At 2527 Magnolia Street in the industrial, oil-spattered warehouse district of West Oakland, a gated door bears a sign reading "Magnolia Editions: Fine Art Projects." To the right, a set of railroad tracks, defunct for decades, stretches along 25th Street towards the bay; to the left, on Magnolia Street, a fully electric, zero-emission Zaptruck charges via an extension cord. To follow the cord into Magnolia Editions is to enter a studio where the locomotive of traditional printmaking with its multi-ton steel presses, toxic chemistry and centuries of historical baggage, intersects with the streamlined electric zip of digital technology and green thinking.

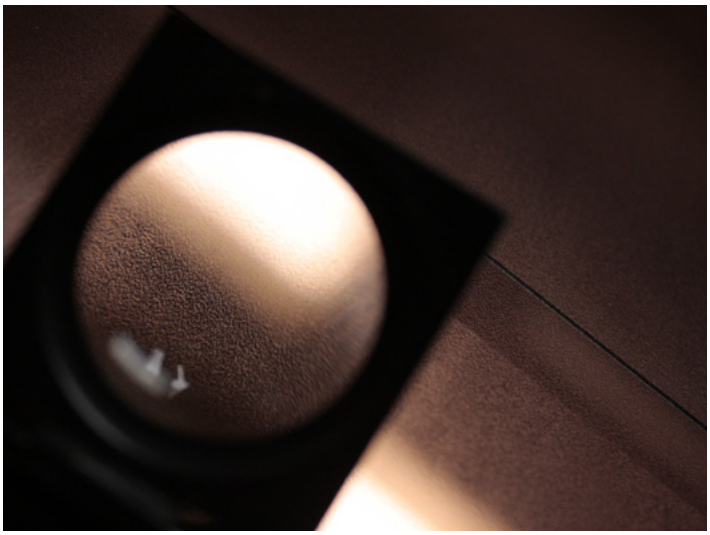
Printer Brian Caraway at Magnolia Editions. *Philip Glass State I*, a 2005 tapestry by Chuck Close published as part of the Magnolia Tapestry Project, hangs in the background.

"All technology is new technology to me," declares studio director Donald Farnsworth, "the Earth is at least four billion years old, but the camera obscura was only invented about one thousand years ago. And most of the techniques we consider 'traditional' are only three or four hundred years old." Farnsworth, a tall, ebullient character somewhere between a mad scientist and John Cleese's Basil in *Fawlty Towers*, founded Magnolia Editions in 1981 with papermaker David Kimball and the late Arne Hiersoux. Its vast warehouse space houses Kimball's papermaking studio, a fleet of printers and presses both analog and digital, and the Natural Builders, an environmental building company started by Farnsworth's daughter and son-in-law (owners of the Zaptruck). The studio's commitment to the broadly defined "fine art projects" translates to a zeal for developing new methods and coaxing the impossible out of traditional media.

Alongside the publication of traditional intaglio editions, a series of more unorthodox undertakings at Magnolia has included both a near-total reinvention of the fine art possibilities of Jacquard tapestry and Farnsworth's current obsession: the development of a method which may explode the possibilities of photogravure.

In traditional photogravure, among the oldest and most difficult methods of intaglio photography, a layer of gelatin tissue serves as an intermediary between a film positive and a copper plate, which is etched in a series of ferric chloride baths to create tiny pockets of varying depth which hold ink. The difference in depth of these pockets sets photogravure apart from half tone processes, in which images are composed of dots varying in size but lacking depth. The process of exposing the positive onto the gelatin and transferring it to the plate is painstaking and complex, and both the toxicity of darkroom chemicals and the scarce availability of the gelatin (currently manufactured by only one company in the world) contribute to the technique's prohibitive difficulty. Still, photogravure prints are prized for their extraordinary tonal subtlety.

