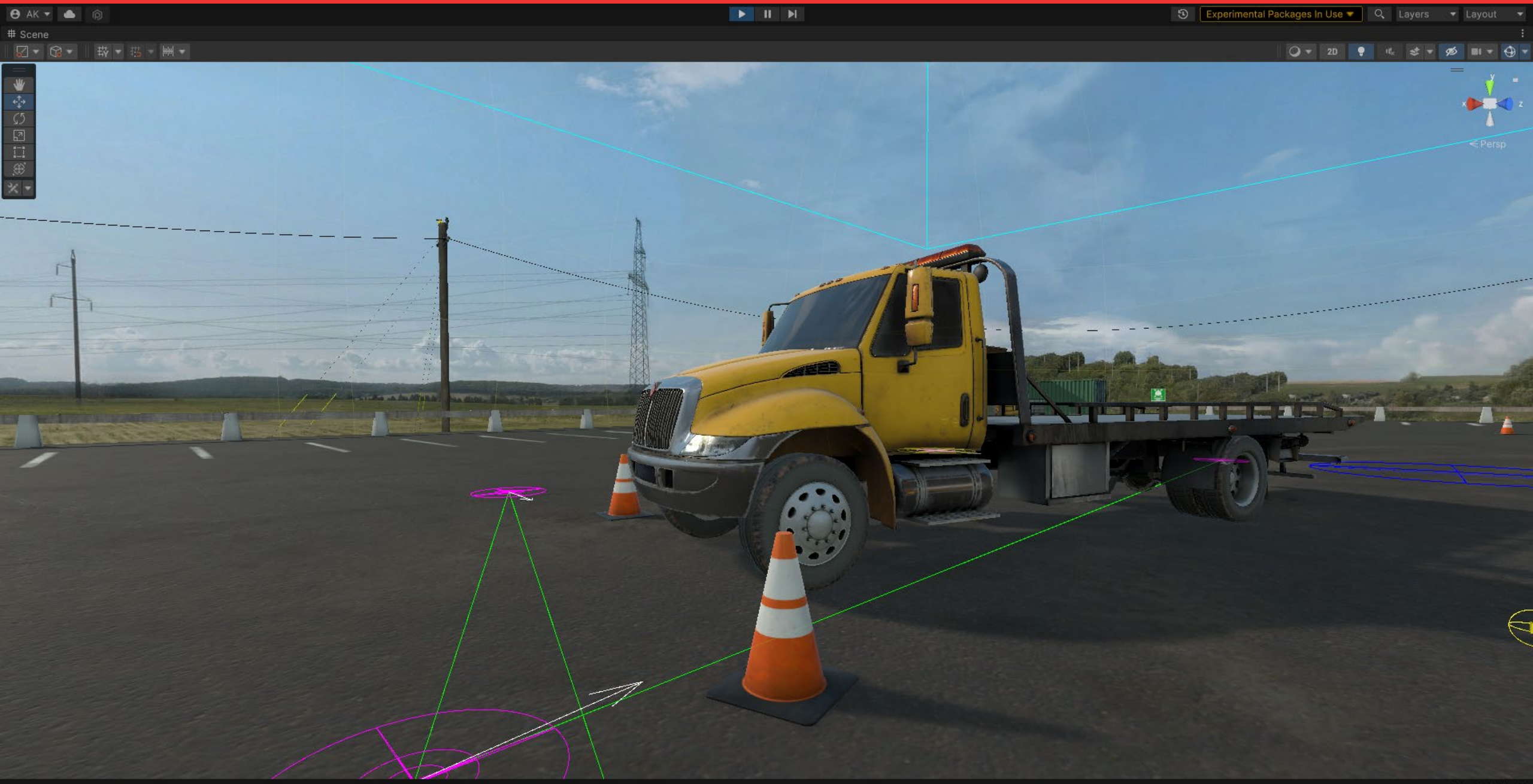
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