A piece of roof glass is flown in by crane and cable to become part of this gradually materializing glass corridor. The corridor's wall panels, which weigh on average 1,400 pounds apiece, are 10.6 feet high and vary in width from 10 to 12 feet, depending on where they fit within the building's curve.

Flying Glass

PHOTOGRAPHS BY PAUL FETTERS

Come to the northern Virginia construction site at HHMI's Janelia Farm Research Campus on any clear morning and you'll see an aerial ballet. Enormous sheets of glass glint in the sun as they rise from the ground and sweep through the air. Grasped by a dozen huge suction cups, the flying glass swings gracefully on thick cables suspended from the arm of a towering red crane. Gliding up and then gently down, the panes float into the outstretched hands of the hard-hatted men waiting on a deck of the massive structure, who situate each window into its prescribed place.

This dance will be repeated many times over in the coming months as hundreds of pieces of glass are set into place, bringing alive the ingenious architectural features of the Janelia Farm landscape building that will house the offices, labs, and support facilities at the heart of the biomedical research center. Beyond the expected benefit of providing natural light and visibility, the glass will play an integral, load-bearing role in the structure. And the glass will also serve a higher function. Metaphorically, it embodies the philosophy of transparent, collaborative science that will take place at Janelia Farm.

At Janelia Farm, the walls of windows have a structure and sociology all their own.

The structural glass will be put to use in a number of ways, most notably the transparent corridor that runs the length of the building along the undulant face of both the second and third levels. Though certainly attractive, the column-free corridor is not intended to be merely ornamental. It is a conscious design element critical to the social dynamic planned for Janelia Farm, says Robert H. McGhee, institute architect and senior facilities officer at HHMI. "The glass corridor lies between the labs and the offices, so it helps connect them." Traveling the corridors, McGhee says, researchers will get "a real sense of what everyone is doing, which is part of the collaborative notion of this building."

Moreover, while the offices and labs of most research buildings are not situated with outside views in mind, and often have none whatsoever, the building will allow everyone working there not only an unbroken vista of the outdoors but also the ability to *go* outdoors. The corridors and office pods will open onto grassy, meadow-like expanses—roof gardens that top the levels below.

"The building is designed to be different," says McGhee. "The office groups, or pods, are arranged like small houses that people work in. And you walk from those into a pantry-like interaction area to get into the labs. So you can't help but run into people, and you can't help but see people as you work. That's really the key to the glass corridors, in the sociology and in the way the building is going to function."

In addition to constituting the corridors, the glass will be used, together with stainless steel, to create two arching feature stairways that connect all three floors. The glass will also surround recessed interior gardens on the ground floor, as well as the entryway, lobby, and pergola-inspired dining room.

The unusual curvature of the building, along with other architectural features, has necessitated customized approaches in engineering and materials design. The fittings that hold the corridors' glass slabs together, for example, and the hollow aluminum rafters that stealthily accommodate the sprinkler system, electrical wiring, and heating and air conditioning needs for the glass-roofed dining area were custom designed and built to specification. Such innovative design solutions are causing a stir in the local world of commercial builders. "We haven't seen anything like this before in Loudoun County, in terms of the complex integration of life safety and other systems," says Brian Knode, senior project director with the Mark Winkler Company, which is overseeing the Janelia Farm project. Knode is working closely with county officials to ensure that the engineering and design meet all regulatory codes.

Going to such great lengths to bring architect Rafael Viñoly's design to reality is important, says McGhee. "We wouldn't go through this if it didn't reinforce a significant program element of the building," which is to facilitate collaborative research broadly across disciplines. In other words, the delicate ballet of flying glass contributes to a bold vision of what research can and should be, a vision played out at the intersection of form and function.

—MARY BETH GARDINER

A computer rendering (right) gives an indication of how the Janelia Farm Research Campus would appear from an aerial vantage point. The curvature of the building's face dictates a radial design for the laboratories, where one wall is part of a curving glass corridor. Because of the unusual, non-angular design, the architects and contractors collaborated to create 3-dimensional models to ensure that all geometries were correct.

Roof panels, seen below, are solar-coated to modulate temperature extremes and reduce glare, and will be outfitted with a fire sprinkler system as well as gaskets and drains to handle rain and condensation. Upon completion, each glass corridor (far right) will approach 1,000 feet in length. Should a glass slab need to be replaced, a motorized cart has been adapted to trundle the heavy panels up and down the corridor.

Glass Passes Muster

Manufactured in Belgium by Saint-Gobain Glass, the strong, resilient, and unusually clear glass used in the Janelia Farm landscape building was fabricated in one large factory run. Because structural glass is rarely called for, Saint-Gobain makes production runs only twice a year. In this case, the request was for a lot of glass.

"As volume of load-bearing structural glass goes, this will be the largest such glass installation in the world, as far as I know," says Charles Blomberg, the architect in building-designer Rafael Viñoly's firm who is responsible for the building's "skin." Blomberg has worked with Viñoly on a number of glass-dense architectural projects around the world.

Manufacturers began adding iron to glass in the 1950s to give windows a green tint (too many people were walking into them) and to make the glass flow better during production. Iron is taken out of the formula for glass that needs to be very clear, such as that used in museums and jewelry display cases—and in the glass used at Janelia Farm. Laminating together multiple panels of low-iron glass creates exceptional strength without a loss of clarity, says Blomberg.

The lamination, solar coating, and other assembly processes required to ready the glass for its particular use in the Janelia Farm landscape building took place at multiple sites in Europe, Canada, and the United States. Nine months of exhaustive performance testing at a site in Pennsylvania assured that the glass is suitable for load-bearing use and that the laminated slabs are able to withstand extremes of factors such as wind, temperature, moisture, air pressure, and impact.

In addition to weight-bearing tests designed to mimic heavy loads from snow and wind, reports Blomberg, there was a series of movement tests, where the mock-up corridor assembly was strongly rocked to simulate severe building movement. Thermal cycling tests evaluated the capacity of the glass to withstand extreme differences between outdoor and indoor temperatures. To test how the glass and joints might stand up to varying wind and air pressures, the mock-up was placed inside a hydrostatic chamber equipped with devices to either push air in or suck it out. "The pressure inward was equivalent to a 110-mph wind," says Blomberg. "And the suction test was actually more onerous than anything the building would experience in real life."

In devising the tests, the team of designers and contractors imagined all manner of worst-case scenarios. One concern was the possibility of a heavy lab cart rolling into the glass. So they created a 100-pound concrete-filled steel cylinder six inches in diameter and hung it from a pendulum. They drew the chunk back as far as possible and let it fly at the glass corridor mock-up. "The force of the blow was somewhere around 400 ft/lbs," says Blomberg, "The whole corridor assembly shook, but the glass wasn't fazed."

To ensure absolute confidence, the team pushed the glass beyond specified requirements in most of their tests. They even broke the glass, to see what the overall impact would be when different layers were broken and under different loads. "We took it to the next level, what is called the 'failsafe mode,'" says Chris Fiato of Enclos Corporation, the specialty glass subcontractor working on the project. "We wanted to know if we could ever get a catastrophic or progressive failure. We never did." — **M.B.G.**