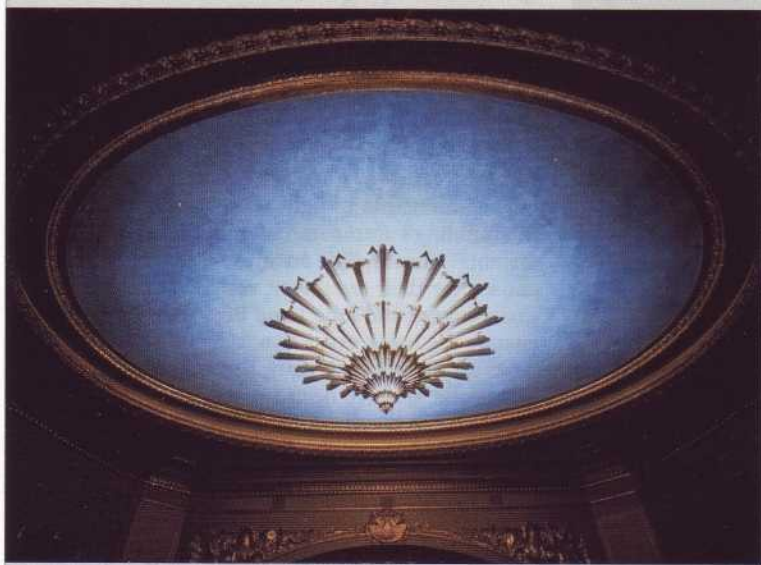


CUTTING-EDGE LIGHTING

The New, Improved San Francisco War Memorial Opera House

In 1932, when the gold brocade curtain rose on Puccini's *Tosca* at the brand new San Francisco War Memorial Opera House, the technical elements of the theatre were breathtaking. State-of-the-art equipment, including a Resistance dimmer board and a futuristic switcher, led *Time* magazine to hail the Opera House as "easily the most attractive and practical building of its kind in the United States."



photographs by Robert Canfield

Fifty-five years later, that same dimmer board hadn't moved an inch, and neither had the switcher. Subsequent upgrades included a Q-file computerized lighting control board and Kliegel R-67 dimmers "temporarily" brought in during the mid '70s. The Resistance was still in use as a houselight control system and dangerously out-of-date. Even when a Viking board and an additional rack of Avab dimmers were added in the 1980s, the Resistance board remained. Everything was patched together with loose cables, portable dimmers with breakout boxes. And the size of the hangs

by Sarah Chauncey

ABOVE:
View of chandelier
and ceiling from
inside the Opera
House

OPPOSITE PAGE:
Installation of new
electrical conduit after
renovations

were growing. By 1989, the Opera House had roughly 2000 plugs, with an average hang of 600 to 800 fixtures for the opera, slightly less for the ballet. Something had to change.

THE EVALUATION

In 1989, the Opera House approached the theatrical design consulting firm of Auerbach + Associates to conduct a survey of all the building's theatrical systems and elements, with a special eye towards certain items which had not been replaced or updated since the building's 1932 opening. Len Auerbach, president of Auerbach + Associates, along with Larry French, a principal with the firm, consulted on the evaluation. What they found shocked them (no pun intended). Not only were original house circuits being used and patched through the original Resistance dimmer board, but also the building was overrun with cable and bulky Kleigel racks. "About a third of the circuits were the original set in the theatre and were all two-wire, ungrounded circuits," explains French. "There was also a concern about safety issues. What originally started out as a survey of grounding issues, became, as a result of what we observed, a rather thorough state of the systems kind of report." Adds Auerbach, "what we encountered was a combination of original house circuits, and an enormous amount — miles — of loose cable. Two-thirds of the circuits that were in use when we did our survey were all being handled by temporary loose cable. A lot of multi-cable that was strung from the dimmer lofts, was sort of on several levels stage right, and if you can imagine a multi-cable running up 120' to the grid, and in some places, coming right back down again." Within cable jackets, wires had come apart; audio and lighting cables were tangled together and strung over consoles and fixtures; doors were propped open with cable: the entire system was an electrical fire waiting to happen. And the problems weren't just backstage. Explains Auerbach, "(The ballet and opera) discovered of course, that over the years, they needed more and more circuits out front of house. What they did was poke a hole through the proscenium wall, basically eliminating the firestop value of the proscenium wall." French sums up the mid-1989 evaluation: "The evaluation was a warning call, if you will, that, in our view, there was quite a range of unsafe conditions and practices that would only exacerbate the problem. Our recommendation was a phased gutting and replacement of the entire theatrical lighting, circuit distribution and control system." The duo envisioned the upgrade as a gradual process which would take place over several years.