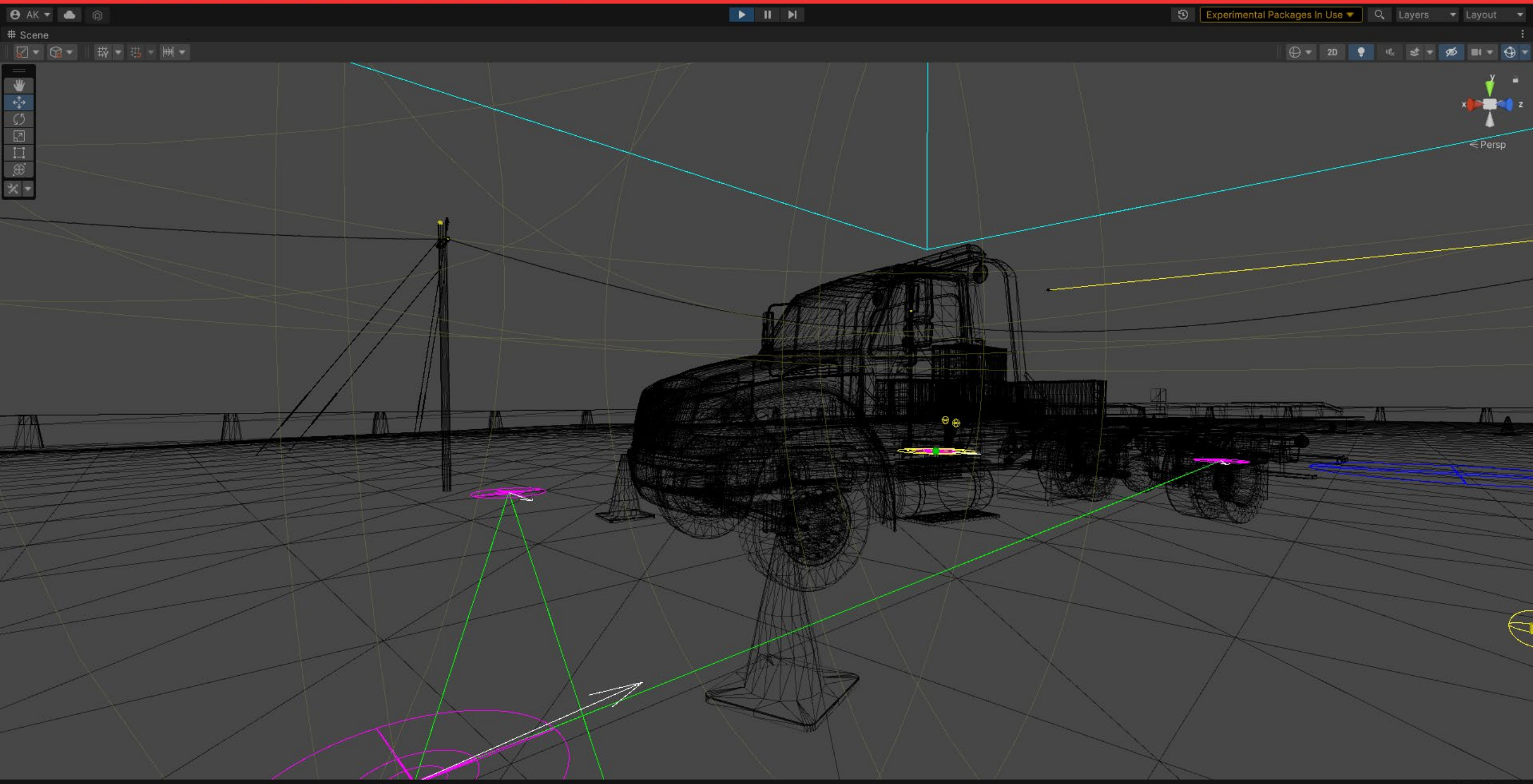
Technical Challenges and VR Development

