



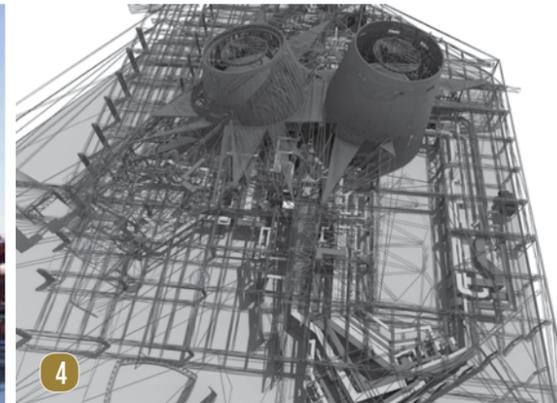
Montreal Planetarium

Star-gazing building demonstrates environmentally-responsive architecture on Earth

Located within Montreal's iconic Olympic Park complex, this project was the winning entry in a two-stage international competition. The project brief called for an intervention that would humanize the rather bleak site, which included an existing underground parking structure adjacent to the Olympic stadium. Together with the nearby Botanical Gardens, Insectarium and Biodome, the Planetarium is part of Montreal's 'Space for Life', the largest concentration of natural science museums in Canada.

By Marc Chenouda, M. Arch.





The planetarium is an educational, cultural and scientific museum for astronomy. The architectural response was guided by a desire to connect the building to nature, the place from which the vastness and beauty of the night sky can be experienced most profoundly. Another goal was to make this experience accessible to all, not simply to patrons of the Planetarium itself.

With sustainability a central concern, the decision was made to retain the parking garage and utilize it for part of the building program. This strategy reduced both heat loss and unwanted solar heat gain while offering a wonderful opportunity to explore access to natural light by sculpting the space and creating mood and ambiance.

The concrete structure is draped with an undulating, accessible green roof that connects the various levels of the site and creates an attractive amenity where people can linger amid trees, shrubs and public art. Two large conical skylights project through the vegetated roof, symbolizing the connection between nature and sky, and bringing natural light deep into the building.

These skylights, together with a portion of the upper floor, are new constructions built on top of the existing structure. No additional foundations were necessary.

The ground floor of the building houses the public spaces, including the main entrance, two star theatres, exhibition spaces and a cafe. The second floor houses the administrative offices, while the lower level serves as the link with the adjacent Biodome, and includes related activity areas, change rooms and a dining room.

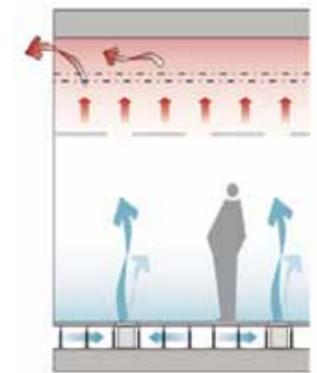
The Milky Way Theatre, which seats approximately 200, is the traditional astronomical facility where visitors study and learn about the stars in the sky. In the dubbed Chaos Theatre, visitors sit back and relax on bean bags and are taken for a twenty minute multimedia odyssey through the universe. There is also a permanent interactive exhibition with projectors and multimedia games.

The green roof is the most visible 'facade' of the new building. Custom-made fescue turf creates a durable and drought-resistant ground cover that permits public access and requires minimal irrigation. Rainwater is harvested in a closed loop system that collects water from areas of permeable paving, both on and beyond the site, redistributing it via a drip irrigation system controlled by the building's own weather station.

