EDMONTON INTERNATIONAL AIRPORT
OFFICE AND CONTROL TOWER

Canadian Consulting Engineering Awards 2015

DIALOG®

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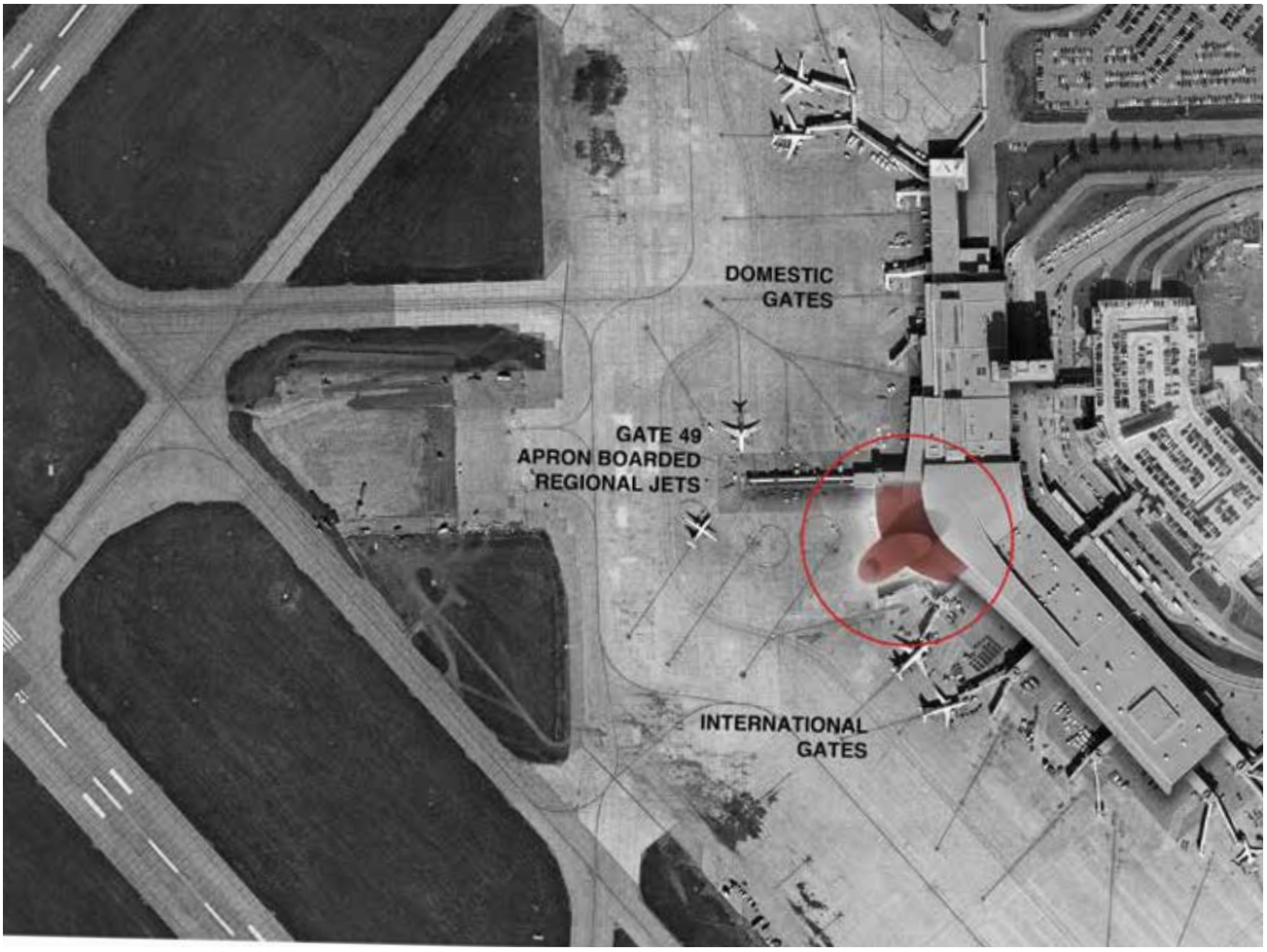
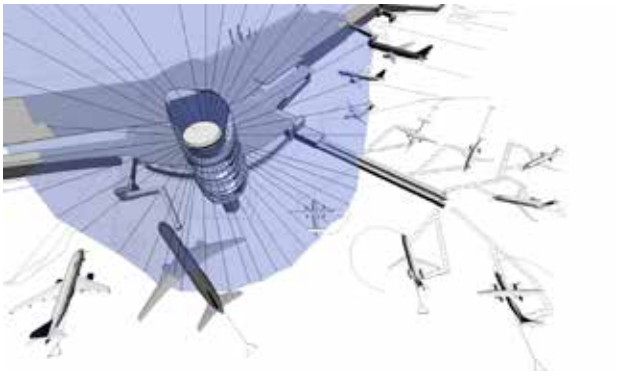