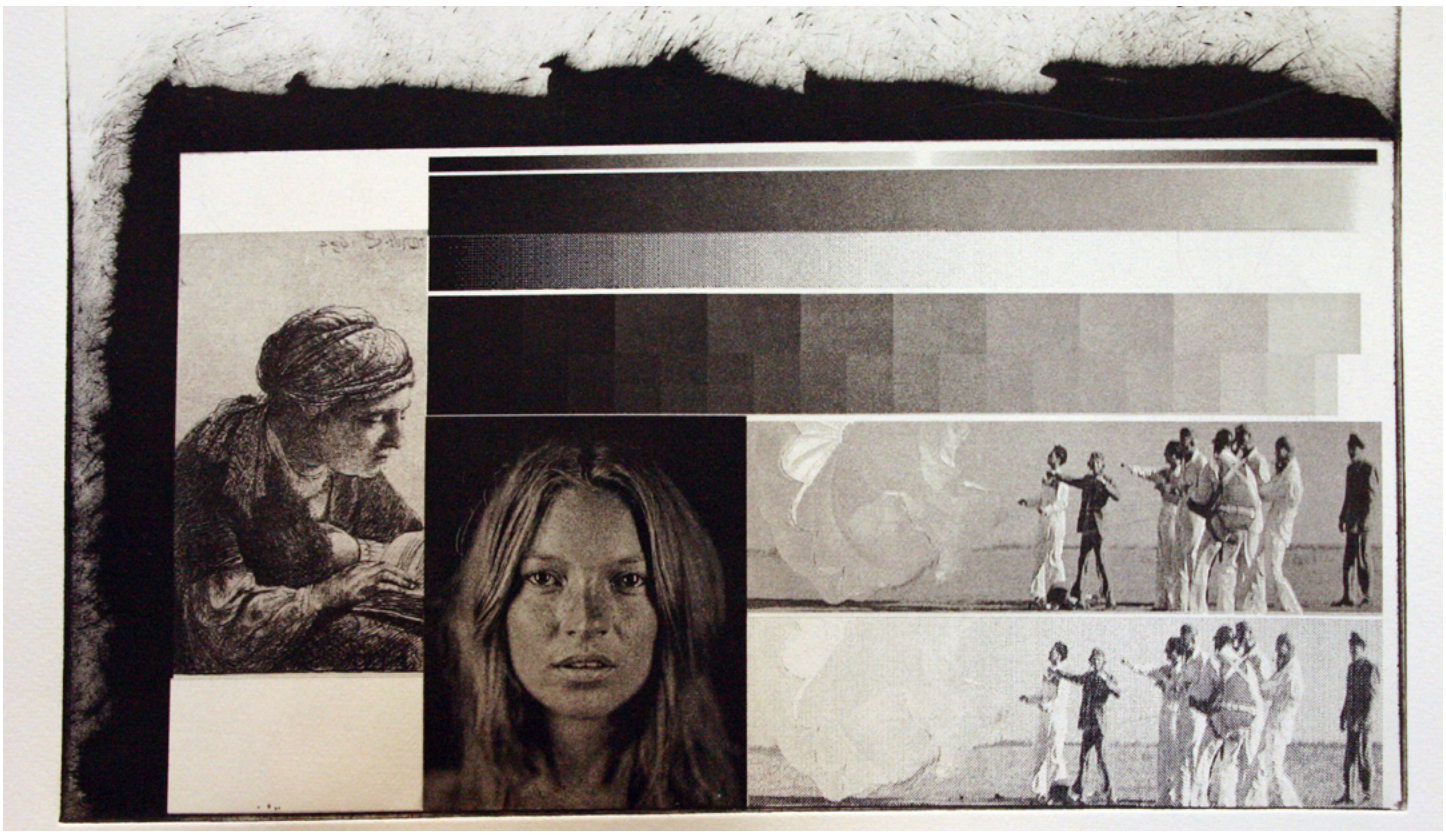
"What's really special about photogravure," explains Renee Bott, "is that it can capture beautiful, very light gray tones and that it goes from white to black in a gradual scale, known as continuous tone." Warm, self-effacing and perpetually suntanned, Bott is a master printer and co-founder of Paulson Press, a printmaking studio in Berkeley specializing in intaglio editions. When Paulson editions by Isca Greenfield-Sanders and Tauba Auerbach in early 2008 required photographic imagery to be silkscreened onto copper plates, Bott contacted Farnsworth, who suggested an alternative to the traditional half-tone