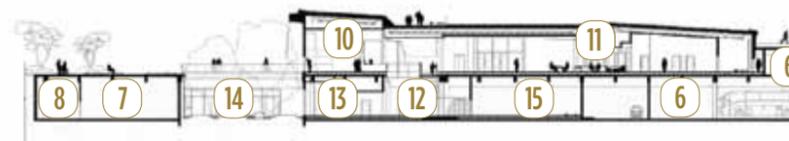
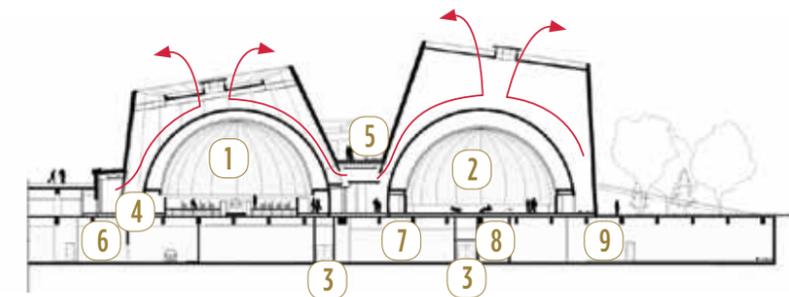
The building contains two large 40,000 litre rainwater reservoirs that capture water from the roofs and terraces. Filtration and treatment systems ensure that the harvested water is suitable for use in the toilets and urinals.

The main energy strategy for the Planetarium was to recycle excessive heat or cooling from the adjacent Biodome, which runs on an open-loop geothermal system. This previously wasted energy supplies more than half the Planetarium's energy needs. The complementary demands of the two buildings optimizes the use of the geothermal open well system. Extreme weather demands are supplied by high efficiency gas boilers which also act as an emergency back-up system.

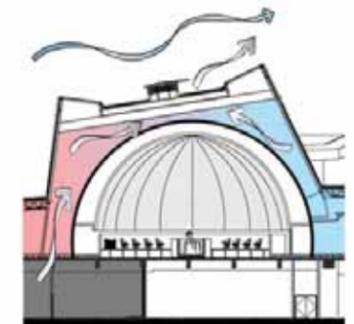
The hybrid ventilation and heat recovery systems, manufactured in Manitoba, meet the acoustic requirements of NC20, while recapturing 80-95% of the latent and sensible heat energy from exhaust air, both winter and summer. The fresh-air central system has a water atomization humidification adiabatic system which allows low temperature energy usage as a source of heat.



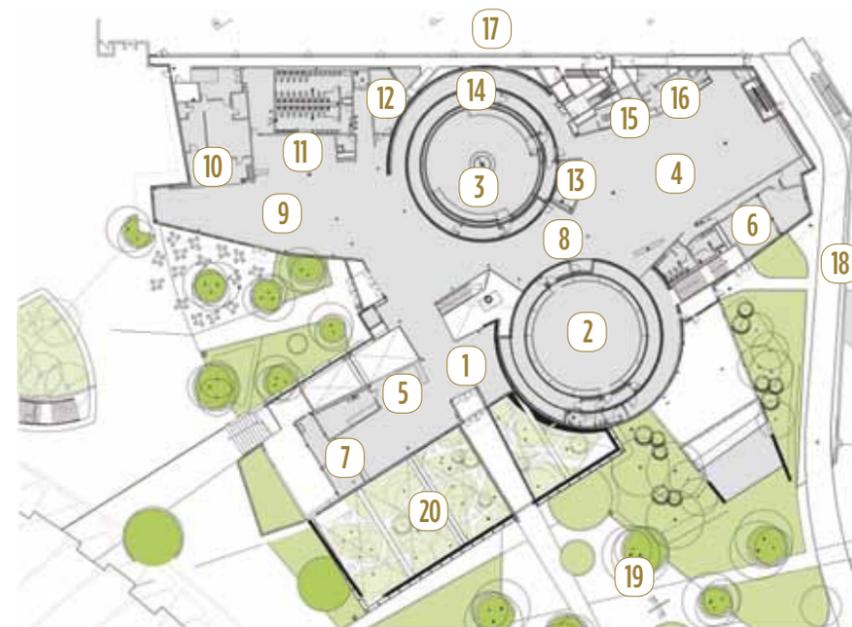
Raised floor air displacement ventilation



