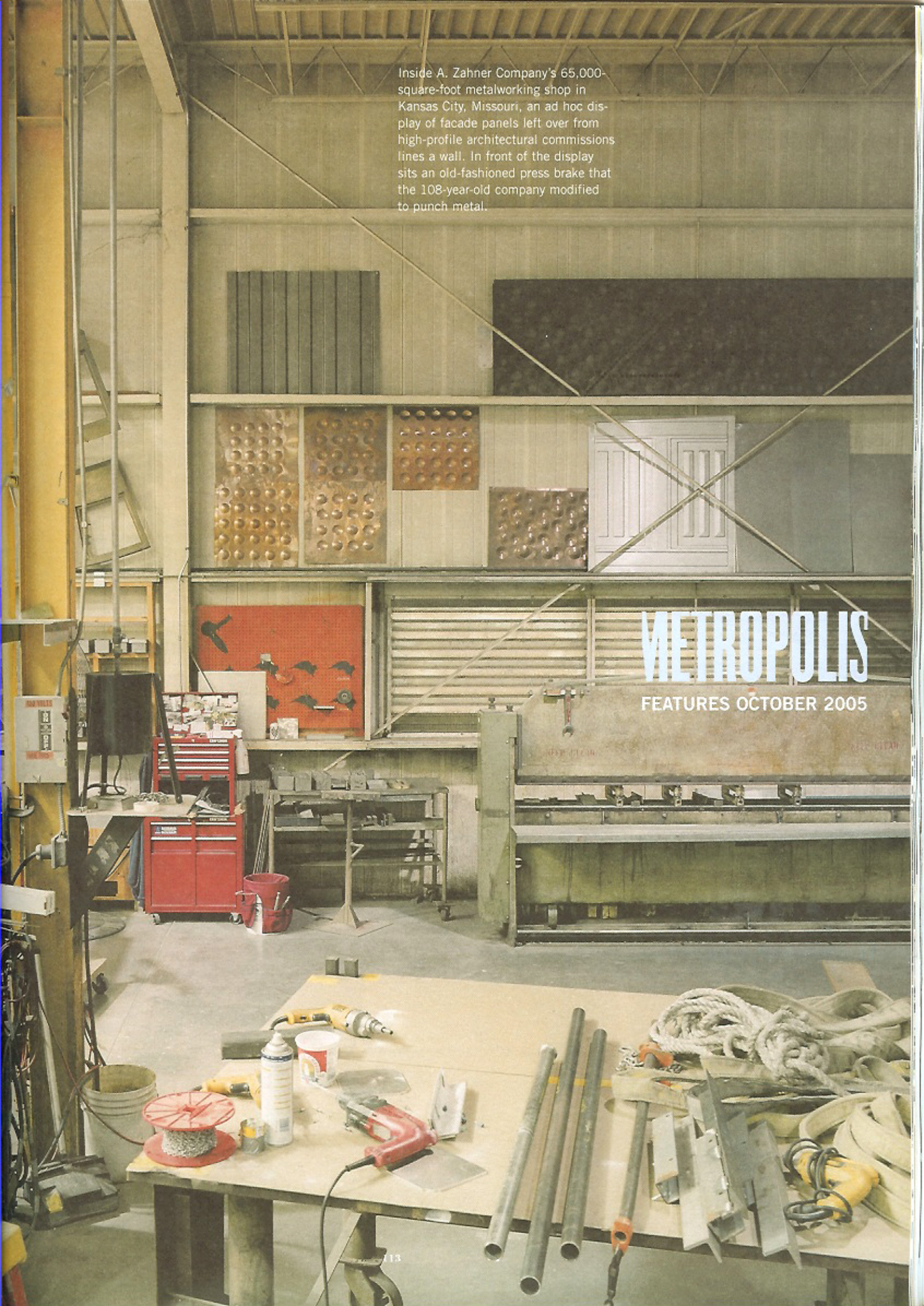


Inside A. Zahner Company's 65,000-square-foot metalworking shop in Kansas City, Missouri, an ad hoc display of facade panels left over from high-profile architectural commissions lines a wall. In front of the display sits an old-fashioned press brake that the 108-year-old company modified to punch metal.

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SHEET-METAL MAGICIANS



An obscure company is fast becoming
the go-to fabricator for facade
and structural innovation.