The Edmonton International Airport (EIA) is a significant Canadian transportation hub just south of the city on the open Alberta prairie. DIALOG was challenged to design a new combined office and control tower atop the main terminal that would serve as a distinctive landmark for the Edmonton Region. Showcasing the region's cultural vibrancy while providing an enjoyable, relaxing environment, the Central Tower has quickly become a dramatic icon for both EIA and visitors to the Capital Region.

INNOVATION

Sculpture is an art form. Constructing a sculpture on the secure airside of one of western Canada's busiest airports is a marriage of art and science: the essence of design engineering. As sculpture, the Edmonton International Airport Central Tower is a welcoming beacon to visitors arriving to the windswept prairies of Alberta's Capital Region. But it is also much more than a sculpture: the Central Tower is an active office building and airport control tower that requires precise considerations for safety, security, and efficiency.

Control towers are traditionally built as slender structures to maximize views of the runways and offer minimal impact to ground-level airside operations. So to combine a control tower with an office building, the shape of the office floors had to be controlled carefully to ensure clear sight lines. With the unique shape of its floor plate and its construction on top of an existing, active terminal building, long spans are necessary to minimize the number of new foundations. These spans are achieved using structural steel, avoiding the hazard of concrete trucks on the secure airside apron.



The lateral force resisting system relies on steel plate shear walls, an innovative first in western Canada. Steel plate shear walls are built up from steel beams and columns with thin infill plates, offering speedy erection, excellent ductility, and robust performance to meet the post-disaster performance requirements for critical civic infrastructure.