A loupe reveals the stochastic (random dot) texture printed by the UV-cured pigmented inkjet printer.

dot of silkscreen. "I knew half-tone dots would work for Isca's imagery," says Bott, "so we used a more traditional silkscreen-style technique. But for Tauba's plates, Don offered the idea of creating a block-out resist using digitally cut adhesive vinyl. We made six plates using this technique, and the images came out beautifully." Farnsworth was busy working on photogravures for *Watermark*, a book by letterpress printer Peter Koch. For Auerbach's imagery, a grid of regularly spaced black and white squares, the etching of the plate was a simple either/or operation: each small section of copper was either covered with vinyl and blocked out or else uncovered and exposed to the acid bath. But *Watermark*'s more detailed photogravures, images with a range of black and gray tones, required the laborious traditional process. Each image was digitally printed at Magnolia Editions onto a sheet of mylar using tiny random dots; the mylar was then contact printed in a darkroom onto a sheet of gelatin overlaid onto a copper plate, which was etched in a series of acid baths. Unai San Martin, one of a handful of contemporary masters of traditional photogravure, oversaw the production of the plates, which were inked and printed onto sheets of damp paper using an etching press at Magnolia Editions.

Meanwhile, Farnsworth was considering the purchase of a large and expensive new tool: a UV-cured pigmented inkjet printer with a flat bed measuring eight by four feet. "The interesting thing about this printer," he says, "is that it prints with a random dot and variable-droplet size as well as density. Unlike an Epson, which has only a few sizes of picoliter dots, this has seven different sizes, ranging from 6 to 42 picoliters." The printer collides jets of ink in midair a fraction of an inch



A print pulled from an early direct-to-plate test, including an etching by Rembrandt; a portrait of Kate Moss by Chuck Close; various grayscale spectrum tests; and two versions of a vintage photograph, part of an artwork by Isca Greenfield Sanders: one with and one without a half-tone dot matrix.

Chuck Close, *Kate*, 2007, Jacquard tapestry, 103 x 79 in, edition of 10.

Early direct-to-plate tests of grayscale tones and Close's Kate Moss portrait.

above the media and the ink falls on the media as a larger or smaller dot, depending on how many jets come together to collide. Where a half-tone dot pattern might look regimented and mechanical, says Farnsworth, this printer's output ends up looking "more random and organic, like mother nature had a hand in it." Farnsworth weighed the hefty cost of the printer (thirty times the price of an Epson 9800) against its potential applications: "I was lying in bed one night thinking, how can I justify to my employees and my partner spending so much money on a printer? I knew that this printer could print on board, canvas, paper, plexiglas – and then it came to me: I wonder if the UV-cured ink will resist ferric chloride?" Rather than contact printing a photographic image from mylar onto a gelatin-covered plate, Farnsworth envisioned a process in which the printer would lay down the image directly on the copper. He took a road trip to a business in possession of the printer and arranged to do some test prints. "I didn't exactly tell them I was going to etch it," he says, "I just asked, 'would you mind printing on this piece of copper?'" He took it back to Magnolia, placed it in an acid bath, and it worked: the ink acted as a resist. Farnsworth called the salesman and committed to the purchase of the printer.

