CHAPTER/REGIONAL TECHNOLOGY AWARD - SHORT FORM

1. **Category (Check one and indicate New or Existing, if applicable)**

(●) Commercial Buildings	(●) New or ( ) Existing
Institutional Buildings:	
( ) Educational Facilities	( ) New or ( ) Existing
( ) Other Institutional	( ) New or ( ) Existing
( ) Health Care Facilities	( ) New or ( ) Existing
( ) Industrial Facilities or Processes	( ) New or ( ) Existing
( ) Public Assembly	( ) New or ( ) Existing
( ) Residential (Single and Multi-Family)	

2. **Name of building or project:** South Airport Traffic Control Tower

City/State: Chicago/Illinois

3. **Project Description:** New Air traffic control tower to oversee the south runway at O'Hare

Project Study/Design Period: January 2011 (Begin date (mm/yyyy)) to April 2013 (End date (mm/yyyy))

Percent Occupancy at time of submission: 100%

4. **Entrant (ASHRAE member with significant role in project):**

a. Name: Mahmood (Last) Fazal (First) (Middle)

Membership Number: 5170217

Chapter: Chicago

Region: VI

b. Address (including country): 205 N. Michigan Ave. Suite 3600

Chicago (City) IL (State) 60601 (Zip) USA (Country)

c. Telephone: (O) 312 616 7436 d. Email: fazal.mahmood@exp.com

e. Member's Role in Project: Project Manager

f. Member's Signature: Fazal Mahmood

5. **Engineer of Record:** Exp U.S. Services Inc.

By affixing my signature above, I certify that the information contained in this application is accurate to the best of my knowledge. In addition, I certify that I have discussed this entry with the owner and have received permission from the owner to submit this project to the ASHRAE Technology Awards Competition.

Submission for the
2015 ASHRAE Technology Awards, Illinois Chapter

South Air Traffic Control Tower

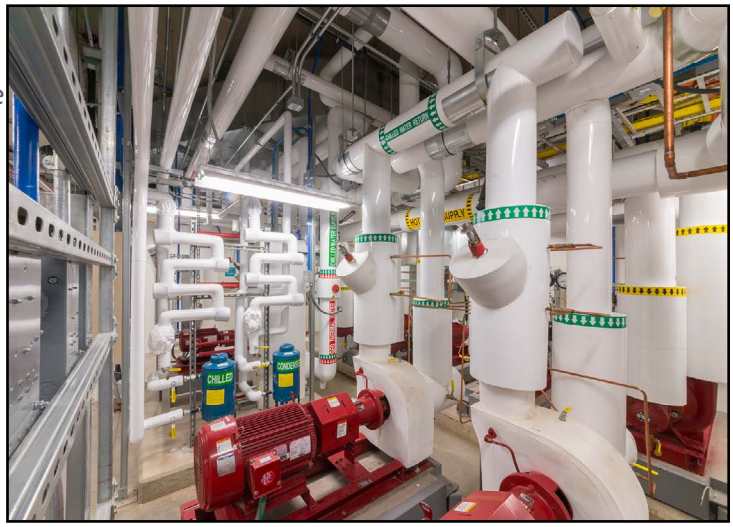
CHICAGO, ILLINOIS

The new South Air Traffic Control Tower is located in the south airfield of Chicago O'Hare International Airport, and was designed to guide air traffic for the newly constructed south Runway 10R-28L. The tower is 207 feet tall with thirteen floors and the cab. The control tower has a single story support building with 10,070 sq. ft. area which houses the major mechanical and electrical equipment, and the staff spaces. The tower has an area of 19,609 sq ft. with the cab as the only occupied floor. The majority of the tower is unoccupied and is used to transport the controllers to the cab level. The unique shape of the tower as a rectagular prism, as opposed to traditional bulb and shaft design, allows for 2 means of egress to meet the City of Chicago code, as well as greatly enhance construction, operation and maintenace of the electrical and mechanical equipment in the mezzanine level directly below the cab. The tower is also the first tower at O'Hare to achieve a four Airplane Sustainable Airports Manual (SAM) rating and only the third in the U.S. to achieve LEED gold.