THE EARTHQUAKE

Then Mother Nature stepped in as co-producer of the renovation. In late 1989, the Loma Prieta earthquake struck San Francisco, leveling several buildings and severely jarring thousands of others, including the Opera House, which sustained system-wide damage. If the preliminary evaluation had been a warning call, the earthquake was a cosmic fog horn. Structural changes became necessary, as the old lighting bridges and riggings suffered dangerous decay. It became clear that more renovations were necessary, that they had to be implemented immediately, and most difficult of all, that the theatre would have to close down for a season in order to facilitate the changes.

This brought a new light to the evaluation and a three-tiered approach to funding. The federal government lent a hand, via the Federal Emergency Management Administration (FEMA); their money was to be used for seismic upgrades along with other improvements. The City of San Francisco passed a bond issue, which allowed for restoration of things like front of house, seating and upgraded washrooms. But the funds for theatrical systems upgrade came from the Committee to Restore the Opera House

(CROH), a private group composed of opera and ballet board members. CROH would ultimately handle fundraising for all the theatrical systems renovations, including the majority of lighting considerations and 10,000 additional square feet of backstage and support space.

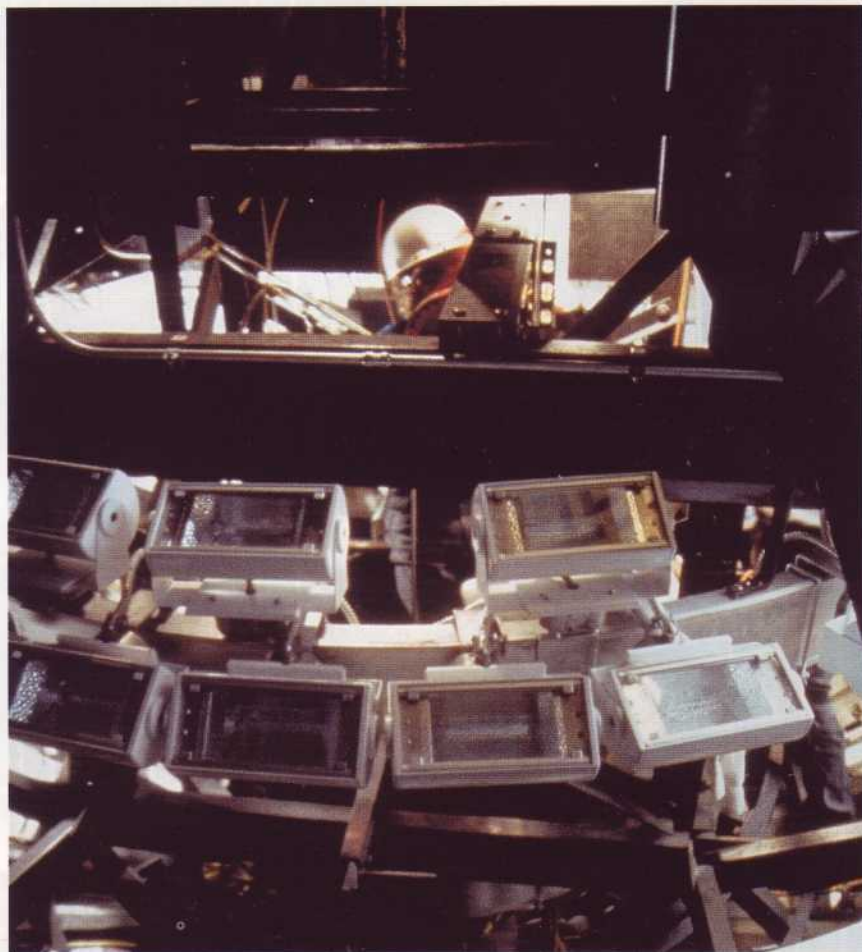
THE BIDS

Now that Auerbach and French knew what was wrong with the systems, they had to decide what upgrades to install. When asked how they came to their decisions, French quickly quips, "a lot of meetings!" Auerbach elaborates: "We worked very closely with the opera and ballet designers, technical directors and the master electricians," he recalls. "We were a very strong collaborating group." The team evaluated both the opera and the ballet's needs, with two main points in mind. One, both companies ran in repertory and brought back productions