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LEVERAGING INTERNATIONAL COLLABORATION FOR INTERACTIVE LUNAR SIMULATIONS: AN EDUCATIONAL EXPERIENCE FROM SEE 2025

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ABSTRACT

This paper presents an educational experience from the Simulation Exploration Experience (SEE) 2025, focusing on leveraging international collaboration to develop interactive lunar simulations. Specifically, the FACENS team created two interoperable simulation federates, a Lunar Cable Car system and an Astronaut system, using Java, Blender and the SEE Starter Kit Framework (SKF). Putting emphasis on the educational and collaborative aspects of SEE, our primary objectives included developing robust real-time interactions with international teams, improving simulation visuals, and improving astronaut behavior and logic using optimized path-finding algorithms. Seamless interoperability was demonstrated with federates developed by Brunel University and Florida Polytechnic University. Our experiences and lessons learned provide valuable insights for future teams engaged in distributed simulation development and international collaborative projects in the space exploration domain.

1 INTRODUCTION

The Simulation Exploration Experience (SEE) provides a unique educational platform that connects students, academia, and industry professionals from all over the world, encouraging collaborative innovation through space exploration simulations. This paper reports on the contributions of the FACENS team from Brazil to SEE 2025, highlighting our efforts to design interactive lunar simulations that emphasize international cooperation and real-time interoperability.

For this year's event, FACENS developed two main simulation federates: a Lunar Cable Car system for efficient astronaut transportation, and an Astronaut federate focusing on realistic movement behaviors. Built using Java programming, Blender for visualization, and the modular SEE Starter Kit Framework (SKF), our federates demonstrate significant advances in both technical execution and educational value. Our primary objectives included fostering robust international interactions with partner teams, enhancing the visual fidelity of our simulations, and refining astronaut logic with improved path-finding algorithms.

Key interactions involved federates from Brunel University's SpacePort, Florida Polytechnic University's Greenhouse, and the University of Central Florida's Beacon, showcasing seamless integration and collaboration facilitated by standard interoperability protocols (SpacePort, Greenhouse and Beacon are the names of the respective federates developed by the cited teams that collaborated in SEE 2025). Through regular synchronization meetings and the use of industry-standard frameworks, the FACENS team's experience exemplifies the educational and collaborative potential inherent in distributed simulation environments, providing a valuable reference for future participants.

The remainder of this document is organized as follows. Section 2 discusses relevant background and literature; Section 3 outlines the problem statement and research objectives; Section 4 details the simulation methodology and experimental setup; Section 5 presents and analyzes the simulation results; Section 6 offers a discussion of insights and implications; finally, Section 7 provides conclusions and suggestions for future work.

2 BACKGROUND AND LITERATURE REVIEW

2.1 The Simulation Exploration Experience Program

The Simulation Exploration Experience (SEE) has been a collaborative initiative since 2011, uniting students, academia, and industry to advance distributed and interoperable modeling and simulation (M&S) standards (Taylor et al. 2014). Over time, SEE has progressively aligned with frameworks such as NASA's Artemis Program and Moon to Mars Campaign Strategy. The 2025 edition emphasizes the development of initial lunar infrastructure to support sustained human presence on the Moon and enable future Mars missions (Elfrey et al. 2011).

SEE 2025's scenario focuses on Cislunar space, particularly the Lunar South Pole and Gateway orbital station. In line with Artemis objectives, participating teams design and simulate systems for a sustainable lunar base, encompassing habitats, power generation, laboratories, and transportation facilities. Concurrently, the mission explores local resource utilization for propellant, construction, and mining, thereby enhancing scientific returns through improved mobility and sample retrieval (Falcone et al. 2017).

Within this framework, FACENS's contribution in 2025 extended earlier work on lunar-surface logistics by developing two federates, a Lunar Cable Car and an Astronaut Agent, integrated with partner simulations from Brunel University (SpacePort), Florida Polytechnic University (Greenhouse), and the University of Central Florida (Beacon Network). Regular multi-team coordination, shared repositories, and formal "dry-run" events ensured that isolated prototypes matured into a cohesive operational federation prior to the final demonstration (Ghorbani et al. 2024).