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Technical Challenges and VR Development

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PLAYTESTING AND FEEDBACK

- Discovering Bugs or Glitches
- Usability Insight
- Understanding Expectations
- Technical Performance
- Accessibility
- Validation (What's working)



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INDOOR ELECTRIC MOTOR GANTRY LIFT

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OUTDOOR DIESEL GENERATOR BOOM TRUCK LIFT

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OUTDOOR SOLAR PANEL BOOM TRUCK ROOFTOP LIFT

FUTURE PLANS

- Additional lifting scenarios (Transformer, Conduit, Pipes)
- Developed under the NORCAT VRC Platform
- Electrical engine within system for future projects
- Networking for collaborative training simulations
- Scoring and record keeping with a SCORM LMS or NORCAT LMS
- AI trained using Machine Learning vs coded AI
- Expansion of NETCO Virtual Training Lab to also have a Virtual Industrial Facility



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INTEGRATING VR INTO THE CURRICULUM



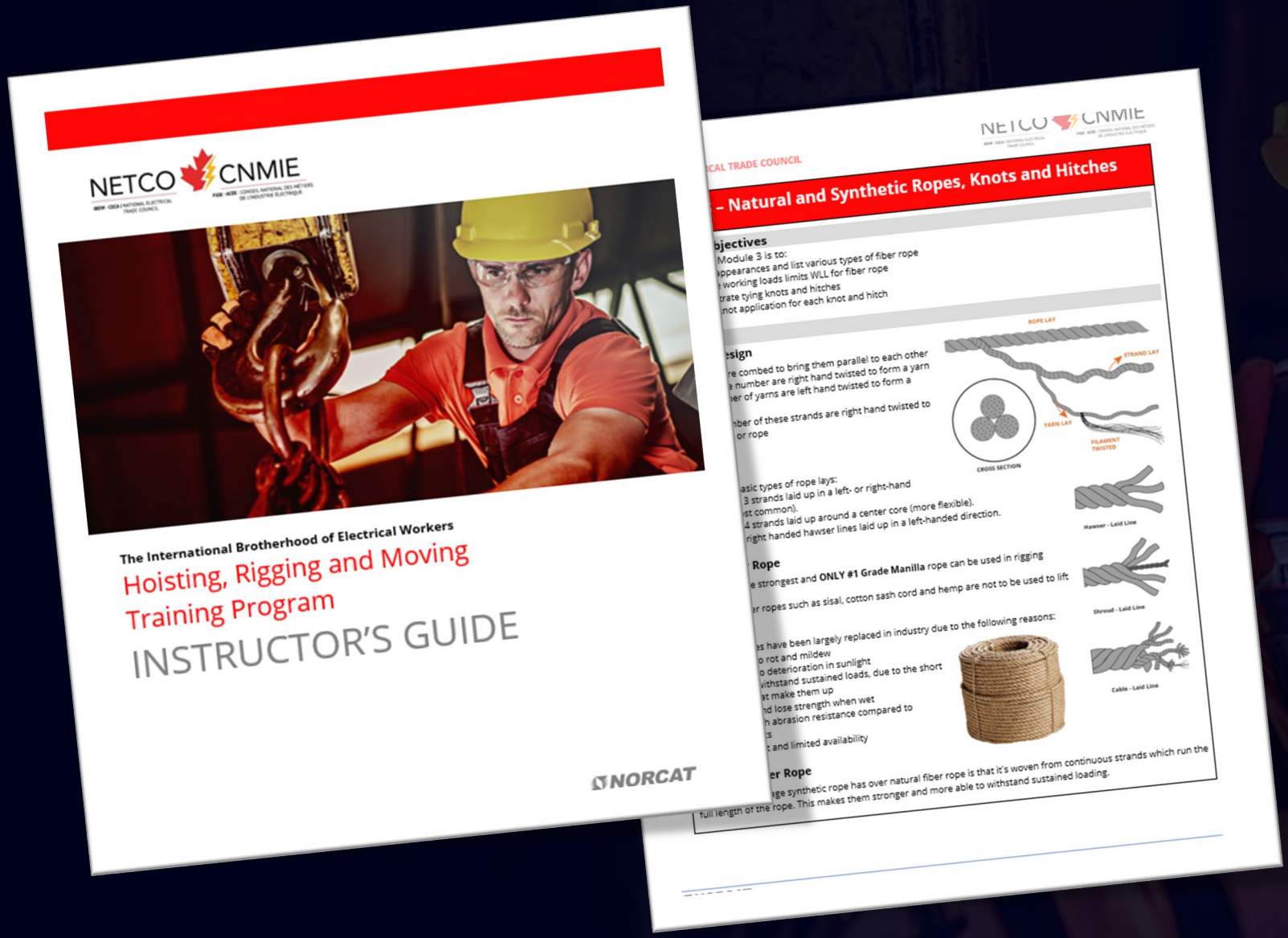
BLENDED LEARNING MODEL

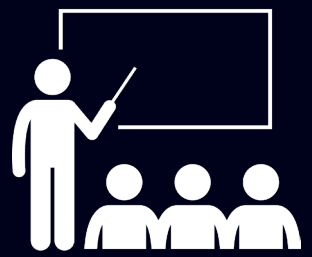
- **Instructor-Led**
  - PowerPoint for Classroom Training
  - Instructor Guide
  - Student Workbook with Desk Exercises
