

Design and Construction of Puk Studios

By David Rideau

A new residential facility is equipped with a 5-way custom monitoring system and LEDE acoustics.

To many engineers, producers and musicians who have used the facility, it is no small exaggeration to say that Puk Studios represents one of the most interesting and innovative approaches to acoustic design in recent years. Taking a rare, "spare-no-expense" attitude, its designers transformed a previously obscure studio operation into an ultra state-of-the-art recording facility.

The studio's history, as told by John "Puk" Quist, owner/chief engineer, is an interesting one. Originally a quaint farm nestled in the Danish countryside, the site was bought in 1966 and transformed into a monastery that ran a drug rehabilitation program. In 1975 the owner died and the run-down property was purchased by Birte Quist.

At the time, Birte was not living on the farm, but in a nearby town where she met John, an aspiring musician/engineer. Quist soon realized that the farm buildings would make a perfect home for his newly purchased Soundcraft console.

From these humble origins, Quist's studio grew to become a simple, but well functioning, facility that was used to produce many Danish hits.

Not content with success on the local level, Quist set out to secure funding to build his dream studio, which would raise Puk to an international standard.

Studio financing

To understand the problem of financing and maintaining a studio in Scandinavia, one should be somewhat familiar with the region's record and film industry. On one hand, you have an audience that has come to expect a high level of technical excellence, as seen and

heard in U.S. and other countries' releases. But at the same time, there exists a limited buying audience, which almost eliminates the chance of making a profit. (The population of Denmark only is 6 million.)

The film industry gets around this problem with generous government grants to filmmakers. The Scandinavian record industry is not as fortunate and survives by allotting modest budgets to its recording artists. Such budget restrictions are reflected in session payment from the producer to the bottom of the food chain: the recording studio.

So how does a Danish studio owner survive? Two top rooms in the area—Easy Sound Recording, Copenhagen, Denmark, and Polar Studios, Stockholm, Sweden (ABBA's studio)—have done so by building their rooms in cities that guarantee a certain amount of international traffic. In both cases this method has worked well.

Quist, however, wanted to keep his facility where the only traffic is an occasional cow. In this case, it was a gamble that paid off. The Danish government, interested in generating revenue in this less-populated area of the country, was willing to provide a large, low-interest loan, the first payment not being due for two years. Puk was on its way.

Design concepts

The idea was simple enough: to build an extremely advanced recording facility, with no architectural restrictions. All design parameters had to conform to digital standards of dynamic range, frequency bandwidth and system distortion.

The team chosen to execute this idea included Andy Munro, of Munro Associates, London, who was mainly responsible for the control room design; and Ole Lund Christensen and Knud Rosenskjold, of the Danish company SLT, who would take care of the technical and electronic aspects. Architect Mogen Hansen, who was responsible for much of the interior design, translated construction assignments into reality for the local building crews.