2.2 Standards and Toolchain for Distributed Simulation

Interoperability inside SEE is governed by the IEEE 1516-2010 High-Level Architecture (HLA) (Möller 2012) and enforced at run time by commercial or open-source Runtime Infrastructures (RTIs); the 2025 event recommends Pitch pRTI v5.3 (Pitch Technologies 2024). Common data semantics are prescribed by the SISO SpaceFOM, which, together with the SEE HLA Starter Kit Framework (SKF) (Falcone and Garro 2016) and the open-source HLA Development Kit (Falcone et al. 2017), accelerates boilerplate development while shielding student teams from low-level network concerns.

FACENS implemented both federates in Java, using the modular services supplied by SKF (object ownership management, logical-time advancement and publish/subscribe utilities). Three-dimensional assets were modeled in Blender, exported as OBJ/MTL pairs and ingested by the Distributed Observer Network (DON) (NASA 2015) for live visualization. These tool choices mirror best practice reported in the distributed-simulation literature (Möller 2012) and ensure that lessons learned can transfer directly to industry-scale HLA projects.

3 PROBLEM STATEMENT AND RESEARCH OBJECTIVES

The Simulation Exploration Experience (SEE) 2025 presented a unique challenge to create lunar simulations, emphasizing collaborative international interaction and technical innovation. In this context, the FACENS team addressed the fundamental challenge of designing effective and realistic transportation solutions within the lunar environment, focusing specifically on astronaut mobility and logistical efficiency.

The main problem faced was the integration of diverse federates into a coherent simulation environment that accurately represents lunar conditions and supports robust real-time interactions among multiple international teams. To systematically address these challenges, the FACENS team established clear, targeted research objectives:

1. **Facilitate robust international collaboration** by implementing real-time interoperability using industry-standard High-Level Architecture (HLA) and Runtime Infrastructure (RTI) protocols, enabling seamless interactions between FACENS federates and those developed by international partner teams.
2. **Enhance visual realism and model fidelity** of the simulation environment, leveraging advanced 3D modeling tools such as Blender and Substance, and improving the representation of astronaut behaviors and environmental interactions to increase simulation authenticity and educational value.
3. **Optimize astronaut movement and decision-making logic** within the lunar simulation, integrating advanced path-finding algorithms such as the optimized A* algorithm (Hu 2005) to ensure realistic, efficient navigation and interaction behaviors, thus increasing the practical applicability and effectiveness of simulated lunar operations.

These objectives guided the methodological approaches, collaborative interactions, and the evaluation criteria of the FACENS team's simulation project, providing a clear roadmap for addressing the challenges of distributed collaborative space simulations and laying a foundation for future developments in the field.

4 SYSTEM ARCHITECTURE AND SIMULATION DESIGN

This section presents the general architecture and implementation of the federated simulation system developed by the FACENS team for SEE 2025. It introduces the two main federates, the Astronaut federate and the Lunar Cable Car federate, presenting the planning tools used to define their behavior and interactions. It also details the 3D modeling and software architecture, and demonstrates the experimental scenarios used to validate the system's functionality and interoperability, including integration with international teams.

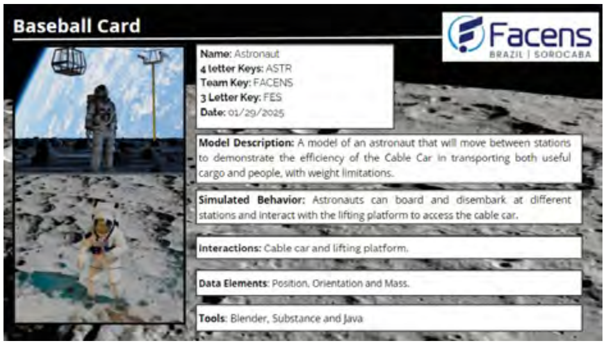
4.1 Simulation Model Development

For the Simulation Exploration Experience (SEE) 2025, the FACENS team developed two primary simulation federates: a Lunar Cable Car system and an Astronaut federate, aimed at enhancing astronaut mobility and logistical efficiency on the lunar surface. The lunar simulation environment was established based on critical environmental conditions provided by NASA (NASA 2023a), such as gravity (1.62 m/s^2), radiation exposure, extreme temperatures, atmospheric composition, and structural requirements for habitats. These parameters guided the development of realistic scenarios and conditions for simulations (NASA 2023b).