  - Resource Book
  - Knowledge Assessment
  - Practical Skills
- **Virtual Reality**
  - Skill-Building Exercises
  - Scenarios / Lifts



Integrating VR into the Curriculum

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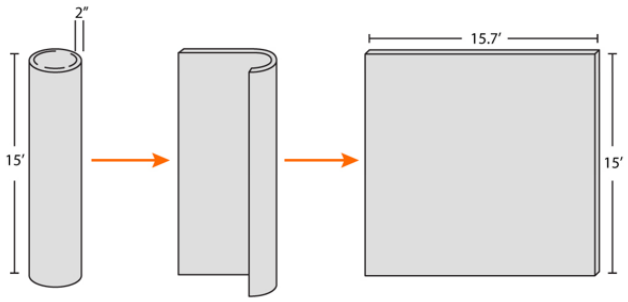


CLASSROOM TRAINING

Integrating VR into the Curriculum

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3. **Calculate the weight of the steel pipe.**



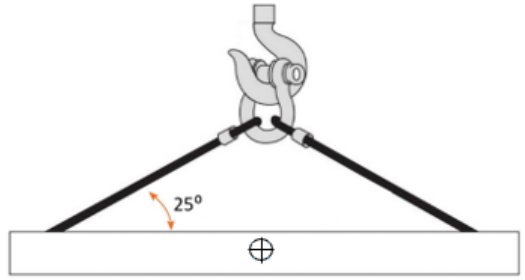
Values:
Diameter = 5'
Height = 15'
Thickness = 0.167' (2")
Steel = 490 lbs per cubic foot

Formula:
CIRCUMFERENCE = DIAMETER x π
TOTAL VOLUME = CIRCUMFERENCE x THICKNESS x HEIGHT = CUBIC FOOT
LOAD WEIGHT = TOTAL VOLUME x WEIGHT PER CUBIC FOOT

Answer:

2. **Spot the errors/safety hazard and explain what should be done differently.**

a.



Explanation:



Auxiliary/Whip Line	Auxiliary Hook	Boom	Boom Lift Cylinder	Counter Weight	Jib
Load	Main Hoist Line	Main Hook	Main Load Block	Operator's Cab	Tracks/Wheels

CLASSROOM EXCERCISES

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TRAINING EXCERCISES

HANDS-ON

- International Hand Signals
- Load Weight Calculations
- Knots and Hitches
- Sling Configurations
- Equipment Inspections
- Lift Planning

VIRTUAL REALITY

- Practice Hand Signals
- Determine Proper Lifting Points
- Equipment Inspections
- Lifting Scenarios



