AZ AWARDS 2017

CATEGORY

ARCHITECTURE: COMMERCIAL AND INSTITUTIONAL UNDER 1,000 SQM

ENTRY

#1990 GEMMA OBSERVATORY

DESCRIPTION

Located in the mountains of central New Hampshire, Gemma is positioned at the end of a steep, half-mile gravel drive. Characterized by granite bedrock outcroppings and centered in a three-mile radius "dark" landscape, the exposed site is ideal for sky observation.

Operationally, the focus was on minimizing impact of temperature differentials, which cause building movement and air distortion that impede astronomical viewing, and on maximizing functionality of important building components.

The Observatory has two separate structural foundations, one for the building and another for the telescope mounts, to ensure the telescopes are not affected by any building movement, no matter how small. Super-insulated structural wall panels minimize heat transfer between conditioned spaces and viewing platforms, reducing both building movement and heat eddies that create air distortion. Metal cladding for the exterior efficiently dissipates solar heat gain, further reducing building movement and air distortion.

To meet Gemma's sustainability goals, the design includes maintenance-free exterior cladding, insulating panels that drastically reduce operating costs, and a remote photovoltaic array that allows it to operate completely off the grid. In addition, both the rotating turret and the observation hatch employ hand-operated systems using high precision equipment typically found on manufacturing facilities' robotics floors. These assemblies easily accommodate the structure's substantial weight, and are long-life components whose operation will not degrade over decades of use.

Formally, Gemma's design integrates traditional observatory program elements with the aesthetics of the remote surroundings, creating a unique architectural expression.

The typical domed observation space becomes a faceted turret, eliminating the interior sloped ceiling in order to provide more usable space that is also more comfortable to occupy. The southeast corner of the building's rectangular body pulls out of alignment to accommodate a larger radius around the exterior telescope pier, while its northeast corner is oriented toward the White Mountain National Forest. The building's continuously faceted shape reflects the surrounding landform. Finally, terraced concrete platforms transition between the summit's granite bedrock and the building foundation, knitting together natural and man-made landscapes.

While Gemma's cladding supports functional needs for heat transfer and formal adaptability, equally important is how the zinc's dimension, color, and patina establish a visual relationship to the gray granite characterizing the summit. Its unconventional pattern responds to the irregular site topography as well as the building's geometry, and reflects the building's orientation to both geological and celestial landmarks.

As a counterpoint to the stark geological context, the Observatory's interior is lined with fir plywood, creating a haven of refuge and warmth from the harsh surroundings. A helical, plywood-and-steel stair leads from cantilevered entry canopy, past research office, sleeping bunk, and warming room, and up one flight to a doorway that opens to the exterior observation deck and 22" telescope. Continuing, the stair arrives at the turret's 16' diameter primary viewing platform, with an oversized hatch designed to accommodate a 24.5" telescope. A rift at the corner creates a window, which frames Polaris when the turret is locked into the southern cardinal position.

PROJECT SPECS

Dimensions: 197.8835 m2 (2,130 sf)

Materials: Concrete, steel, SIPs (Structural Insulated Panels), fir veneer plywood, stainless steel rails, zinc cladding, ipe exterior wood decking

Fabrication techniques: Direct fabrication from original digital design files facilitated implementation of complex geometries used to design both the steel structure and the faceted walls.

Architect and cladding subcontractor were able to exchange digital fabrication files to automate the process of laser cutting and stamping individual zinc panels. This process incorporated algorithms generated by the archi-

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PROJECT SPECS (CONT'D)

tect, minimizing waste during fabrication, promoting ease of construction, and maintaining quality and cost control.

Manufacturing / building process: The slab foundation is pinned with 12 anchors to granite bedrock at depths of 18″ to 7 feet.

Both telescopes have structurally separate foundation piers, at 30″ and 24″ diameter with heights of 15′ and 12′ respectively.

In addition, the primary observation platform's steel structure is isolated from the telescope pier, ensuring vibration insulation.

SIPs were manufactured and numbered off-site. Assembly required only three days.

A linear rail assembly typically used to move heavy machinery on factory floors was adapted to carry the structure and weight of the rotating observation turret. This is the first time such an assembly was used in an astronomical observatory in North America.

The rotating observation turret is easily operated by hand. Main gears (integral with the linear rail assembly), gearbox, and gear reducer are custom-designed to be powered by hand and are convertible for future use with an electric motor. The hatch is similarly designed to be hand-operated with a combination of linear rails and gear reducers.

Eight photovoltaic solar panels supply all energy needed for light, heat, telescopes, charging modules, on-site vehicles and miscellaneous equipment.