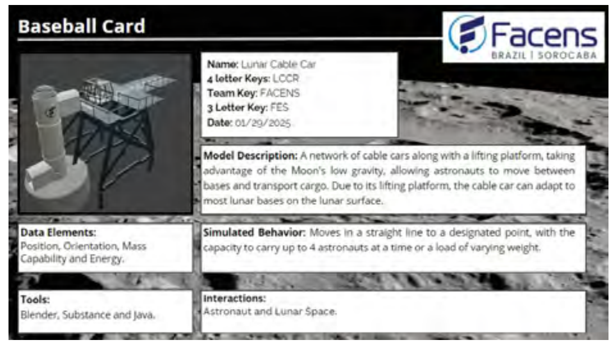
To organize the development process and define how the federates would interact, we used two main tools: Baseball Cards, which summarize key aspects of each federate, like behavior, data exchange and technical setups, and the Interaction Matrix, which outlines expected communications and interactions of our federates and with federates from other teams.

4.1.1 Baseball Cards

The baseball cards contains the core information about the proposed federates, such as name, team, description, simulated behavior, interactions, data elements, and tools used to implement that federate. Figures 1a and 1b show the FACENS Astronaut federate and the Lunar Cable Car federate, respectively.



(a) Astronaut federate baseball card.



(b) Lunar Cable Car federate baseball card.

4.1.2 Interaction Matrix

It is a tabular matrix elaborated to register and plan the interaction between the team's federates with their own federates or with the other teams federates. It contains the behavior expected for each federate with the other federates, and an early preview of what will be coded during the implementation step.

Federates	Lunar Cable Car (Facens)	Astronaut (Facens)	Cable Car Station	Lander(Brunel)	Greenhouse (FPU)
Lunar Cable Car (Facens)		Transports Astronaut to destination: Publish -Have free space/no space left -Waiting for subject info -Send nearest station location -Moving(with direction and speed)			Receives energy from the Greenhouse Publish -Energy level
Astronaut (Facens)	Rides on Cable Car: Publish -Wants to ride -Send size, weight and destination -Leaving Cable Car(if in destination)		Is moved by the Station: Publish -Location	Receives a message to leave Subscribe -Receive message Publish -Leave the Lander	Astronauts can go into Greenhouse: Publish -Request entry -Moves inside the Greenhouse
Cable Car Station	Inform the route to the Cable Car: Publish -Send position of the station	Moves the Astronaut: Publish -Moves the Astronaut from the ground to the Cable Car			
Lander (Brunel)	Send a message to the Cable Car Publish -Asks the Cable Car to transport the astronauts to the Lander	Send a message for the Astronauts to leave and go to the nearest Cable Car Publish -Arrival			
Greenhouse (FPU)	Provides energy for the Cable Car Publish -Energy	Astronauts can go into the Greenhouse: Publish -Location -Accepts Astronaut request to entry			

Figure 2: FACENS Interaction Matrix.

4.2 Model Implementation

In 2024, the FACENS team proposed a different approach to lunar logistics by developing a simulation of a cable car transportation system, designed specifically for the unique environment of the Moon. Cable cars are a traditional transportation method in the Brazilian coastal regions, due to the geographical relief that alternates between mountains and beach plains, and mainly used by tourists, but also for cargo transportation between remote areas.

For the 2025 edition of SEE, the project was reused and improved with better transport animations, more realistic mechanics including attributes such as astronaut weight, maximum cable car capacity, addition of more transport stations, as well as interactions with teams from other universities, Brunel University of London and the University of Central Florida, who developed fixed and interactive environments to which the cable car could transport its astronauts.

4.3 3D Modeling and Visual Development

Detailed 3D models were developed using Blender software, visually representing the transportation system and astronaut interactions within the lunar environment. For an enhanced perspective of the models and animations created for this simulation, a video demonstration is available on YouTube (FACENS SEE Team 2025a).

The 3D models used in the simulation include a **Cable Car Station (a)**, a **Cable Car (b)**, and an **Astronaut (c)**, each designed with realism and engineering principles in mind.

(a) Cable Car Station: The station was designed to be compact and safe, featuring an integrated elevator and boarding platform. Its structure was inspired by research on hyper velocity impacts (Steiner and Malla 2021), employing a combination of layered materials and aerospace-grade alloys to enhance durability and impact resistance. Additional features include a communication antenna and an induction charging platform for vehicle docking.