season after season. Two, everyone involved wanted to be as flexible as possible, to accommodate future technological developments. "It's just a general attitude we had about everything there, that we can't predict the future," says Auerbach. "We can push the industry as much as possible, but the building has to develop an infrastructure that will allow new systems to come along later, just as they've experienced over the years, and just as we're experiencing now. We've really pushed the industry in terms of what the users want and expect." Adds French, "At the time we were designing the system, the installation date was a good four years away." So the collective travelled to various lighting conferences, meeting with Strand Lighting, Electronic Theatre Controls (ETC) and Colortran, who at that time, were the three major lighting manufacturers vying for the job. "As a result of these talks and extensive research into the development of Ethernet and LAN-based multitasking systems, we came up with a specification which directed the manufacturers to the construction and installation of the system," explains French.

Obviously, the designers, TDs and MEs all had different needs and wants with regard to the new system. "When you get right down to it, what is this system anyway?" asks French rhetorically. "It's a design tool, right?" And the designers — two very different people, for the opera and ballet — were primarily concerned with different needs, but they both desired a flexible and accessi-

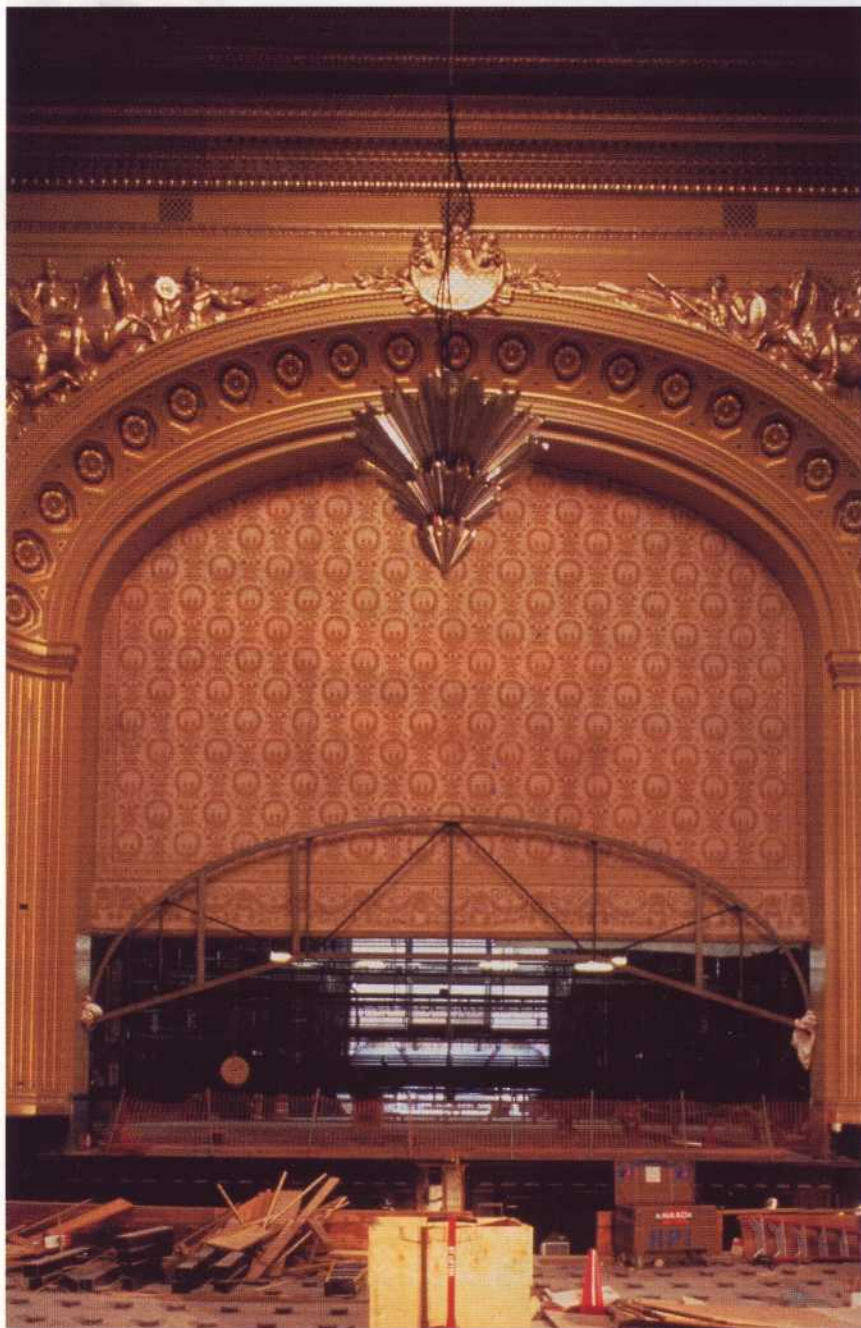
ble control system, one that was fast in typical time-crunch situations and not cumbersome. So the group took those needs into consideration, as well as the concerns of the master electricians, who wanted to know how much maintenance would be required of the system, how much future expansion they would have and, above all, how they would manage the entire system. Recalls French, "it became clear that if we were to go back to a system that would be typical of the time, we would be run-

