



The Immersive Construction Laboratory: A Regional Asset

The purpose of the Immersive Construction (ICon) Laboratory is to facilitate the effective use of virtual reality (VR) techniques in design and execution of advanced energy retrofit projects. The ICon Lab contains an immersive projection display which allows 3D and 4D models to be displayed in stereo at full scale. The ICon lab groups up to 40 people to simultaneously participate in the integrated design of a building. The ICon Lab is located at the EEB Hub headquarters in Building 101 at the Navy Yard. A sister system is located at Penn State University Park. The two systems are interactive with one another.



The ICon Lab at the Navy Yard is already supporting advanced energy retrofit project design efforts most notably including the Building 661 Project. A training program is now underway to encourage use of the ICon lab by Greater Philadelphia architectural and engineering (A&E) firms and other firms in the Greater Philadelphia building industry. User manuals provide guidelines for the system use as well as the computational and analytical tools offered by the Lab.

Regional Asset

This state-of-the-art Laboratory is a boon to the regional A&E community, and can help create a shift in current practice among regional firms toward more integrated efforts. A long term goal of the EEB Hub is active and ongoing use of the ICon Lab by regional firms. Anticipated uses include:

- **Immersive Display of Full Scale Walkthroughs:** Immersive display environments allow an individual or a team to navigate, at full scale, a virtual space prior to construction. The Lab can be used for the visualization of physical facility characteristics including architectural, electrical, and mechanical design. What may be even more valuable is the review of computational data from the applications, such as computational fluid dynamics data visualizations.
- **Interactive Workspace for Design Charettes:** The Lab will allow a project team to interactively push a significant amount of data to the display screens during design charettes. From previous research studies, this ability to review many data sources and to engage a broader range of design team participants will help teams identify more potential solutions and keep all participants more informed. Through improved integration of design tools and real time simulation results, project teams will be able to make highly informed decisions during the design charettes.
- **Co-located and remote meetings and presentations:** The process of advanced energy retrofit project design and execution is inherently collaborative due to a large number of disciplines and professionals involved. The level of success of any collaborative project largely depends on the effectiveness of communication among the participants. The integration of high quality video and audio conferencing allows a more seamless sharing of information across displays and locations.

Immediate Use for Building 661

The ICon Lab is currently used for Building 661 design review meetings. The Lab is used to display an interactive and real-time navigable model of Building 661 developed in Unity 3D, as well as the building information model (BIM) used for performing various energy and daylight simulation analyses. A very important aspect of the design, construction, and operation of energy efficient buildings is leveraging the analytical capabilities of computational modeling to optimize the facility design. To fully leverage the value of the models, it is important to be able to engage the project team in the modeling initiative. The immersive display system allows the project and research teams to navigate design and analysis models in stereo at a 1:1 scale, to use the lab as a highly interactive workspace environment, and to leverage the developed content and display for outreach and education initiatives.

The Penn State University Park ICon Lab is also supporting the Building 661 project by providing a means to develop the Building 661 BIM and a range of corresponding energy simulations. The Building 661 BIM (Figure 1, left) developed during Year 1 is currently being used by the design team. To support the visualization of the existing conditions, as well as the proposed design solutions for the retrofit, a real time navigation model was also developed using the Unity 3D game engine (Figure 1, right). The information from the model is being used to develop energy and daylighting models and perform simulations for Building 661 existing conditions (Figure 2).



Figure 1: Building 661 BIM model (left) and real-time navigable Unity 3D model (right)

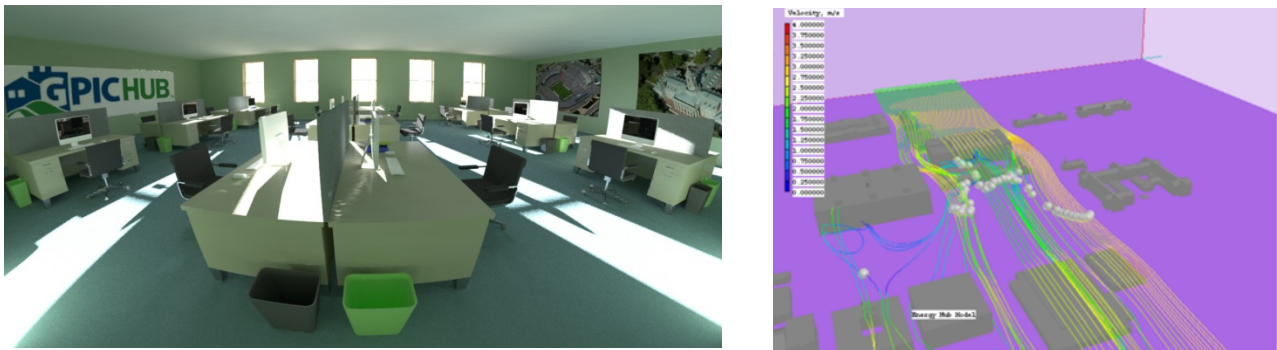


Figure 2: Building 661 daylighting model (left) and airflow movement model (right)