(b) Cable Car: The vehicle's design focused on balancing weight efficiency and resilience. The cable car can carry up to four astronauts. To protect against micrometeorite impacts, a Whipple shield system was implemented, widely used in orbital missions such as the International Space Station, this system has demonstrated high effectiveness in mitigating damage from hyper-velocity impacts (Wen et al. 2020). The vehicle is also equipped with a lithium-ion battery to ensure a continuous power supply.

(c) Astronaut: The astronaut model was designed with an emphasis on functional realism. Detailed textures highlight the structural, protective, and life-support components of a lunar spacesuit, including simulated signs of wear from lunar surface exposure.

(a) Cable Car Station 3D Model. (b) Cable Car 3D Model. (c) Astronaut 3D Model.

Figure 3: 3D Models used in the simulation.

These 3D models were exported in .obj format, ensuring compatibility with the simulation environment and visual standards set in previous SEE editions.

4.4 Software Architecture Development

The simulation relies on two large HLA federates: the Lunar Cable Car Federate (LCCR or LCC interchangeably), which models the entire network of pressurized cable cars linking bases and laboratories, and the Astronaut Federate (ASTR), which represents each crew member as an autonomous agent requesting transportation. These two modules maintain intensive communication via EntryCableCar, WalkCableCar, WalkOutCableCar, LCCArrivedStation and LCCLeavingStation interactions, ensuring that the flow of embarkation, movement and disembarkation is synchronized for all federation participants.

Lunar Cable Car: The LCC describes a pressurized four-seat vehicle that travels, in an continuous loop, through a parameterized set of points (LCCPathPoint) and stations (LCCStopPoint). At each frame, the MovementSystem calculates the direction vector between successive points and derives an orientation quaternion to align the cabin, which is essential for the augmented reality visualizations planned for 2025. On reaching a station, the system changes its state to ARRIVED, publishes LCCArrivedStation and triggers the PassengerControlSystem, which runs the queuing, seat validation and boarding/disembark counting routines. When the counters reach zero, the LCC notifies LCCLeavingStation and restarts the course.

The properties adopted for FACENSCableCar and coded in the FOM are:

- PositionVector - XYZ vector (m) indicating the absolute position of the cab;
- RotationQuaternion - orientation of the cabin in the form (x, y, z, w);
- CurrentStationID - identifier of the station where the cabin is docked; “NULL” during the journey;
- Velocity - current linear velocity (m s^{-1});
- DestinationStationID - next scheduled station;
- Occupancy - number of passengers on board;
- Capacity - maximum capacity (seats) of the cabin;
- EnergyLevel - percentage charge of the traction battery.

Attribute adopted for the FACENSCableCarStation object:

- StationID - unique station identifier, used by federates for routing and to trigger LCCArrivedStation and LCCLeavingStation interactions.