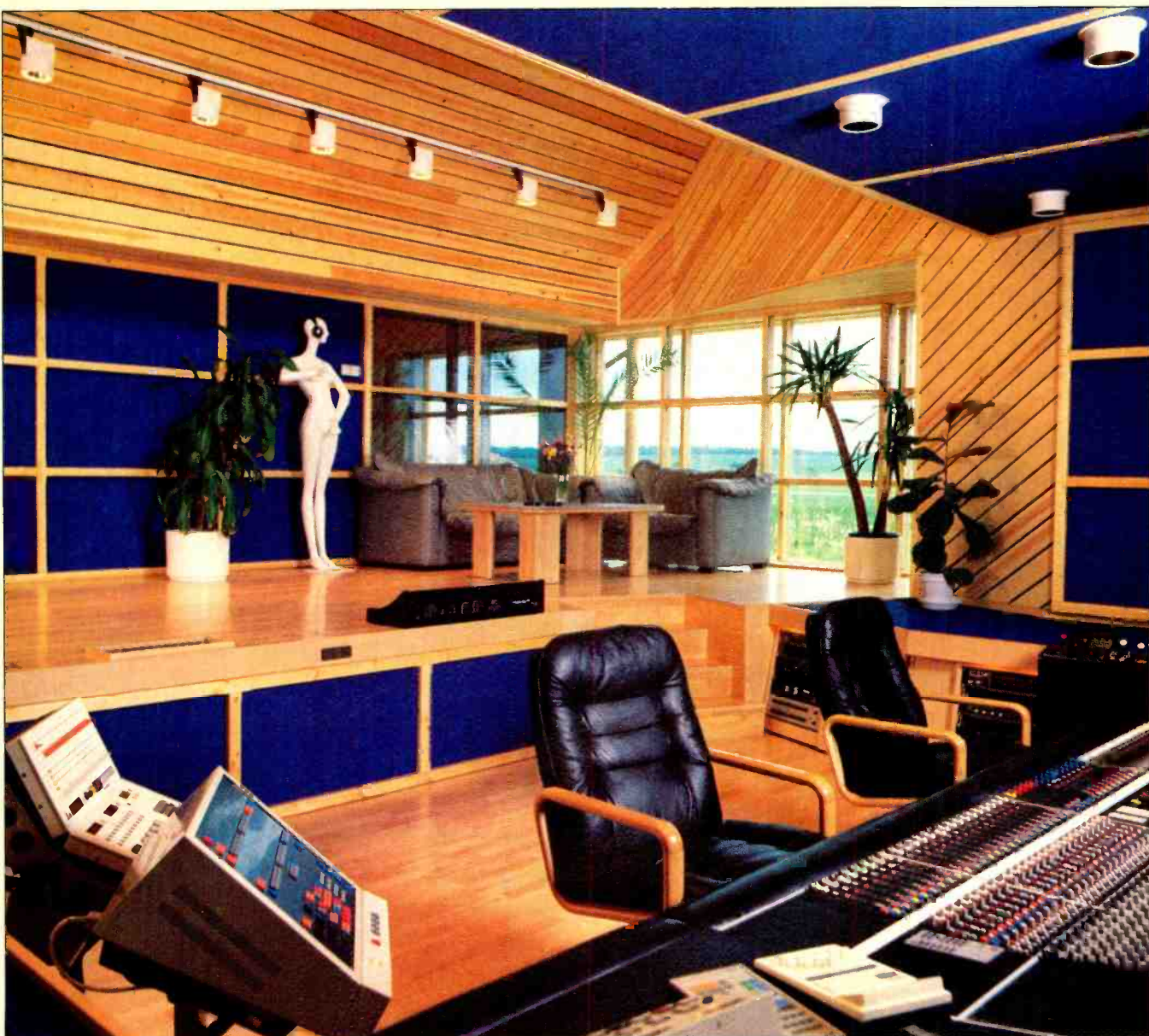
The basic approach for all aspects of the design was to establish a goal, look at it theoretically and then try to develop it in real terms. This often led to abandoning traditional ideas or trying several approaches to solve a particular problem. Sometimes the discussions between Puk owners and the designers didn't lead to an immediate agreement, but eventually a working solution was reached.

Control room acoustics

For Quist, the most important consideration was the control room design. As a working engineer, he realized that more and more recording was taking place on his side of the glass. So in addition to the traditional area in the control room for the engineer and producer, there should also be a stage for several musicians and their instruments.

Quist took this concept a step further, feeling it could be a psychological boost to have the musicians raised on a platform behind the console, so that the players could look down on the engineer and producer seated before them.

Quist also felt that it would be advantageous to incorporate a number of windows in the room design to provide



views of the scenic countryside, generating an airy atmosphere with natural lighting.

It was agreed as much as possible to base the control room acoustic design on the Live-End/Dead-End (LEDE) concept. Admitting that no design is perfect, Christensen pointed out that the well documented results of time-delay spectroscopy (TDS) demonstrate that no reflective surfaces should be placed around the monitors to reduce early reflections off the walls into the monitoring position behind the console.