ning dedicated wire for each of the various systems, the addressing of the dimmers, the printing commands, the video, the file information for shows, and the DMX distribution for colour scrollers and moving lights. If we were to go at this in a traditional manner, it would all be done with dedicated wire for each of those elements." So the group began bandying about ideas that didn't involve dedicated wiring. "It became clear that both Strand and ETC were developing networks based on Ethernet technolo-



TOP:
Chandelier uplights
with workers inside
the chandelier

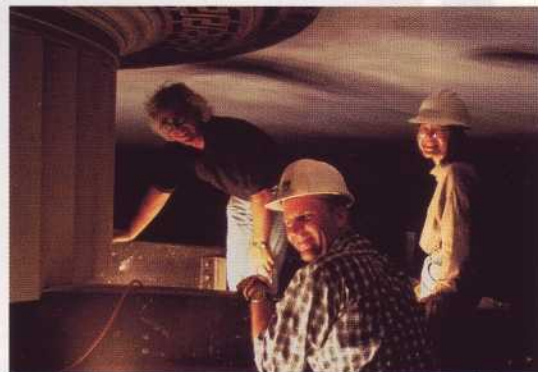
RIGHT:
Exterior of the San
Francisco War
Memorial Opera
House



LEFT:
The chandelier finial
being lifted into its place

BELOW:
Workers inside the
chandelier

BOTTOM:
The original dimmer
light board before reno-
vations were completed



gy," he adds. "And we elected to go in that direction with the entire system. So what is now the main means of communication from all of the control input devices to the output devices is a Category 5 wire, which is typical of your office network wire, except that it is open-ended to accept the next generation of bandwidth and speed, in the Ethernet world. It was a calculated risk. And we guessed right. So now, instead of having dedicated wire for all these different protocols, it's all going down one pipe."