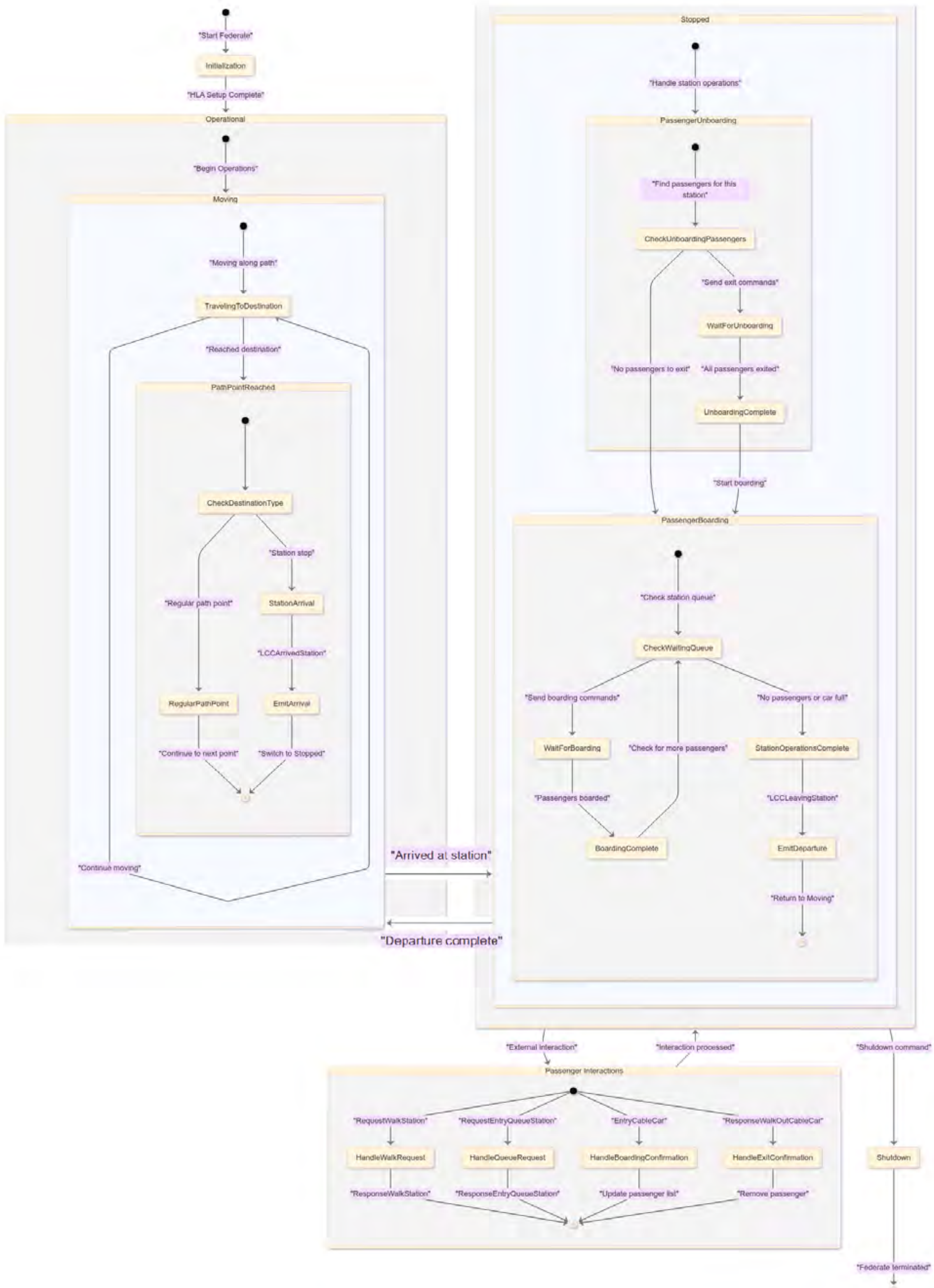


Figure 4: State machine diagram for the Lunar Cable Car Federate (LCCR).

Astronaut: Each astronaut is instantiated into the scenario either through the BrunelFacensSpawnAstronaut interaction or normal astronaut startup creation; ASTRO-LCC then publishes EntryCableCar with their astronautid and the station where they are waiting. The LCC validates the existence of a free seat and adds the agent to the passenger list. The moment the PassengerControlSystem confirms physical boarding, the LCC issues WalkCableCar; the reverse occurs in WalkOutCableCar when the astronaut leaves the cabin. Throughout the journey, the FACENSAstronaut object transmits body temperature, heart rate and O_2 saturation; if any parameter exceeds critical limits, the LCC raises the landing priority at the next stop. In this way, the federated pair ensures safe and traceable transportation of personnel between lunar facilities, in line with the operational requirements of 2025.

