



OptiNet™
Optimizing
Ventilation



New Jersey Devils Arena OptiNet Case Study

New Jersey Devils Arena Application

The Design Problem:

The New Jersey Devils were looking to build a new ice hockey and sports arena for their operations, a facility which is now called the Prudential Center. It was designed with a budget of \$375 million by architects Morris Adjmi and sports facility specialists, HOK. Vanderweil Engineering who did the mechanical design for the project was charged with designing an arena that needed to be energy efficient, have an excellent indoor environment regardless of whether the facility was used for hockey or monster truck rallies, and finally that the facility would have the best ice in the NHL. To help achieve these goals in a cost effective and reliable manner Vanderweil turned to Aircuity and its unique OptiNet Energy and Environment Sensing system.

Specifically Vanderweil was looking to achieve several different sensing objectives in order to meet the arena's performance, energy and environment goals. Firstly, to efficiently provide the best ice in the NHL, they needed a means to accurately and reliably sense dewpoint at many different points around the arena in order to be able to properly control the air dewpoint to prevent condensation on the ice that would soften its surface. Accurate control of dewpoint is important in an ice arena since too high a dewpoint can soften the ice whereas too low a dewpoint can waste significant amounts of energy due to the large amount of outside air required in an arena. Additionally, accurate dewpoint information can also be used to help optimize the refrigeration of the ice sheet to achieve hard ice with the optimum energy usage.

Secondly, Vanderweil wanted to use demand control ventilation to reduce the massive quantities of outside air required in arenas. Normally this involves the use of many carbon dioxide (CO₂) sensors to help determine how much outside air is required based on the number of people in the arena. However, a multi-use arena can also have a high generation of many potential contaminants such as carbon monoxide from the Zamboni machines, exhaust vapors and dust from monster trucks, and motorcycles, circus acts, etc. In order to reduce ventilation during these and other events other sensors such as TVOC sensors, carbon monoxide sensors, and particle sensors were also required at over 30 locations in the 100,000 sq. ft arena. When these sensors indicate that the air is clean then the ventilation can be reduced to a level dictated by the number of people in the arena as sensed by the carbon



dioxide sensors. When contaminants are sensed, then the outside air is increased to provide a healthy and comfortable environment. As such this multi-parameter form of demand control ventilation provides the optimum amount of outside air in order to provide both energy efficiency and a superior indoor environment.

To achieve the above objectives was going to require the use of 5 different air parameter sensors, dewpoint, carbon dioxide, carbon monoxide, TVOC (total volatile organic compounds), and particulates at over 30 locations for a total of over 150 sensors. The cost of all these individual sensors was potentially very high as well as the maintenance and calibration requirements were daunting due both to the hard to access locations of the sensing points throughout the arena as well as the significant costs involved in the individual calibration needs of all of these sensors. As such the idea of using conventional sensors was rejected as being too costly and hard to maintain.



The OptiNet Solution:

Looking for a more accurate, cost effective and more reliable solution, Vanderweil choose Aircuity's OptiNet Multiplexed Sensing System to handle the New Jersey Devil's facility wide sensing requirements. Instead of using many individual, lower quality commercial sensors placed at the location and in the environment to be sensed, OptiNet changes this age old paradigm of sensing. The OptiNet approach is to bring the environment sequentially from the many locations to be sensed to very few high quality, industrial sensors that are used in a multiplexed fashion and are located in a centralized sensed location. This central location could be in a mechanical room, utility closet, or other easily accessible location.

This multiplexed system routes packets or samples of air sequentially from each area to be sensed through a hollow structured cable to a shared set of sensors. Every 30 to 60 seconds a sample of air from a different area is routed on a common air sampling backbone to the same set of sensors, known as a sensor suite, for measurement. These sequential measurements are then "de-multiplexed" for each sampled area to create distinct sensor signals used for traditional monitoring and control applications as required. Typically 15 to 20 areas can be sampled, with one set of sensors, approximately every 15 minutes depending on the requirements for those spaces. This new sensing approach significantly minimizes calibration and maintenance expenses by reducing the number of sensors by a factor of 15 to 20 and also allowing the economical use of higher quality that are more accurate and reliable. As such the number of required sensors for the Prudential Center was reduced from over 150 sensors to just 10 total.

The calibration process for these sensors is also simply and easily accomplished through an exchange program whereby a set of factory calibrated sensors from Aircuity periodically replaces the onsite sensors every 6 months. The system and its sensors are also remotely monitored by Aircuity to look for any significant sensor drift, a sensor failure, or any unexpected changes in system operation. The system is therefore assured to operate at peak performance with minimal, or no disruption to the facility's operation.

Summary of Results:

The OptiNet was installed into the Prudential Center during 2007 and the project was completed and opened with a series of concerts by Bon Jovi in October of 2007. The facility is not only used by the New Jersey Devils Hockey team, but also the Seton Hall Pirates men's basketball team and the Xtreme Soccer League's New Jersey Ironmen indoor soccer team as well as for any other events. For the facility operation during all of these events, the OptiNet system provides useful control and operating information to ensure an energy efficient and healthy environment with the added bonus of great playing ice for the New Jersey Devils home hockey games.