On a glaringly bright June afternoon in Kansas City, I find myself standing outside a factory building admiring the effects of the Missouri climate on panels of perforated copper. "When we were constructing this we had a severe ice storm in Kansas City," says my tour guide, Paul Martin, a mechanical engineer who had helped design the panels. "After it melted away it had the most spectacular purples." He points to the verdigris streaking in the cinnamon-colored surface. "The way water falls down copper...there's no way to replicate it." Martin's colleague Roger A. Reed nods in reverent agreement: "It's incredibly lovely."

Now that mutable architecture has found expression in mutable metals, imaginative engineers are in demand. The panels in Kansas City were a test run for the distinctive facade of the de Young museum, opening this month in San Francisco's Golden Gate Park. The architects, Herzog & de Meuron, have described it as a metamorphosing permeable skin intended to mimic the effect of light filtering through a canopy of leaves. It is the job of engineers like Martin, at A. Zahner Company, a 108-year-old architectural-metal firm in Kansas City, to turn such flighty metaphors into hard reality. Long known for its close association with Frank Gehry's metallic meanderings, the company has consulted and produced skins, structures, and systems for an impressive list of architects, including ARO, Antoine Predock, Morphosis, Steven Holl, Zaha Hadid, Rem Koolhaas, Tadao Ando, and Michael Graves. In

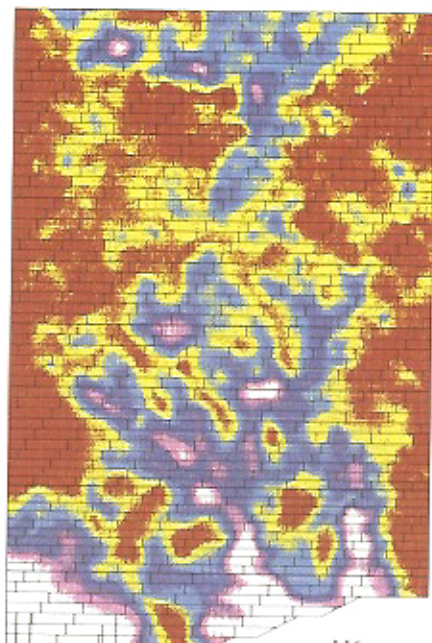
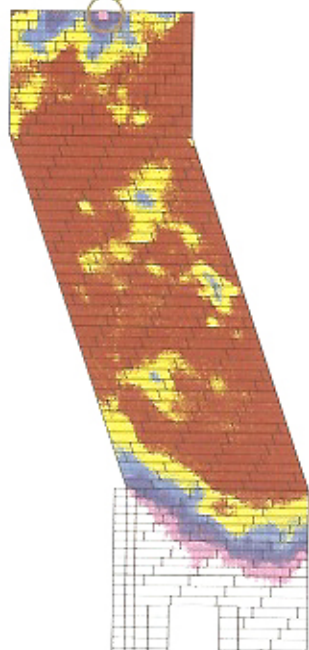
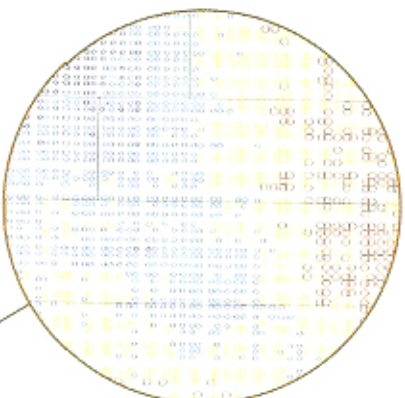
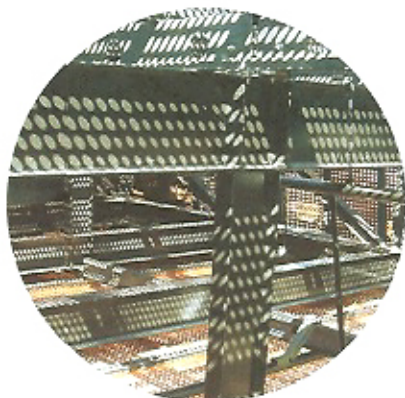
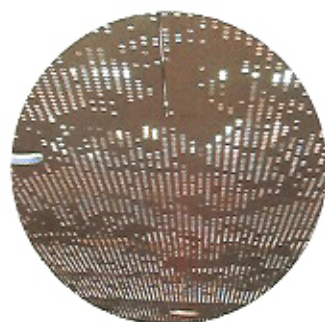
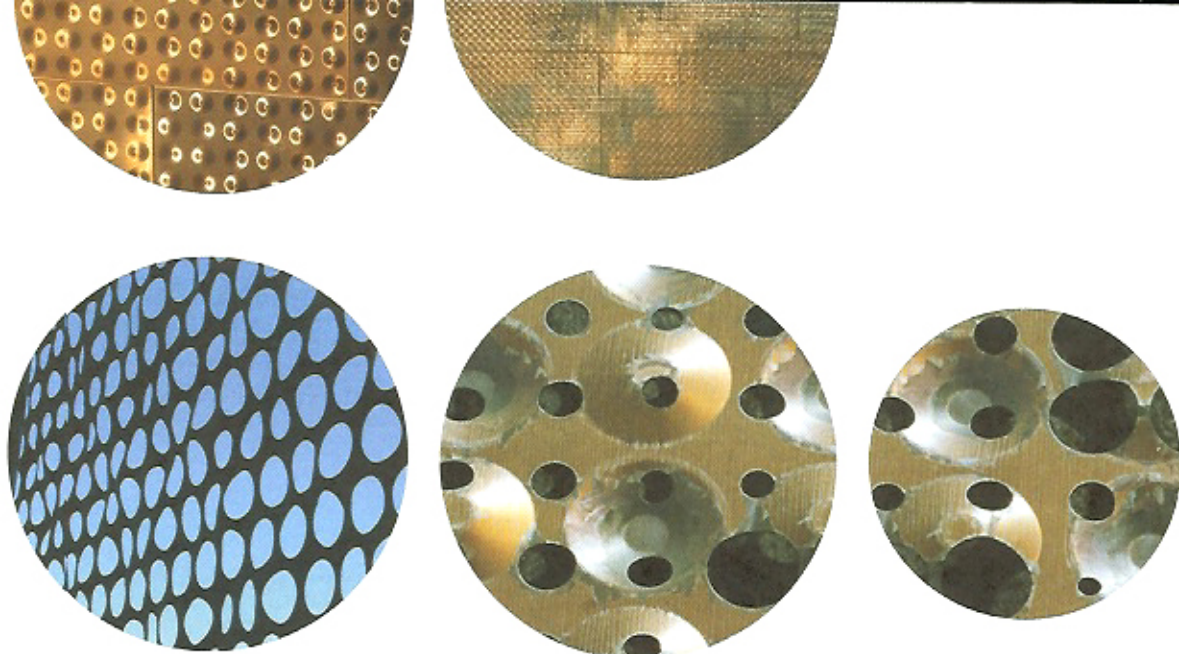
the age of folded, textured, and curvaceous buildings, Zahner has become a clinic for twisting and treating metal.