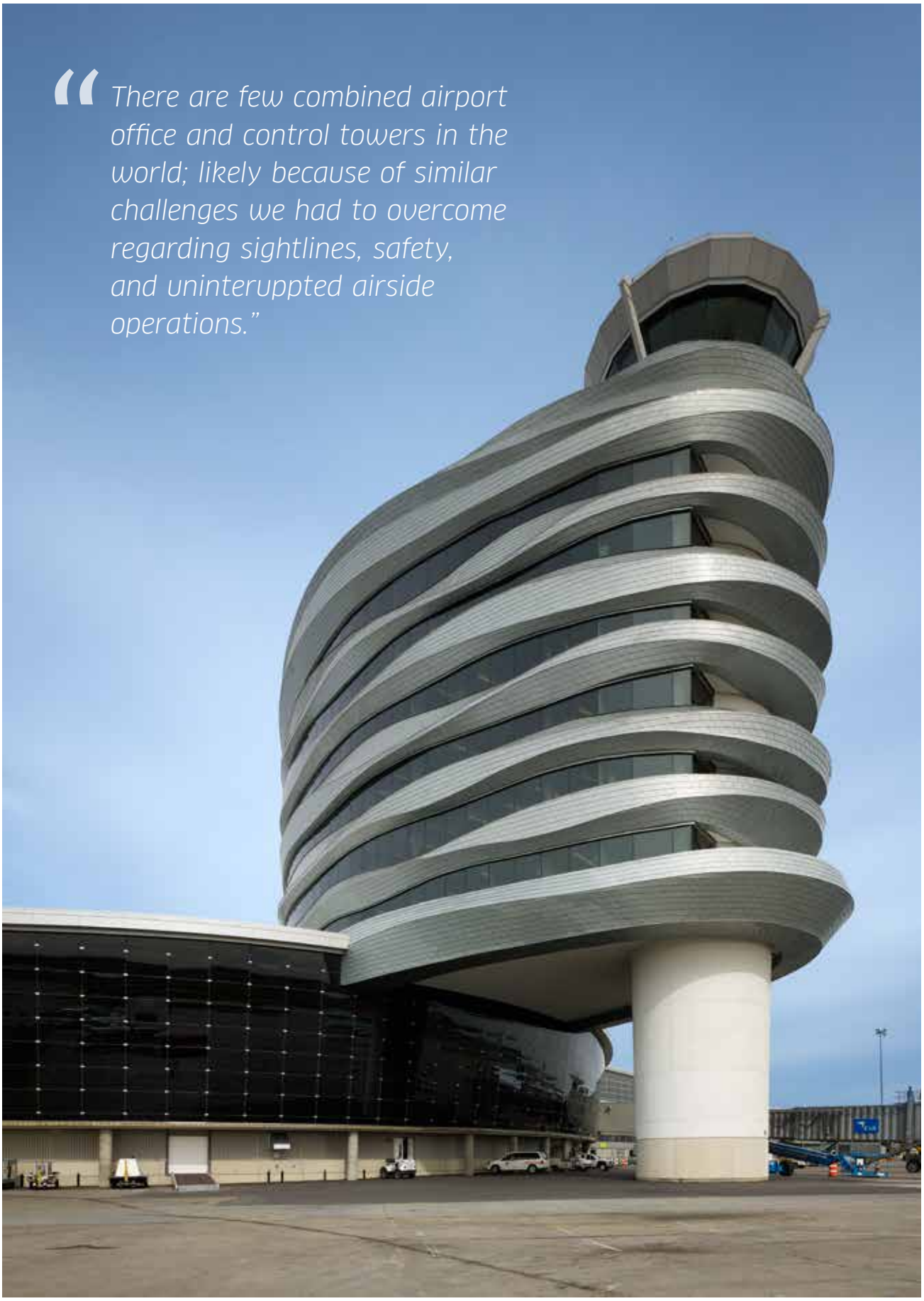
Thin-plate steel-plate shear walls were first conceived in the early 1980s by Dr. Jim Montgomery of DIALOG while he was a faculty member at the University of Alberta, working in close collaboration with Dr. Geoffrey Kulak. Research into steel plate shear walls continues to this day at the University of Alberta.

Through a highly collaborative design process, DIALOG's team designed the main steel girders with their flanges raised above the floor beams, creating an underfloor plenum space used by the mechanical and electrical engineers for ventilation and conduits.

Cooling is provided with overhead radiant cooling panels in all areas, with radiant heating providing heating to perimeter spaces. Storm water is captured and reused for toilet and urinal flushing to reduce domestic water demand. Optimized building envelopes in the terminal expansion allows the use of existing system capacity extended into the new areas.

Electrical systems for the office building are state-of-the art, with energy efficient direct/ indirect lighting utilizing fluorescent and LED sources. Energy savings is achieved through advanced lighting control techniques such as programmable low voltage switching and line voltage occupancy sensor switching.

Through this collaborative process, DIALOG's designers have created an inspiring and functional sculpture that upholds the best of design engineering: a true marriage of art and science that is an emotional connection to Edmonton and the prairie landscape.