Building section - Red arrows show natural ventilation



Venturi effect



Site plan/Floor plan

- 1 Hall
- 2 Milky Way Theatre
- 3 Chaos Theatre
- 4 Exhibition room
- 5 Ticket office/information
- 6 Office
- 7 Storage space
- 8 Hall
- 9 Restaurant
- 10 Food service
- 11 Shop
- 12 Kitchen
- 13 Backstage room
- 14 Theatre entrance
- 15 Server room
- 16 Meteoric laboratory
- 17 Existing parking
- 18 Parking access
- 19 Sundial
- 20 Inner courtyard

- 1 Milky Way Theatre
- 2 Chaos Theatre
- 3 Exit
- 4 Showroom access
- 5 Green roof
- 6 Parking
- 7 Technical room
- 8 Storage space
- 9 Biodome storage space
- 10 Hall/reception
- 11 Café
- 12 Biodome access
- 13 Animation room
- 14 Inner courtyard
- 15 Cloak room

MATERIALS

Lower level of structure uses the existing parking structure, upper level structure uses steel framing clad with aluminum panels, vegetated roofs, reflective membranes on roofs of cones; raised floor system for displacement ventilation. The Dual Core™ ventilation system by **Tempeff North America** employs two energy cores which deliver extremely high, frost-resistant energy recovery.

EXTERIOR VIEW OF THE CONES AND GREEN ROOF. © VINCENT AUDY [1]. FRONT FACADE. © STEPHAN BRUGER [2]. STEEL FRAME DURING CONSTRUCTION. © VINCENT AUDY [3]. 3D RENDERING [4]. BIRD'S EYE VIEW OF THE BUILDING AND LANDSCAPE. © FAUTEUX ET ASSOCIÉS [5]. INTERGRATION OF NATURAL ELEMENTS IN THE PROJECT. © FAUTEUX ET ASSOCIÉS [6]. INSIDE THE MAIN HALL. © STEPHAN BRUGER [7].



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PROJECT CREDITS

ARCHITECT Cardin Ramirez Julien + /Edifica
LEED CONSULTANT EXP
CONSULTANTS Patenaude-Trempe Inc. Experts Consultants
ACOUSTIC Dessau [Acoustique]
UNIVERSAL ACCESSIBILITY Société Logique
LANDSCAPE ARCHITECT Fauteux et associés architectes paysagistes
CODE CONSULTANT Sylvie Destroismaisons
TECHNOLOGIC INTEGRATION Go Multimedia
PHOTOS Stephane Brugger, Espace pour la vie [Diane Pinard], Vincent Audy, David Giral

PROJECT PERFORMANCE

- Energy intensity [building and process energy] = 702 MJ/m²/year
- Energy intensity reduction relative to reference building under ASHRAE 90.1 1999 = 47%
- Potable water consumption from municipal sources = 2,187 L/occupant/year
- Potable water consumption reduction relative to LEED reference building = 70.6%
- Reclaimed and recycled material by value = 20%
- Regional materials [800km radius] by value = 20%
- Approximately 85% of the existing parking structure was retained

Furthermore, windows and dampers are installed on the outer walls of the exhibition halls and in the coned-shaped roofs to allow natural ventilation when conditions permit.

In winter, all the excess heat from the equipment, lighting fixtures and visitors in the Planetarium is recaptured by the cooled water circulation system and transferred to the heated water circulation system. In summer, 100% of the heat used to dehumidify the air is recaptured from the cooling condensers.

By its very nature, the Planetarium is designed to stimulate greater public awareness [particularly in children] of the beauty and wonder of the stars. Being part of the Space for Life network, the new facility supports the organization's mission through communication, conservation, education and research. By actively demonstrating a new way of experiencing nature, the Planetarium encourages people to better protect it. ◀

MARC CHENOUDA, M. ARCH. IS WITH CARDIN RAMIREZ JULIEN ARCHITECTS IN MONTREAL.

THE OLD PLANETARIUM PROJECTION EQUIPMENT IS INTEGRATED AS AN EXHIBIT. © STEPHAN BRUGGER [8]. GREEN ROOF VIEW. © FAUTEUX ET ASSOCIÉS [9]. PATHWAY ON THE GREEN ROOF. © JAMES BRITTAIN [10].



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