Metal runs in the veins of this company. President and CEO Bill Zahner—great-grandson of the company's founder, Andrew Zahner—lives in a copper house in Kansas City. He has written *Architectural Metals*, a 450-page textbook on the forms and behaviors of metallic building materials, and the 350-page sequel, *Architectural Metal Surfaces*, which bears as its epigraph a line from the Book of Malachi: "He will sit as a refiner and purifier of silver." After joining the family business in 1978 with a civil engineering degree, Zahner decided to immerse himself in researching the properties of the stuff he'd grown up around, with a keen taste for its artistic and architectural applications. When in 1986 union representatives of the Sheet

Metal Workers International Association (SMWIA) invited him to act as an intermediary on its behalf for the design of a union anniversary exhibit, Zahner met the exhibition's designer, the then lesser-known Frank Gehry. The two men became friends, and in the ensuing years Gehry began to call on Zahner for advice on metal behaviors and treatments. Their first big

By Peter Hall

Top row, from left: a metal screen-lined catwalk in the tower of the de Young museum; two details of exterior copper wall panels. Right: looking out through the tower's perforated screen; three details of weathered PVC-coated test panels. Below: the ceiling in the children's courtyard; and light patterns cast during construction.



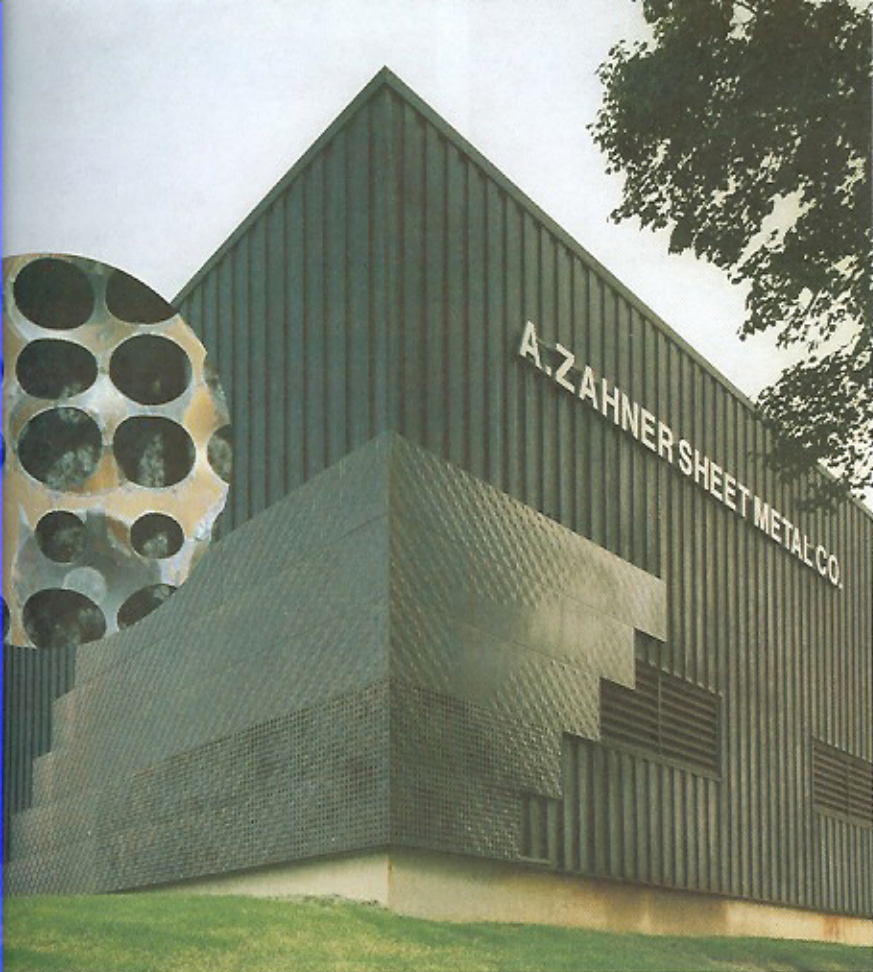
A. Zahner Company has worked with an impressive list of architects, including Gehry, Koolhaas, Holl, and Hadid.

collaboration was the Weisman Art Museum's new building, in Minneapolis which opened in 1993.

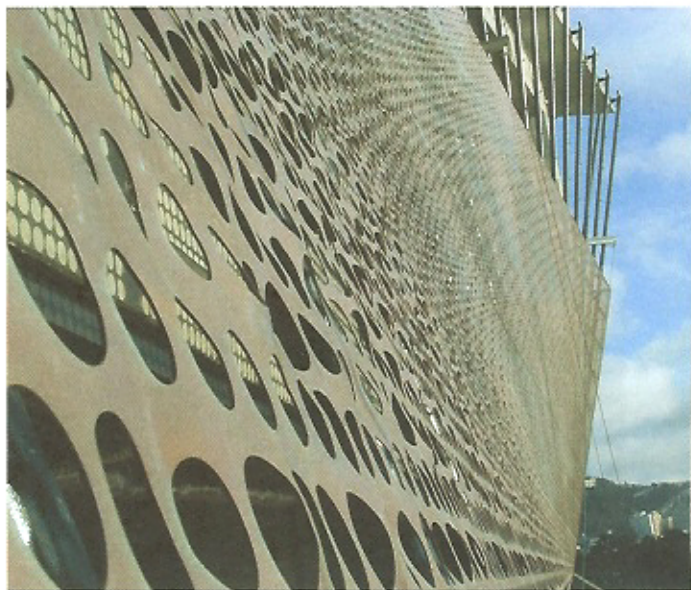
With its cascading turrets in beaten and brushed stainless steel mimicking the rippling Mississippi below, the museum was put together as one might expect from a sheet-metal shop: the flat sheets were cut and finished in the factory, and applied like shingles to the surface of the brick building on the site. Under the skin was a fairly conventional structure. But when Gehry's office landed the Experience Music Project (EMP), in Seattle, it came to Zahner with a bigger challenge: the building's voluptuous skin was a structural element, the curving steel, pipes, and tubes forming a kind of exoskeleton. Such 3-D surfaces—derived from modeling capabilities of computer-aided design tools newly imported from the auto and aerospace industries—suggested three-dimensional prefabrication. Zahner realized it needed to rethink its whole design, production, and fabrication process, and make a substantial investment in computing power. "That project completely changed this company," Zahner vice president of engineering Tony Birchler says. "We bought two Silicon Graphics Octanes at \$25,000 a piece. Before that it was two guys drafting. When Gehry hired us to develop the skin we had no idea how we were going to do it. Fortunately the owner was committed to the project and wanted to see it through." He adds, with a nod to the deep pockets of EMP patron Paul Allen, "We like working with billionaires."