The control tower is the first project at O'Hare to utilize a closed loop geothermal system for the cooling and heating needs. The ground temperature is at a fairly constant temperature all year and is used as a heat source and sink. A ground water source six pipe heat pump provides simultaneous chilled water and hot water for cooling and heating needs of the building. The geothermal system comprises of 35 bore holes, each 505 feet in depth. A high efficiency grout

was used to maximize the heat transfer between the ground and the fluid. The ground source heat pump is widely considered as one of the most energy efficient, environmentally clean and cost effective heating and cooling system.

The support building is served by a variable volume air handling unit. The offices are served by variable air volume boxes with heating coil. The hot water supply from the heat pump is limited to 135 F and is used to heat the space. A perimeter heating system is utilized to heat the building when the Air Handling Unit is not operational. Normally this type of facility operates 24/7 however demand control ventilation and night set back schedule allowed the owner to reduce the energy usage of the building.



A dedicated air handling unit with 100% standby capacity serves the cab area. The Air handling is constant volume with minimum outside air to meet the ventilation requirements of the people. The control of the cab atmosphere is very critical for the operation of the tower. Dew point sensors are installed on the glass to maintain the correct dew point to avoid condensation or fogging on the cab glass.

Computer and server rooms are served by dedicated air conditioning units with chilled water and hot water coils.

BIM technology was utilized to document the entire building in Revit by all disciplines. This facilitated a better coordination between all disciplines and helped the contractor view the model in 3D during the bidding and construction phases, as well as developing a 3D as-built model.

The MEP design was driven by a pursuit of sustainable strategies from design through construction with energy conservation to be the main goal for the building which operates all year round with a constant equipment load to support the operation of the tower.
Picture 1 illustrates some of the features implemented in the design without compromising the operation of the control tower.

Energy Efficiency

- Energy modeling was used to estimate the project's total energy consumption using ASHRAE 90.1 energy modeling design guidelines, with the objective of providing a building that exceeds the LEED requirement of 10% below ASHRAE Standard 90.1-2007.
- Current energy modeling reports anticipate a 14% reduction in energy usage when compared to the baseline building.
- A geothermal system (ground water source) was used to enhance the energy efficiency of the

heating and cooling systems.

- No CFC-based or HCFC-based refrigerants were used in HVAC&R systems and refrigerants used had a low global warming potential.
- A Measurement and Verification Plan was developed by the CxA for meters and energy use, measuring devices to monitor building energy consumption for at least one year after occupancy. A diagram locating all metering devices used to measure energy consumption of equipment will be included in the commissioning plan.
- The design exceeds the requirements of ASHRAE Standard 62.1-2007 for ventilation.
- CDA purchased renewable energy certified by Green-e
- Air handling units were provided with filters that have a Minimum Efficiency Reporting
- Value (MERV) rating of 13 or higher and separate carbon filters

Energy

Energy performance rating	Design: 85	Target: 75
CO2 Emissions	Design: 422 mt/y	Target: 474 mt/y
CO2 emissions reduction	Design: 28%	Target: 19%
Energy cost savings: 14.22%		

Indoor Air Quality

- Interior smoking room provided with dedicated exhaust and required separation.
- An outdoor air delivery monitoring system was installed with airflow measuring stations and carbon dioxide sensors at air-handling units serving occupied areas. Carbon dioxide sensors were installed in all Conference and Break Rooms.
- Meets all VOC limits.
- Individual lighting and thermal comfort controls for 90% of occupants (except where functional requirements do not allow), in order for building occupants to make adjustments to meet their individual needs and preferences.
- Daylight provides for at least 88% of all regularly occupied spaces, and views will be provided for at least 90% of all regularly occupied spaces, in order to provide a connection with the outdoors and reduce energy used for lighting systems when not required.
- Post-occupancy survey

Innovation

- The first control tower at O'Hare to utilize a geothermal field for heating and cooling, and achieve a 4 Airplanes SAM rating.
- Combination of geothermal field with boiler and water side economizer to provide most effective and efficient system to meet the building heating and cooling demand.
- Use of natural and forced air to ventilate the stairs to save energy while maintaining acceptable environment in the summer.
- The operation of the cab space requires the use of a clear non-insulated glass. These glass

assemblies are normally available with a high shading coefficient and thermal conductivity values. Typically it results in higher energy usage. In-spite of these limitations, the design was able to achieve 14% energy savings, utilizing an efficient air distribution system with coordinated roller shades .