TRAIN THE TRAINER

- Course was pilot tested and co-delivered with NETCO to a group of Trainers and Training Directors from Local IBEW's across Ontario
- Familiarization with the course curriculum and VR equipment & controls
- Course improvements were identified



Integrating VR into the Curriculum

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Integrating VR into the Curriculum

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Integrating VR into the Curriculum

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FEEDBACK AND REITERATION

- Follow-up meetings and workshops with the NETCO SMEs and NORCAT course developers
- Feedback and course evaluations reviewed
- Curriculum revisions

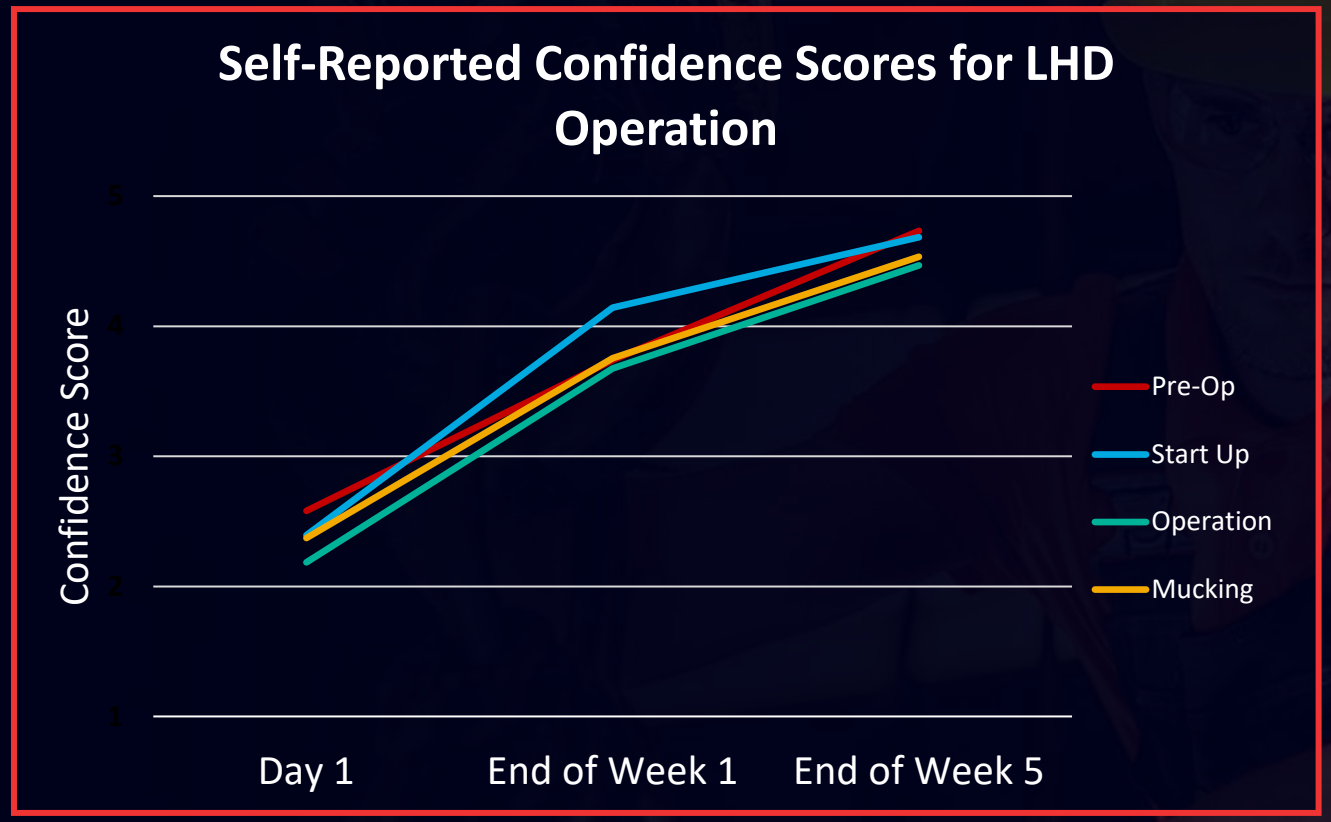


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CONFIDENCE SURVEY

98.5%

increase in self-reported confidence around equipment operation between Week 1 and Week 5



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FEEDBACK SURVEY

100%

of trainees reported that they would recommend this training to a friend or colleague

I was blown away by how realistic the VR is. I really felt like I was actually with a real machine.