It's clear that the two men are excited about the new system. "Once you get past the fact of intensity and time in the typical lighting control console," raves Auerbach, "you start dealing with all the other information that everybody wants now, which is the control

of moving lights, which may have upwards of 25 different addresses per unit, colour scrollers —"

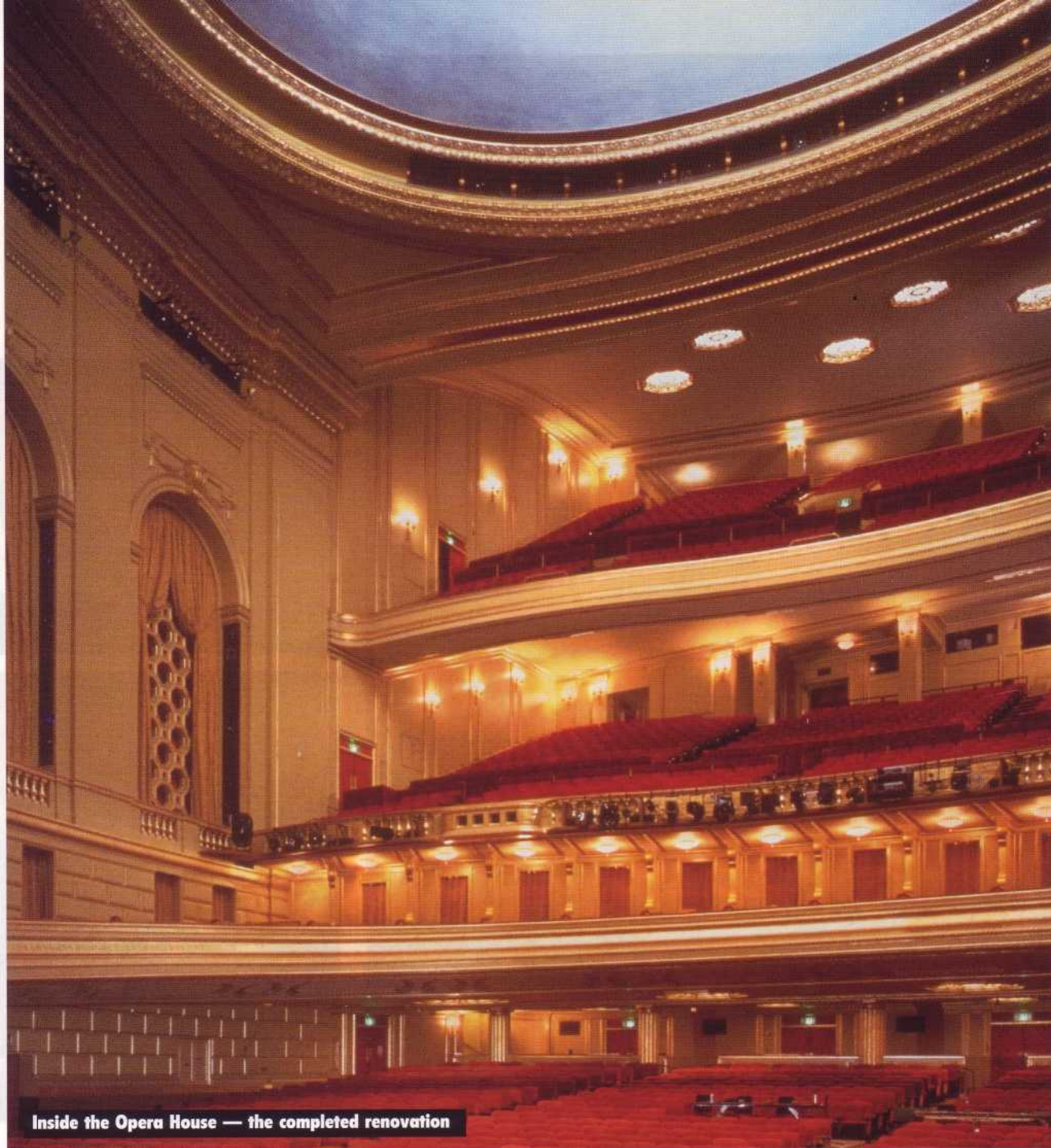
"Not to mention network printing, distributed video —" interrupts French

"We're able to distribute the video displays anywhere throughout the house now," continues Auerbach, "because of Ethernet, because of the way you essentially tap into or out of it."