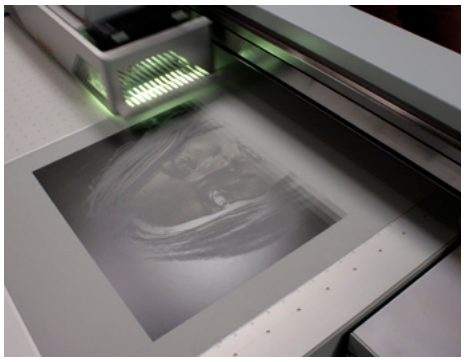
While the technology for printmaking continues to evolve, the benchmarks have been unequivocally set by tradition. Each printing technique has its own uniquely impressive effect against which all new methods are judged: the impenetrable, moody blacks of lithography, for example, or the crisp lines of a hardground etching are instantly recognizable by printmakers and difficult to duplicate by other means. The printer Farnsworth bought was originally designed as an alternative to silkscreen processes; one of its strengths is its variation of dot size and pattern, which allows for an ink film thickness – the amount of ink deposited on the plate – which can achieve powerfully heavy darks. Lithography and silkscreening are two processes known for their ink film thickness. "Under a microscope, a print from this printer looks to me very much like it was done on a litho stone," says Farnsworth. Consequently, in the initial direct-to-plate tests Farnsworth printed (using, in a nod to tradition, a high contrast etching by Rembrandt), he had no problems achieving thick, inky blacks. However, the spectrum of very light values which would make for a truly

continuous tone, the unique effect of photogravure, proved more elusive.

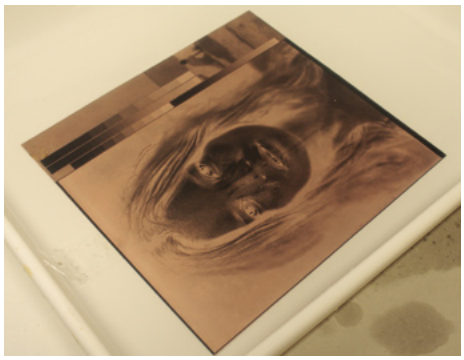
Continuous tone is traditionally achieved in copper etching via aquatint, a type of ground which resists acid and is randomly distributed on the surface of the copper. A plate is placed in a specially designed box containing rosin dust, fine particles of which are sifted evenly onto the plate and heated until they adhere. The artist paints onto the plate with asphaltum where an image is not desired; when the plate is etched, the acid "bites" around each tiny grain of rosin, creating a tooth in the plate to hold ink. In photogravure, aquatint typically takes the place of a half-tone screen, creating a random dot pattern for the acid to bite.

Farnsworth had been working on a series of tapestry portraits by Chuck Close since 2003, and selected a handsome black and white image of Kate Moss, scanned from a daguerreotype by Close, to use as a continuous tone test. The exploratory nature of the direct-to-plate trials seemed conceptually in line with the rigorous, bravura experimentation that has characterized Close's process for decades. "He consistently pushes whatever media he's working in beyond its apparent capacity," says Farnsworth, "which is what we were trying to do with photogravure. He also has the sharpest eye of any artist I've ever met. Getting the values right for a Close was the goal because to my mind, if you can do it for Close, you can do it for anybody." The tonal subtlety and range of values in Close's portrait of Moss set an incredibly high bar for Farnsworth and Bott's experiments. Moss's pupils and the shadows surrounding her are a deep black, while the tiny lights reflected in her eyes pop with a seductive brightness. Certain passages emerge in fine, high contrast detail, while others blur together in dreamy soft focus. The surface of her skin is a rich topography of minutely varied grays, possessing an incredibly detailed, unforgivingly realistic texture.

Over the course of several months, Farnsworth and Bott conducted countless experiments with the nascent digital direct-to-plate photogravure process. While the high contrast Rembrandt image yielded satisfying results, Kate Moss was another story entirely: "In any kind of printmaking on a grayscale from light to dark, you generally lose the highlight and shadow detail," explains Farnsworth. "So in Photoshop you modify the levels or curve of your image accordingly, so that the highlight detail is a gray and the shadow detail is a dark gray, not a black. We were compressing our scales and doing test after test, and we just couldn't get light grays. And we were flatbiting all of the blacks." (In etching, flatbiting refers to an area intended to be black which, despite being deeply etched, has lost its dot pattern and cannot hold ink; flatbite prints as an irregular gray with dark edges.) Bott approached the project from a traditional etching perspective and suggested the use of an aquatint; Farnsworth was open to the idea, but skeptical. "Our tests indicated that without the aquatint, the high contrasts were burning out," Bott recalls, "and that was very bothersome to me." Bott brought various test plates to Magnolia in pairs: one plate with aquatint and one without. She felt sure that without an aquatint, the black areas would flatbite forever, and the light gray tones would be unattainable. Farnsworth's theory was that an aquatint places a matrix on the plate which is not specific to an image and therefore actually removes more detail than it enables. He continued to adjust the values printed on the plate by experimenting with the color profiles used by



Close's Kate Moss image being printed on an aluminum lithography plate in an early experiment. The green glow is a UV light which cures the ink immediately after it is laid down.