★★★★★

I feel much more confident / competent than when I first started.

★★★★★

VR training made it easier in person as now you know how to perform and properly find mostly everything in a pre-op

★★★★★

I was expecting to be very nervous going to the mine Monday, but I am pretty confident and excited instead

★★★★★

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THE FUTURE OF VR IN TRAINING



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ACCESSIBILITY AND AFFORDABILITY

As VR technology becomes more affordable and widespread, it will likely be more accessible to smaller companies and educational institutions.

This will enable more individuals to access high-quality training, regardless of location or economic status.



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REAL-TIME COLLABORATION

As connectivity improves, real-time collaboration within VR environments will likely become more common.

This will enable teams from different locations to work together on projects, fostering teamwork and enhancing problem-solving skills.

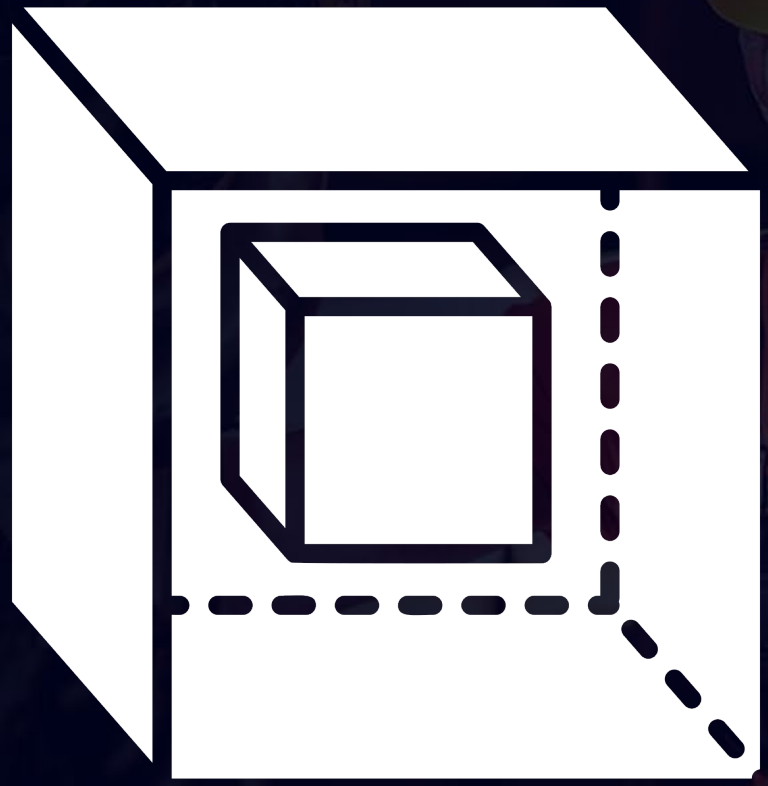


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REALISTIC SIMULATIONS

High-fidelity simulations allow learners to gain hands-on experience with equipment, scenarios, and tasks that mirror real-world conditions.

This immersive experience can improve understanding and retention.