French clarifies what his colleague means. "As a simple example, one of the components of this system is a video display terminal for the designers, which is not slave to the console. The designer can select any video information that they want from a keypad at their desk, no longer asking the console operator to switch screens or "show me that," they can see anything they want, and they can print anything they want. Not only

can they print locally, they can print over the network, so if they want to send an example of a cue over to the ME in one of his rooms, they can do it."

But we digress. Now that you know the end result, let's get back to the process: when it came down to the wire, the two finalists were Strand and ETC, who put together virtually identical financial bids. "Both of these companies that were bidding knew that the reward of this job would be their future," says French. "This was going to be an R&D effort, and that was actually built into the specifications, a part of the bid was to include a two-year focused research and development effort in the development of the system. It included regular meetings on the part of the opera, ballet and Auerbach to review and discuss the development of the software and the



Inside the Opera House — the completed renovation

hardware.” Strand emerged victorious, primarily because “at that time, Strand had already integrated the ancillary functions that were so important to the designers in the same console — and within the same number stream, which was very important, because typically, moving lights were separate address, separate console and in calling up a cue, you were really cueing several things at one time. Now, in a single-number address, you can build a cue that not only deals with time and intensity and all of the delay and the kind of commands that you would do normal to consoles as we had known them, but you can also include all of the what I call the ancillary functions — pan, tilt, focus, all of that sort of thing. And built into the same address, which for the

designer, let them focus only on one number stream, rather than being all over the place.”

At the time Strand’s bid was accepted, the idea of DMX distribution via a network was still brand-new, and the company had just released its first console with a “channels and attributes” component. What they ultimately developed for the Opera House would go on to become a successful element in their product line, setting them ahead of the pack in terms of design technology. In order to have brilliant software, though, it has to be supported by state-of-the-art hardware.

THE GROUNDING

It was clear to Auerbach and French from their survey that the electrical

grounding system needed to be entirely revamped. The main switch gear was from 1932 and had long since ceased to be code-compliant. Says Auerbach, “When we built the demands for all of the new systems, a second service had to be brought into the building, which allowed us to say ‘well, we want our own transformation.’ In the new dimmer room that we built, we also made it part of the complex to have transformation at that point. We run 480 volts off of the main transformers down below, up to our theatrical transformers, which are not more than ten feet away from the dimmer racks, allowing users to have very stiff power. And the transformers are all K-rated, with isolated grounds, so that we have a totally dedicated transformation for the dim-

ming system." In describing specific load capacities, French quips, "You can direct plug in more than 900 2000-watt loads. Can't do any more than that. We think they've got enough capacity!"

THE HARDWARE

Auerbach takes us on a verbal tour around the system: "There are two complete main consoles — the 550i, Pentium Pro-based, 2000-channel, 2000-attribute control consoles — full-blown, full-tilt boogie, top of the line. In addition, there is a 520, which is used on a rolling table as a focus desk on stage, for focus sessions. There is a PC which operates in synched tandem to whichever console is identified as the main board; it is a backup computer that is running simultaneously much as a second set of brains in a typical console might be. There's the backup PC, and then there's the designer desk, which is the video switching and printing facility. It's also the first system to have three colour network printers — it prints in colour, showing the screen as it is."

THE SOFTWARE

A simple question about the name of the software elicits laughter from both men. "It's complicated," says French. "There are about six different software bundles that are operating simultaneously, it's basically Light Palette, but embedded in Light Palette are a number of other software programs which do things like handle the network traffic, deal with the DMX patching and addressing, handle the reporting from the dimmers, etc." Specifically, "with the Strand package now, if you buy Light Palette, you pretty much get it all, and whether or not you use it is up to you. If you purchase reporting dimmers, the software for Reporter, which is the package that handles the information, pretty much comes with it. What's kind of fun now is that you can configure entire dimmer racks down the network, which couldn't be done before." The package also allows for voltage compensation, something heretofore unheard of in computer packages. "You can overdrive the dimmers, feed them with more than 120 volts, and the advantage to this is that the wire size for the long runs, no longer has to be big in order to keep the voltage drop from affecting the opposite plug." Auerbach elaborates: "it does (allow compensation) in terms of code, but you still have a certain impedance on a long run, and there is an allowable voltage drop. The key to this is that if you have a long run, from one side of the stage to the other, that you don't have a difference of intensity or output at the plug, from one side to the other." French sums it up simply by saying "The dimmer calculates based on load and adjusts its output voltage to ensure

that, at the plug, you're getting as close to 120 volts as possible."