Copper Kate Moss plate being etched in the acid bath. Areas not intended to be etched have been masked by printing a layer of ink over them with the UV printer, so lighter areas appear to be dark, as in a photonegative.

Kate Moss plate being prepared to print. The masks have been removed and the image appears as a positive again.

the printer and modifying the levels of the digital image itself. Meanwhile, Bott helped to transform the etching facilities at Magnolia, bringing in the necessary chemicals and equipment to fully deoxidize each plate after etching.

"We finally determined that it would take a minimum of five passes through the press and five acid baths," says Farnsworth, "and that every single mask printed onto the plate would have to be printed twice." Here the new printer really began to pay off. Whereas most other printers pass paper across or under ink heads moving in two dimensions (back and forth), Farnsworth's machine has a flat bed: paper or other media remains stationary and the ink heads pass across it in three dimensions on a treaded track. As a result, it is possible to print multiple times with the exact same dots of ink landing in exactly the same place. If one imagines the etching process etching tiny peaks and valleys into the plate, the peaks all have a dot of ink which acts as a mask protecting them. As additional masks are printed, the accumulation of masks is visible under magnification as tiny black spots growing larger on the peaks of the mountains. "The flatbed printer allows us," says Farnsworth, "to etch a stochastic [random] dot pattern into the plate in a completely controlled, precise way."

A breakthrough came in early May of 2008, when Farnsworth experimented with printing a very light grayscale and etching the plate in brief one second intervals. When printed, this plate yielded the coveted light values: "Renee came in and I showed her this ridiculous looking print that went from white to almost white – that is, super light grays to infinitesimally darker grays. It went nowhere, but it showed us that we could achieve these beautiful light tones without an aquatint." Farnsworth and Bott realized that they could start with these light tones and work up to the darks by printing onto the plate, etching it in acid, and then repeating the process for the next value in the spectrum. "This process is an inversion of the traditional photogravure method," Farnsworth notes, "where you're etching through a sheet of gelatin, and gradually the gelatin is getting thinner and more acid reaches the plate, so the last thing that's etched are the light tones." Instead, the digital direct-to-plate method required Farnsworth and Bott to etch the light values first and to lay down a new layer of ink onto the plate between acid baths, masking out the lighter values to protect them from subsequent etches. The initial mask looks like it has barely been printed; the masks grow in density until the plate eventually appears almost completely black. In another reversal of the traditional process, where the acid baths are increasingly watered down as the process unfolds, Farnsworth and Bott discovered that their method worked best when they began with a weak bath and proceeded to one that was more acidic.

Encouraged by the progress of their experiments, Farnsworth and Bott set their sights on an even trickier target: if they could eventually achieve continuous tone in grayscale photogravure, they reasoned, why not color? Farnsworth had spent much of 2007 developing a color palette and digital weave techniques for a full color Chuck Close self-portrait tapestry, initially translated from a Polaroid. He called up the original scan and began to break the image into the four-color CMYK (cyan, magenta, yellow and black) separation used in photographic reproduction. A plate was printed and etched for each of the four colors; four plates at 10 passes each meant a total of 40 printing sessions. Bott's eyes light up as she recounts printing the plates at Paulson Press: "The excitement was almost unbearable as I prepared the wet paper and the press began to roll. Everyone at work started to crowd around. We put

Renee Bott uses tarlatan to remove excess ink from a Kate Moss test plate.

down the yellow, rolled it through; put down the red and it registered surprisingly well; and everyone went, 'wow, look at that!' We put down the blue, and when we pulled it back it looked almost like a complete photograph. By then all the printers had stopped and come over. We put the black through and pulled it off, and the color photo image of Chuck Close emerged in almost perfect unity. It was a magical moment. Everyone started high fiving."