Operation and Maintenance

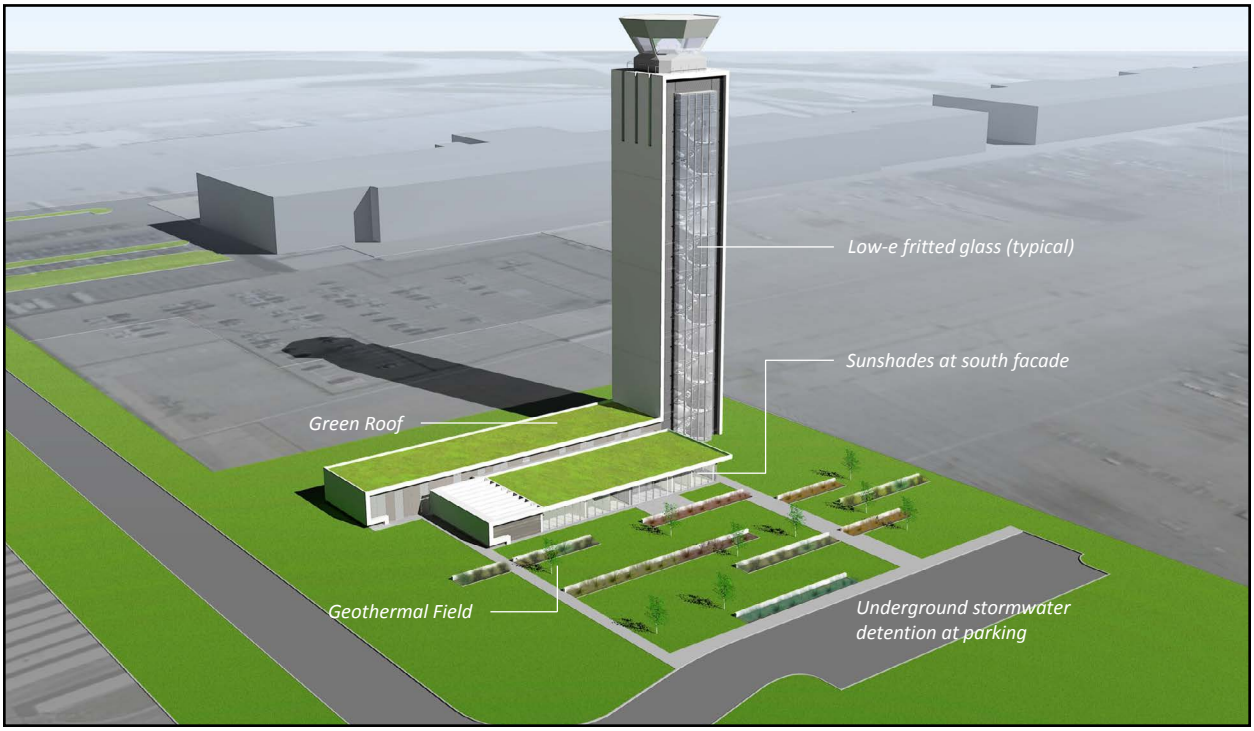
- The building operates fully on direct digital control systems (DDC) and is monitored from the remote location with minimum input from the tower staff.

Cost Effectiveness

- 14.22% energy cost savings.
- Vegetated roof extends the life of the roof therefore saving costs incurred for replacement and maintenace.
- 40% water use reduction

Environmental Impact

- Minimize surface runoff - water detention beneath parking lot
- Vegetated roof reduces heat-island effect, storm water runoff and extends life of roof system
- 40% water use reduction
- No irrigation - native low-maintenance vegetation (doesn't attract wildlife that would be threatening to aviation operations)
- Low-flow plumbing fixtures and flow restricting fittings were specified to reduce water consumption. Toilets and urinals utilize auto-sensor operated flush valves, and lavatories that utilize manual operation faucets with flow restricted outlets were installed.
- Reduced CO2 emissions by 28%.



SOUTH AIR TRAFFIC CONTROL TOWER
System Schematic Diagram

Exhibit 1