Another big development with the Strand package is the use of a file server to save cues and entire shows. Instead of saving the show on a floppy disk and re-installing it, or saving it to the hard drive of the local console, the Opera House's Pentium Pro PC "allows you to run a large number of redundant backup versions of any show. Because it's built just like your computer, with file trees, we can make 16 different Traviatas under the "Traviata" directory. So you can save every session, every hour, in a different file, if you should so choose," explains French triumphantly. "And the system allows you to retrieve not just the show, but a portion of the show, so if you liked Cue #5 in Traviata, version one, day five, you can go back and pull it out and import it into your current show."

"The (1989) evaluation was a warning call, if you will, that, in our view, there was quite a range of unsafe conditions and practices that would only exacerbate the problem."

—Larry French, Auerbach + Associates

But wait — as the saying goes — there's more! Let's say you're working on two shows at once — or you're working on one show, but you want two different people inputting numbers, to speed up the process. Let us present to you . . . partitioning. "Say I have my two main desks operating, and I want to do my fixed-light level information on one console and my moving light information on the other console," explains French. "I can set the system up so that the fixed-light console has access only to channels that are related to fixed lights, and the moving-light console has access only to channels that are related to moving lights. If I happen to enter channel information for access that I don't have, it simply won't take the information." The partition can be whatever the programmer chooses — not just fixed lights vs. moving lights. You can also run cues simultaneously, one from each partitioned block. "I can be working in two different cues, live on stage," he continues, "affecting only channel information that I have control over, record in that cue without affecting levels and channels that I don't have control over, so you can now be working simultane-

ously on two separate cues."

The Strand system offers yet another way to maximize efficiency, by allowing technicians to work offline. Says French, "you can take any console out of the system offline, which disconnects it from the live outputs, load another show, work on it, save it, and then come back online, loading the current live show." The package allows a person to use one console as an editor while a live show is being run off another console.

SECURITY AND BACKUPS

How do you keep Joe the Janitor from coming in and entirely reprogramming your show in the middle of the night? Through a series of logins, each one of which is assigned certain capabilities. "Based on how far up the ladder you are in priority, that gives you access to various levels of control within the system," reveals French. "So you can actually restrict your most junior guy to just being able to enter levels. He can't record anything, can't call up a cue, can't change a setup screen, etc. to the highest level, which allows you all of the access to all of the parts and pieces of the system."

Although the Opera House system is extraordinarily sophisticated, Auerbach hastens to point out that, "at its most basic level, this system still can be a single-console connected hard and direct to the dimmers with DMX wire." It takes time for technicians, designers and electricians to learn the programming, to get hip to all the upgraded lingo, not to mention the mere concept of multitasking during a tech rehearsal or even performance. The changes are being integrated slowly, and what Auerbach and French have revealed is truly the maximum capacity of the system. But the other benefit to having the capability to run the system manually is that, in case anything goes wrong, the operators have a ready-made backup system.

DRUM ROLL, PLEASE...

On September 6, 1997, the San Francisco Opera opened its 75th season. While theatre goers enjoying the revival of Puccini's *Tosca* will certainly notice the improvements in the washrooms and seats, they will likely have no clue about the improvements backstage and above their heads. But the designers, technicians and electricians who work at the Opera House can breathe easier — and maybe even effect changeovers and tech rehearsals more quickly than ever. And, as it must, the show will go on. **PL**

Sarah Chauncey is Toronto-based freelance writer with an extensive background as a television producer, production coordinator and theatrical stage manager.