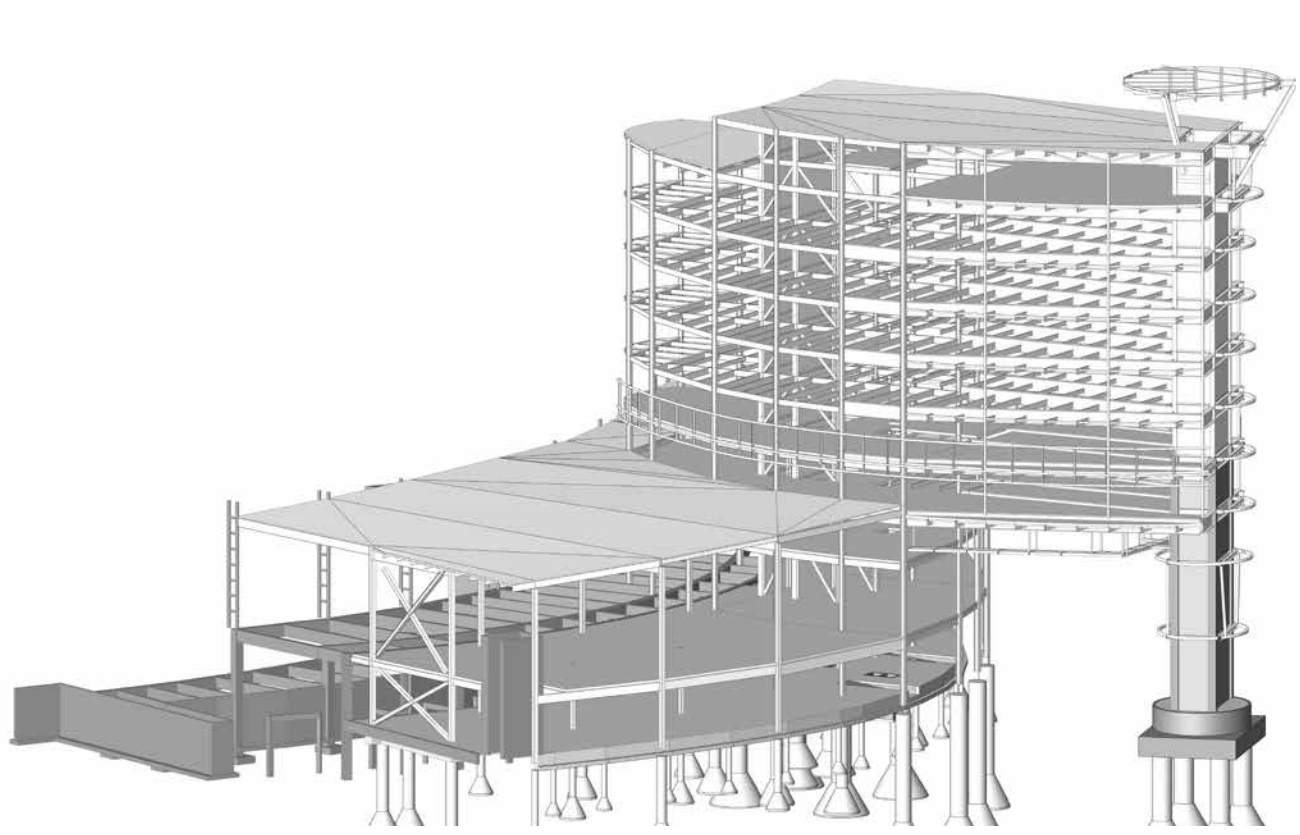

“There are few combined airport office and control towers in the world; likely because of similar challenges we had to overcome regarding sightlines, safety, and uninteruppted airside operations.”

RISING TO THE CHALLENGE

To achieve a sculptural form of windswept prairie grasses and snow, the COT and its cladding systems have elegant yet extraordinarily complex geometry. The floor plan is curved and asymmetric, and the undulating cladding geometry means that no two stainless steel panels are the same. Complex geometry of the façade is made more challenging by the need to provide a high-performance building envelope for Edmonton's demanding climate. Throughout the design close coordination of the architectural and structural BIM models were essential to achieve success with the steel structure, the building envelope, and the cladding and glazing geometries.