While Close's iconic portraits were gradually materializing, certain values remained unsatisfactory. "We had values right in the middle of the tonal range that would flatten out," remembers Farnsworth. "We had finally achieved beautiful highlights, beautiful shadows, but now our midtones were just gone: all the same gray for four or five steps." The first color test was too light, so Farnsworth and Bott attempted a second four color separation and turned everything up: using larger plates, they added another layer of ink in the midtone values, increased the strength of the acid, and lengthened the etch time. But this turned out to be too much change at once, and the second test was too dark. A seemingly endless process of fine tuning followed. Bott brought a Baumé meter to measure the density of the acid baths and Farnsworth adjusted the digital files so that the first few light etches would be completely blocked out. "In these kind of experiments, you're tempted to rely on what you see," says Bott. "The temptation was to say, 'there's too much or not enough ink here,' and make adjustments accordingly. But if you do that, you keep undercompensating or overcompensating for the etch time. We finally had to become very scientific: Don would change the profile for each mask based on what our intellects told us, not our eyes."

Farnsworth explains that determining which variable to tweak was a multiple-choice puzzle: "If, for example, the white point [highlight] was printing too dark, we could A, darken the mask – it's a negative, so a darker mask allows less acid to touch the plate; B, double or triple print the mask; C, add another mask and another etch; D, weaken the acid; E, shorten the etch time; F, add an aquatint; or G, do something we hadn't thought of." Shallower pockets of ink, achieved via a slightly longer etch with a stronger mask, yielded excellent light tones but also produced an undesirable grain in the highlights. A grayscale test Bott had printed, demonstrating that the most variation in tonal value appears within the first four minutes of etching, served as evidence that the duration of each acid bath would be a crucial factor. Bott and Farnsworth ended up

Michelle Morgan pulls a proof of the color direct-to-plate photogravure at Paulson Press. A separate plate was etched, inked, registered and printed for each color.

Initial proofs of the color self-portrait at Paulson Press.

with etch times of under four minutes for many of the masks, some lasting only seconds. Shorter etch times for the highlights and midtones, coupled with double density masks (ie, printed twice) and stronger and longer etch times for the shadows, yielded an increasingly accurate, predictable grayscale. In June, they masked, etched, and printed another test plate with remarkable results: having correctly coordinated acid strength, mask density and etch times, a continuous tone grayscale had finally been achieved, and Kate Moss had (arguably) never looked better.

"What's exciting about this whole thing," says Bott, "is how quickly and easily it's done: compared with old-fashioned photogravure, with chemicals and a darkroom and pouring from one bath to the next, this is so easy." This comparative ease becomes even more significant, adds Farnsworth, when one considers the possibility of working on a larger scale. "If a small plate can be successfully etched, the same sequence of events can be used to make a large one; to scale the whole process up doesn't entail wrangling enormous sheets of moist gelatin and film, hoping to avoid over- or underexposure, streaks, or fingerprints." Farnsworth's goal now is to set up the facilities at Magnolia for an acid free process in which photogravure plates are etched in water via electrolysis rather than ferric chloride. Recent software modifications have made it possible to print two masking layers onto a plate at once, reducing the number of sessions on the UV printer for each plate by half; still, the process is not, to borrow one of Farnsworth's favorite phrases, like falling off a log. Nevertheless, as companies like Polaroid scale back their film production and darkrooms diminish in availability, the direct-to-plate process has the potential to emerge as the new wave of photogravure.