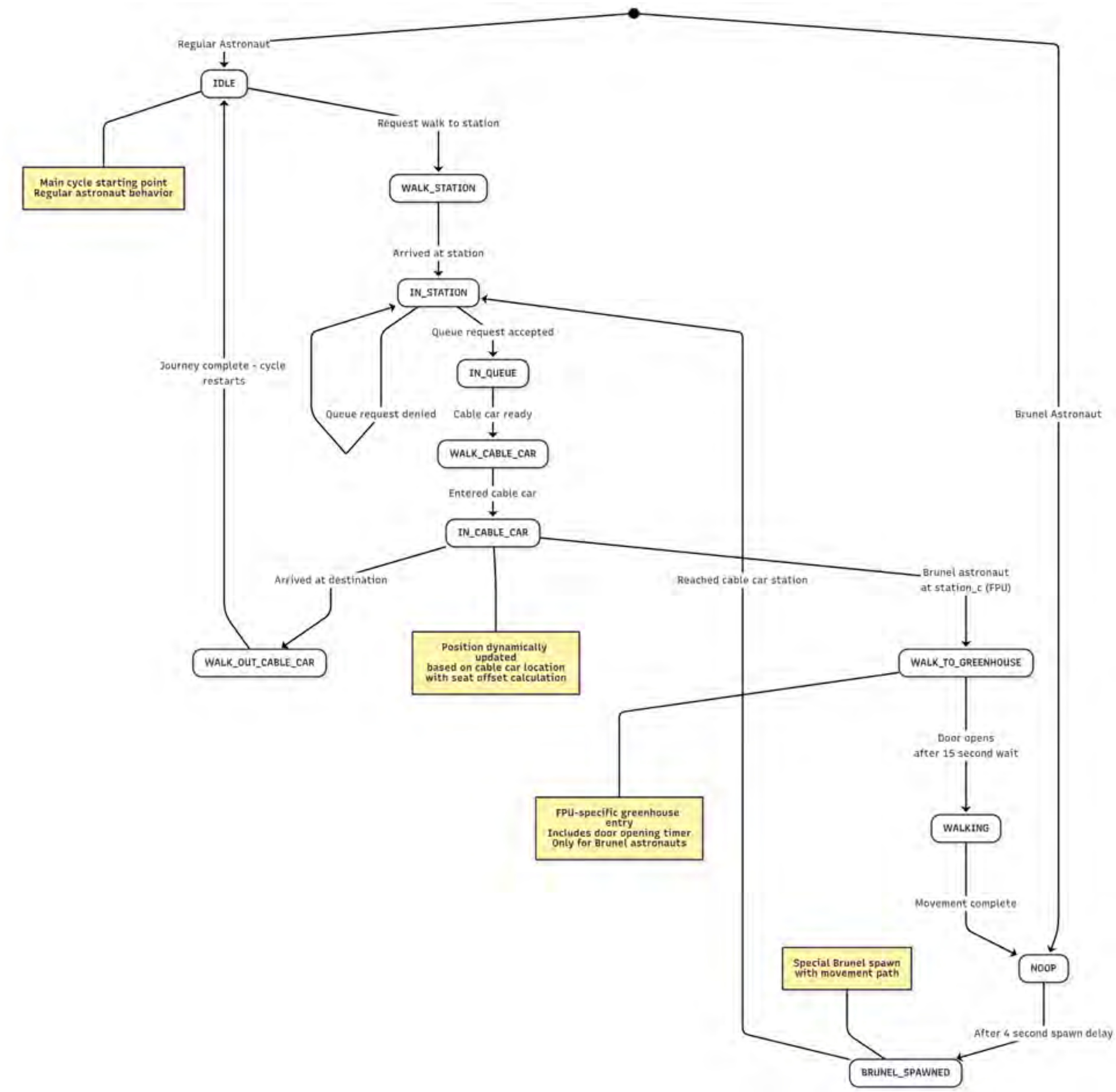


Figure 5: State machine diagram for the Astronaut Federate (ASTR).

4.5 Experimental Design

The experimental phase of the project comprised two primary scenarios:

1. **Primary Scenario**: This scenario involved realistic astronaut transportation, simulating the transfer of astronauts from Brunel University's SpacePort to Florida Polytechnic University's Greenhouse. This scenario effectively demonstrated federate interoperability, pathfinding accuracy, and coordinated operations between international teams.
2. **Stress-Test Scenario**: To evaluate the robustness and scalability of the federates, an additional scenario was conducted involving 16 astronauts simultaneously navigating between randomly selected stations. This stress test provided insights into the efficiency and responsiveness of the federates under high-demand conditions.

5 RESULTS

During SEE 2025, a series of integration tests were conducted between the FACENS federates and those of Brunel University London, Florida Polytechnic University (FPU), and the University of Central Florida (UCF). Initial tests ensured stable point-to-point communication among federates, leading to a successful real-time graphical demonstration.

The main scenario showcased the FACENS Lunar Cable Car (LCC) operating within NASA's Distributed Open Network (DON), integrated with 3D assets. The mission began with the landing of the Brunel lunar lander, which was detected via a beacon developed by the UCF. This triggered an event in Brunel's SpacePort federate, which notified FACENS's LCC that an astronaut was on the way to the station. After boarding, the astronaut was transported to the FPU Greenhouse Federation and entered via an airlock to begin energy generation tasks that would eventually support LCC operations.