Zahner's engineers came up with a modular system that has since been refined and dubbed ZEPPS, for Zahner Engineered Profile Panel System. ("We didn't help them with the name,"

Zahner was asked to replicate the effect of light flickering through a canopy of leaves. Abstracted photographs of tree canopies were superimposed onto each elevation of the de Young tower (left). The dark purple and pink regions correspond to areas on the facade where light apertures—circular perforations in the sheet metal—are wider in diameter and densely spaced (detail above) to allow more light to pass through.



Left: an early mock-up of perforated PVC-coated copper facade remains on the corner of the Zahner headquarters (left). Below: a view of the de Young tower's screen, now brownish from weathering. Bottom: looking down past the tower's torquing floor slabs.



Zahner's post-EMP three-dimensional way of working is anything but traditional. One company engineer joked that prospective employees have to take a drug test before they are hired—if they test positive they can work there.

but there are hints that this is not a conventional factory floor. Machines are on wheels to maintain flexibility according to job requirements, and computer monitors sit next to them. A vintage contraption called a Campbell "nibbling" machine has been customized by Zahner to pummel indentations in metal sheets according to data-fed instruction. On the walls and lying around on shelves and surfaces are zinc and copper panels, each bearing signs of having undergone tests for different patterns and patinas. Outside, the boxy 1980s structure has become a palimpsest of experimental building skins, the original weathering steel skin in turn covered by copper panels for the de Young and others from various Gehry projects. "It feels like one of those insects that collects shells on its back," Bill Zahner says of his building headquarters. "We haven't had any neighbors complain yet."

Zahner, who just turned 50, is the eldest of the four siblings, who work at the family business. Jo-Ann Mendenhall is chief problem solver, as Bill puts it, and the youngest, Tom—though educated with a degree in hydrogeology—joined the firm as project manager for the EMP. (He currently handles special projects and enthuses about surface finishes in an even more insouciant way than his elder brother.) The second youngest brother, Robert, is vice president in charge of engineering and labor relations. Although the business has been unionized for more than a century and is on good terms with its local chapter, he admits that there is some effort involved in negotiating with a tradition-bound trade association. Zahner's post-EMP three-dimensional way of working is anything but traditional. One company engineer joked that prospective employees have to take a drug test before they are hired—if they test positive they can work there. The place also attracts a certain kind of worker; as Reed puts it, "People who find the unstable desirable. If they wanted to do the same thing every day, they'd work at Ford."

Developing a satisfactory method for fabricating the de Young facade took the best part of a year. Using a series of abstracted photographs of trees in the park as their source, Herzog & de Meuron architects developed a system with Zahner for replicating the dappled-light effect with embossed concave and convex circles of eleven varying depths and perforated holes of six varying diameters. Further factory tests using the nibbling machine revealed that putting a flat bottom on the embossed circles increased the contrast at a distance. The challenge for the architects was that the design called for several hundred of these shapes in each of the 7,000 copper panels that made up the building skin. "In the beginning the process was almost barbaric, with me sitting in front of a computer with AutoCAD manually placing different-size dots," Herzog & de Meuron architect Chris Haas says. "After weeks of that we realized the amount of time it was consuming." Zahner pulled in a programmer, Eric Wilhelm, who wrote software in Perl that acted as a direct interface between architect and machinery. Armed with this automated version, Haas could adjust the contrast and porosity of the facade by changing the pixel density in a Photoshop image. The Perl script would then spit back a CAD file that could be the

continued on page 167

Sheet-Metal Magicians

continued from page 165

Bill Zahner says that in five years the modular assembly system will look nothing like the metal parts stacked outside. "The interesting point is where it goes from here."

basis of the information read by the machines on the factory floor. "In the end they have tags for every panel in the building indicating the elevation and how far the panel was from the edge," Haas says. "If any part is damaged, Zahner can plug in the file name and repunch it in an instant."