Farnsworth has a patent pending on the technique, but says he only plans to defend his patent if the process is over-commercialized: "I'm not trying to limit the tools available to working artists," he says, "quite the opposite." Besides its relative ease, what is perhaps most appealing about this photogravure method is its compatibility with tradition and, consequently, the unlimited possibilities for innovative combinations of new and old techniques. Farnsworth's UV-cured inkjet printer uses an ink which contains a binding agent and is cured by light. This is a sharp detour from other inkjet printers, which rely on a binding agent at the surface of coated paper (unlike acrylic, oil paint, silkscreen or etching inks, which contain pigment, vehicle, and binding agent, all in one). "Splitting the binder from the ink has given inkjet printing a certain character," says Farnsworth. "With the UV printer, the binder is already in the ink; if we had to coat the copper plates with a binding agent, nothing would etch." Moreover, a digital printer in which the printed surface remains stationary and which foregoes inkjet-specific paper opens the doors for new combinations of digital and analog media in the same piece. "Typically we would need to use coated paper for inkjet printing," says Farnsworth, "so you're limited as to what substrate you can print on, and what other media can be incorporated. Whereas the flat bed allows us to exactly register and print multiple times onto an etching, a painting, virtually any surface. How do you stick an etching into an Epson inkjet printer?" At Magnolia in late July, he shows me a mixed media edition by acclaimed Oakland artist Raymond Saunders. The edition combines the physicality and tonal richness of etching with the ease and color fidelity of the digital realm. A copper plate etched with Saunders's imagery is inked with black ink and printed on damp paper using an etching press; the resulting print is then registered using mylar and printed in multiple passes of full color on the UV printer. An edition by Ralph Goings, combining direct-to-plate photogravure with pigmented ink, is also underway. That the process can accomodate both the wide range of textures created by Saunders's varied mark-making techniques and the exacting level of detail in Goings's "Super Realism" is undeniable evidence of its potential.

A test print of the Ralph Goings direct-to-plate photogravure.

For the most part, Farnsworth explains, inkjet printing has always played by

its own rules and, perhaps as a consequence, continues to be unfairly stigmatized by the art world at large. The possibility of incorporating pigmented inkjet printing at any stage of a work in progress – before or after painting, scraping, varnishing, ad infinitum – levels the playing field, making it a technique for applying pigment to a surface, much like any other. "It's important to understand and to work with the basic chemistry of your medium," says Farnsworth, "to consider the pigments, binders, paper, etc. that make up an artwork." We pause to consider a mixed media work created by Squeak Carnwath earlier in the day; the piece combines an image of Vermeer's *Girl with a Pearl Earring*, ostensibly affixed to a sheet of lined paper by what turns out to be trompe-l'oeil tape, with one of Carnwath's favorite maxims: "Good ideas are not made, they are stolen." The work appears to be a collage with hand drawn elements but was in fact executed entirely on the UV printer. There is silence for a moment as we contemplate Carnwath's enigmatic meditation on the creative act; then Farnsworth turns to me. "All artwork is derivative," he says, "I remember a lecture by Wayne Thiebaud where he said, 'we are all standing on the shoulders of the artists that came before us.' The more you investigate the root, the history of your inspiration, medium, or technique, the more you improve your chances of imbuing an artwork with some degree of originality and, paradoxically, newness. Oddly enough, it's often a matter of going as far back as possible in order to make something as new as possible." A print pulled from a test plate for the direct-to-plate process speaks to Farnsworth's point: the print includes an etching by Rembrandt, a daguerreotype by Close, a vintage photograph from an artwork by Isca Greenfield-Sanders, and a series of computer-generated grayscale spectra. The past and the future appear together here, made up of the same combination of pigment and fibers, literally on the same page. The continuity of the grayscale suggests the continuous tradition linking the three artists, a simple and yet incredibly rich tradition of ink on paper which simultaneously extends back into dark corners of history and forward into an as yet uninscribed future. ■

– Nick Stone

Donald Farnsworth, Renee Bott, and Tallulah Terryl at Magnolia Editions while the UV inkjet printer lays down a mask on a copper plate. The treaded gantry along which the print heads move in three dimensions extends into the foreground at left.

Mixed media works by Squeak Carnwath (left) and Raymond Saunders, incorporating layers printed on the UV inkjet printer at Magnolia Editions.