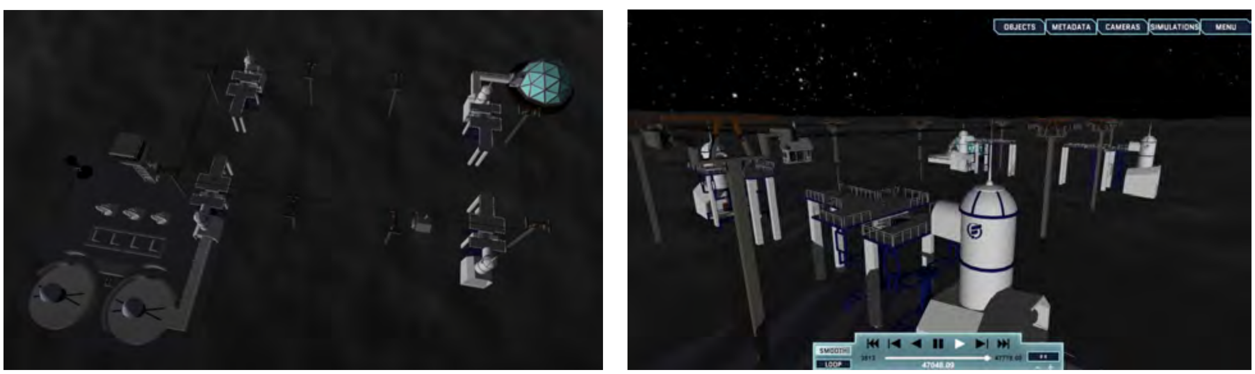


Figure 6: Top view (a) and side view (b) of the lunar base layout used in the primary simulation scenario.

In total, nine astronauts were managed under simulation constraints, such as cable car capacity and navigation logic. Astronauts queued and path-planned effectively, avoiding collisions and optimizing boarding sequences.

A second scenario, designed as a stress test, involved 16 astronauts randomly moving between stations. This tested the robustness of the system under high load and verified the effectiveness of federate synchronization.

On average, the federation handled approximately 20 interaction requests per second across all components, including real-time updates for trajectory prediction and operational state broadcasts from the LCC federate. These results confirm the simulation's success in demonstrating federate interoperability, astronaut behavior realism, and model fidelity. The final demonstration was well-received, with judges commending the integration complexity and collaborative depth. A complete video of the execution is available on YouTube (FACENS SEE Team 2025b).

6 DISCUSSION

The Simulation Exploration Experience (SEE) 2025 provided valuable insights into the efficacy and educational benefits of international collaborative simulations. The results demonstrated robust interoperability among diverse federates, highlighting the strengths and potential of using standardized frameworks like High-Level Architecture (HLA) and Runtime Infrastructure (RTI) in distributed simulation projects.

Efficient communication between federates, especially between our systems and those developed by the teams from Brunel University, Florida Polytechnic University and the University of Central Florida, required special attention to ensure interoperability and respect proposed operational limits, such as the capacity of the Cable Car. The integration between the systems required both technical expertise in HLA/RTI and SpaceFOM, as well as rigorous coordination to mitigate conflicts between distributed events.

The high level of complexity in interactions and federate logic was notably praised by judges and peers, underscoring the project's educational value and technical achievements. Additionally, the visual realism achieved through meticulous 3D modeling and environmental detailing significantly enhanced the immersive quality and practical relevance of the simulation.

Evidently, regular synchronization meetings and integrated validation tests proved essential in overcoming potential technical and conceptual challenges, ensuring seamless federate interactions and simulation accuracy. Weekly meetings were organized with the partner teams to align interactions and event mechanisms. This collaboration provided valuable knowledge reinforcing the importance of technical networking, something strongly encouraged by SEE. The constant exchange of ideas and transparency in development were differentiators that enabled a functional, robust and truly collaborative simulation.

7 CONCLUSIONS AND FUTURE WORK

The FACENS team's participation in SEE 2025 successfully demonstrated the potential of internationally collaborative, interoperable simulation environments tailored to lunar exploration scenarios. Through the development and integration of the Lunar Cable Car and Astronaut federates, the project achieved its primary objectives: establishing robust real-time interactions, enhancing simulation logic and visuals, and showcasing functional system integration within a realistic lunar context.