SUMMARY

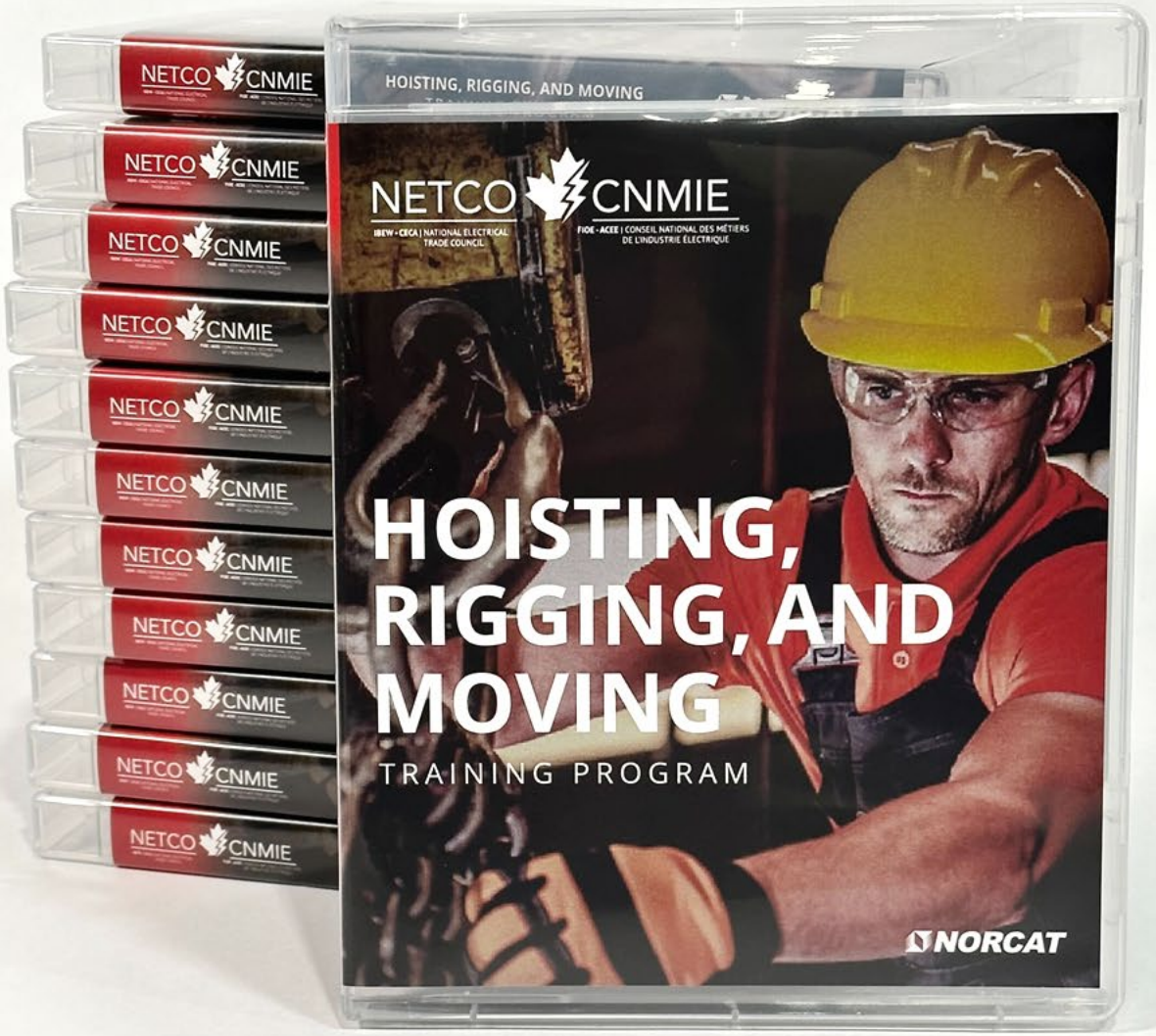
In conclusion, the future of virtual reality learning within skilled trades is bright, with new technologies and methodologies paving the way for more effective, engaging, and accessible training.

By embracing these advancements, industries can cultivate a skilled workforce, increase efficiency, and foster innovation, all while ensuring safety and compliance.



PLEASE REGISTER YOUR PRODUCT.

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THANK YOU.

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SKILLS TRAINING FOR THE FUTURE