Connecting the COT to the main terminal and placing it atop the existing apron was the ideal location for the completed building, but it was by far the most complicated option for the construction process. With Gate 49 only meters away from the site, EIA mandated that construction activities would be prohibited from disrupting airline schedules. These restrictions became a major driver in the design process, leading the team to minimize airside construction activities, for example, by selecting structural steel to minimize the need for concrete trucks to operate on the airside apron.

The team also designed a single built-up "megacolumn" on the airside apron to concentrate airside construction work into one small area and avoid cluttering the airside apron with columns. In order to achieve redundancy and integrity as a post-disaster structure, the megacolumn is designed to resist impact by ground vehicles or an aircraft, and takes into consideration the large aircraft refuel nearby. To control the risk of progressive collapse under extreme loads, the megacolumn is designed to remain standing even if one half of the megacolumn were to be severely damaged.



MEETING CLIENTS' NEEDS

Completed in November 2013, the combined Office and Control Tower project has been an integral part of the Edmonton International Airport's expansion program, responding to increasing ridership and the pressure it had placed on the existing infrastructure and buildings.

The new Central Tower creates a memorable first and last impression for Edmonton; expressing its sense of place and its people. The tower also responds to the growing operational needs of the International Airport and offers enhanced benefits to travelers and airport tenants. There project delivered an environment that is easy to navigate for passenger comfort, environmentally responsible, economically viable, and responsive to all aviation, passenger and airport staff requirements. The new central hall at the departure level connects and engages passengers with views to airside operations, and minimizes the impact of increasing ridership on terminal operations.

The project has created a healthy indoor environment for travelers and staff, and supports the Airport's commitment to sustainable design, targeting a LEED® Silver designation. More than an aesthetic overlay, the profile of the exterior zinc cladding provides optimal passive solar shading on the south and west facades while providing maximum light penetration on the north. Additional sustainable features include optimal solar orientation, rainwater harvesting, and underfloor air distribution.

ENVIRONMENTAL BENEFITS

The Central Tower is designed as a LEED® silver building and works carefully to capitalize on the region's dramatically changing climate. The use of sculptural zinc cladding, as well as optimal solar orientation, allows maximum daylight in the winter and passive shading in the summer. This passive sustainable design approach was fundamental in establishing the siting and orientation of the new combined office and control tower.

An optimal east/west solar orientation was employed to minimize solar gain from the western exposure thereby providing a comfortable interior work environment. Perimeter ribbon windows were designed to maximize daylight and views from all interior occupied areas. The ribbons' aperture opens up to the south and north with views out to the distant city and active runways, while the aperture closes down on the east façade immediately adjacent to the existing main terminal building in response to fire separation requirements and compromised daylight access and views.

The Central Tower collects all roof surface run-off into a cistern located within the main terminal for grey water use and distribution. Mechanically, all air distribution to occupied floor areas is carried through under slab ductwork. This strategy provides for a more comfortable and reliable interior climate for all building occupants.

SOCIAL AND ECONOMIC BENEFITS

Prior to the 2012 Expansion project, Edmonton International Airport was operating at 20 per cent above capacity. To stay competitive, the airport had to expand quickly and efficiently. At the same time, Edmonton Mayor, Stephen Mandel, was addressing a bigger concern: if Edmonton wanted to be a world-class city, it was time to start acting like one and take a stance for better design.

The tower is a symbol of Edmonton's ambitions. It represents a commitment to better design, a commitment to a sustainable future, and a commitment to confidently showcasing our city to the world.

The combined office and control tower is unlike any other airport but the challenge has paid off through operational efficiencies, striking aesthetics, and socioeconomic benefits; earning its notoriety as the crowning achievement of Edmonton International Airport's Expansion 2012 project.

After opening in November 2013, the Edmonton International Airport officially announced the new Central Tower sanctioning it "a distinctive landmark and dramatic icon for both Edmonton International Airport and the Capital Region."