In addition to achieving technical milestones, the project yielded significant educational outcomes. Team members gained hands-on experience with distributed simulation frameworks, improved their understanding of HLA/RTI architectures, and engaged in meaningful collaboration with international partners from Brunel University, Florida Polytechnic University, and the University of Central Florida.

Future work will focus on increasing environmental realism, enhancing astronaut autonomy, and diversifying mission scenarios. Continued international collaboration and federate expansion will further advance the simulation's scope and complexity.

The SEE initiative continues to serve as a vital platform for experiential learning, skill development, and innovation in simulation-based exploration design. FACENS's contribution to SEE 2025 reinforces the importance of education-driven research and sets a strong foundation for future participation and technological advancement in the field of space systems simulation.

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REFERENCES

Elfrey, P. R., G. Zacharewicz, and M. Ni. 2011, December. "SMACKDOWN: Adventures in Simulation Standards and Interoperability". In *2011 Winter Simulation Conference (WSC)* https://doi.org/10.1109/WSC.2011.6148086.

FACENS SEE Team 2025a. "SEE 2025 - Facens Brazil - 3D Models Demo". https://www.youtube.com/watch?v=ZGdWren_7bo. Accessed: 2025-06-27.

FACENS SEE Team 2025b. "Simulation Execution for SEE 2025 Lunar Scenario". https://www.youtube.com/watch?v=hr9RrDhLG1Q. Accessed: 2025-06-27.

Falcone, A., and A. Garro. 2016, April. "The SEE HLA Starter Kit: Enabling the Rapid Prototyping of HLA-Based Simulations for Space Exploration". In *Proceedings of the 2016 Spring Simulation Multi-Conference* https://doi.org/10.22360/SpringSim.2016.MSCIAASSPACE.001.

Falcone, A., A. Garro, S. J. Taylor, A. Anagnostou, N. R. Chaudhry, and O. Salah. 2017. "Experiences in Simplifying Distributed Simulation: the HLA Development Kit Framework". *Journal of Simulation* 11(3):208–227 https://doi.org/10.1057/s41273-016-0039-4.

Ghorbani, M., A. Anagnostou, N. T. Abubakar, H. Aatreya, D. Curry, and S. J. E. Taylor. 2024, December. "Simulation Exploration Experience (SEE) Introductory Tutorial". In *2024 Winter Simulation Conference (WSC)* https://doi.org/10.1109/WSC63780.2024.10838847.

Hu, D.-d. 2005. "Advanced A* Algorithm for Path-Finding and Optimization". *Journal of Civil Aviation University of China*. Accessed 20 April 2025.

Möller, B. 2012. *The HLA Tutorial: A Practical Guide For Developing Distributed Simulations*. Pitch Technologies.

NASA 2015. "Distributed Observer Network (DON) Version 3.1". https://software.nasa.gov/software/KSC-13775. Accessed 20 April 2025.

NASA 2023a. "Moon Composition". https://science.nasa.gov/moon/composition/. Accessed 6 April 2025.

NASA 2023b. "Weather on the Moon". https://science.nasa.gov/moon/weather-on-the-moon/. Accessed 6 April 2025.

Pitch Technologies 2024. *Pitch pRTI™ User's Guide*. Accessed 24 April 2024.

Steiner, J. T., and R. B. Malla. 2021. "A Study of Layered Structural Configurations as Thermal and Impact Shielding of Lunar Habitats". In *Earth and Space 2021: Engineering for Extreme Environments*, 1285–1296 https://doi.org/10.1061/9780784483374.119. Accessed 18 April 2025.

Taylor, S. J. E., N. Revagar, J. Chambers, M. Yero, A. Anagnostou, A. Nouman, *et al*. 2014, October. "Simulation exploration experience: A distributed hybrid simulation of a lunar mining operation". In *2014 IEEE/ACM 18th International Symposium on Distributed Simulation and Real Time Applications*, 107–112: IEEE https://doi.org/10.1109/DS-RT.2014.21.

Wen, K., X.-w. Chen, and Y.-g. Lu. 2020. "Research and Development on Hypervelocity Impact Protection Using Whipple Shield: An Overview". *Acta Astronautica* 180:528–543 https://doi.org/10.1016/j.actaastro.2020.11.018. Accessed 18 April 2025.

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