Zahner has carved out a unique position in the United States with its emphasis on research and development, but it is not known as a low-cost option. According to Martin, the firm more commonly finds itself competing against a budget than against another contractor for a job. Architects who have worked with the firm are quick to point out that a structural Zahner skin can eliminate the need and cost of another contractor designing steel profiles underneath. But Zahner fans are currently small in number. Unsurprisingly the firm is now attempting to position itself as both a fabrication shop and engineering design consultancy so that it is not left hanging for a job order after proposing how to build it. (Occasionally Zahner has seen fabrication techniques it proposed in a bid taken to a different contractor.) This way architects needing to figure out how to fabricate a complex surface will bring their ideas to Zahner before they embark on detailed models, avoiding unnecessary redesigns.

In an era in which pliant forms and organic-looking surfaces are de rigueur, Zahner's expertise must seem less bespoke than it did ten years ago—and more of a necessary stage between conception and production. Morphosis fortuitously encountered Zahner through its general contractor for a courthouse project in Eugene, Oregon. The design includes an "angel-hair" finish on its steel panels (a now standard Zahner innovation to reduce glare and add texture) and a number of sloping asymmetrical surfaces that posed their own fabrication challenges. Information and designs were traded back and forth between Zahner and Morphosis via digital files and physical 3-D printer models (miniature starch-based versions of the buildings), a paperless process hinting at the possibility that 2-D plans may soon be obsolete. "More and more we find continued on page 169


Sheet-Metal Magicians

continued from page 167

subcontractors are interested in 3-D models because they can more easily visualize the project and lay everything out," Morphosis architect Maria Guest says. "Paper is still important, but as a map to navigate the design, 3-D models make it a million times easier and much more fluid."

Out in Zahner's yard computer models materialize into gleaming silver modules. In June the prefabricated panels of the Ohr-O'Keefe museum were stacking up on carts ready for shipping. Each is coded, stamped, and marked, with handwritten special instructions on the reverse in a permanent marker. Bill Zahner argues that in five years the firm's modular assembly system will look nothing like the metal parts stacked outside. "It's evolving all the time, and we're pushing it. Look at the beam-and-column approach: it's not the most efficient way of doing three dimensions. The interesting point is where it goes from here."

It is easy to see why so many of Gehry's rivals have turned to this Kansas City shop for help. The firm is clearly invigorated by its own research, according to Herzog & de Meuron's Loughnan: "Bill Zahner loves his metal. He has a passion for it, and when somebody has a passion it tends to drive the whole process in a positive way." His ongoing research includes an in-house investigation of methods to embed oxidized metal in glass and an external project led by General Electric to develop a laser-forming process for creating metal parts, funded by a National Institute of Standards and Technology grant.

For a day spent bombarded by technical information, my receding impression of A. Zahner Company was of an enthusiastic group of engineers whose zeal for systems and materials was quite distinct from many architects' carefully articulated positions on finishes and processes. One is tempted to find in Bill Zahner's embrace of change a reflection of the unpredictable metals he works with. Metal, it seems, is a fickle fellow, changing literally with the wind. Herzog & de Meuron had expected its gleaming penny-colored de Young finish to progressively fade from a bright copper to a cinnamon color and eventually assume a rich green patina that would blend with its park surroundings over a decade or more. But in foggy San Francisco there was a little too much salt in the air, and a few weeks after the facade was erected dark black blotches began appearing across the perforated forest of metal. Museum trustees freaked out. "A trustee asked how we could avoid this 'adolescent period,'" Bill Zahner recalls. "I said, 'You're just going to have to wait.'" Happily a year before opening day the copper had obligingly mellowed to a more palatable allover tan.  www.metropolismag.com 