Executive Summary

The Millenium Science Complex is a four story, 275,600 square foot, LEED Gold Certified laboratory and office facility for the Life and Material Sciences on The Pennsylvania State University, University Park campus. Located on the eastern end of campus, the Millennium Science Complex is the focus of the Integrated Project Delivery / Building Information Modeling Thesis (IPD / BIM Thesis). The building will house research facilities for the Material Science and Life Science departments. This report includes the final design alternatives completed by Building Stimulus design team during the Spring 2011 Semester. Each alternative presented was done to utilize an integrated project delivery method and building information modeling approach as applicable.

Building Stimulus focused the design alternatives to achieve an overall team goal of improving the efficiency and performance of the building while still maintaining the architectural integrity that the architect, Raphael Vinoly intended for its contribution to the University Park Campus. In order to accomplish this overall goal, three areas of concentration were identified.

The main focus for the design team in order to improve the efficiency of the building's performance involved redesigning the façade of the Millennium Science Complex. This allowed an extensive implementation of integrated project development as this component affected each discipline. A double skin façade was designed to allow for enhanced thermal performance and daylighting control for the perimeter spaces of Millennium Science. After several iterative processes, this design was implemented on two of the building's faces. Not only were the glazing and solar louver systems reconceived, but also the panel design associated with façade. The current precast panels were redesigned to decrease the structural load on the building and to accommodate the twenty-four inch air gap provided for the double skin.

Through the use of BIM processes and Revit MEP, enhanced accuracy in terms of modeling the building's energy performance was also achieved. By modeling the mechanical and electrical components, the original energy model developed in the fall semester was revised to account for accurate plug loads designated in the laboratory spaces to obtain a more realistic energy profile. In order to facilitate the energy performance, lighting designs were created to efficiently meet IESNA design criteria and ASHRAE 90.1 lighting power densities. Lighting designs were also incorporated with the mechanical system through the implementation of chilled beams in the office spaces to reduce energy consumption.

The final area of concentration for Building Stimulus lied with the most iconic portion of the building, the large cantilever. At the cantilever is where the two wings of the building, Life Science and Material Science, join to merge the two research facilities. The truss system of the cantilever was modified by introducing an additional column to each truss, decreasing the unsupported length of the cantilever by 22 feet. The web and chord members were also redesigned to be optimized for strength and deflection, resulting in a savings of 76 tons of steel. Underneath the cantilever, a new lighting design for the existing plaza was created to enhance the iconic stature of the cantilever.