Andy Munro was the first to admit that "the design of Puk's control room represented new territory for acoustic theory." The room's volume of 3,200 cubic feet, he says, "created a special problem, in that a room of this size—even if well-damped—normally would have an RT60 of 0.5 seconds. Because conventional LEDE designs would not work in such a large space, a new approach was taken to ensure that



A dedicated tape machine room houses (from left to right) a Mitsubishi X-800 digital 32-track, an Otari MTR-90 24-track, MTR-10 2-track, Mitsubishi X-80 digital 2-track and a second MTR-10 2-track.

path lengths of reflections were optimized for both the monitoring and rear performance areas."

The room was, in effect, split into two parts. The large rear space is virtually self-contained, yet adds enough diffused

sound field to the front to create the impressions of a rigid rear boundary when one is sitting at the console.

"Room acoustics perceived by musicians working in the rear of the room is two-fold," Munro says. "Sound emanating from the monitors maintains good stereo imaging, without excessive bass lift, while sound created at the back of the room—vocals, for example—sound crisp with their own natural ambience. The geometry required to achieve this degree of acoustic control involved a very high ceiling and critically damped, slat diffusers.

"The problems of early reflections and diffraction around the console have been solved by the use of an acoustic walkway around the front half of the room. It can support a person's weight but, at the same time, is 99% absorbing."

Recording areas

Directly behind the new control room is what's referred to as Recording Area

A. This is an extremely live room, housing a Bosendorfer grand piano, with three of the walls made of glass to take optimal advantage of the impressive view available from this side of the studio complex. To further enhance the room's acoustic and aesthetic properties, a cathedral ceiling has been created on

one side, with vertical beams and glass in between. To control standing waves, all the remaining walls and ceilings use the same method of damped-slat diffusers as found in the control room. The floor is pine.

The larger Recording Area B has been positioned more traditionally in relation



View from the performance area in Control Room A, which features a 56-input Audio+Design/Calrec UA-8000 console and custom 5-way monitoring system.

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to the control room. Once again, the musicians are on a slightly higher level than the engineer and producer facing them through the control room window. This room also has a cathedral ceiling and wooden floors, but is less live than area A because there is less glass. Originally part of the farm, the room retains the old beams, from which suspended curtains can be pulled across as required to modify the room's acoustics.

Recording Area C faces Puk's original control room but is intended to be available to both control rooms. One end of the room's acoustics is live with a beech platform and pine ceiling. The acoustically dead area of the room is carpeted and the walls are treated with dense acoustic tiles.

In addition to the three main recording areas, a vocal booth to the right of the new control room is described as the only truly dead acoustic environment in the facility.

The existing Studio B is somewhat modest in comparison to its newer brother. Monitoring is provided by JBL model 4333s, and the control room is equipped with the same 28-input Soundcraft series 2400 console (serial No. 0001) that Quist brought to the farm several years ago. Although not state of the art, a smart producer could use this room for preproduction and synthesizer programming, allowing the new Studio A to be used to continue the recording process.

Monitoring system

Design of a control room monitor system proved to be one of the most diffi-



Instruments available to clients include New England Digital Synclavier II and Fairlight CMI Series II synthesizers.

Puk adds Second Control Room

In early July, *RE/P* learned that Puk Studios recently completed construction of a second, identical control room. Studio B, also designed by acoustician Andy Munro, of Munro Associates, London, features a 56-channel Solid State Logic SL4064 console, three Sony PCM-3324 digital multitracks (available for use in both Studio A and B) and a Fairlight CMI Series III digital synthesizer.

According to studio owner John Quist, "Even though we are very pleased with the sonic qualities of the Calrec UA-8000 console in Studio A, there was a demand amongst our clients for an SSL-equipped studio, which is why we chose the SL4064 with Total Recall and Primary Computer for the new facility."

In addition, the studio complex has exchanged its existing Mitsubishi X-800 digital 32-track for two new X-850s, which Quist says allows clients to make digital-to-digital safety copies of multitrack masters.

"Also, it's the only way to utilize the cut-and-splice feature of the X-850, because you have to copy the spliced tape in order to store it properly," he says.

During subsequent evaluation tests with a Techtron TEF-10 analyzer, Munro reports that overlay comparison of the time delays spectrometry plots of both rooms indicated practically identical RT60 and acoustic performance in studios A and B.

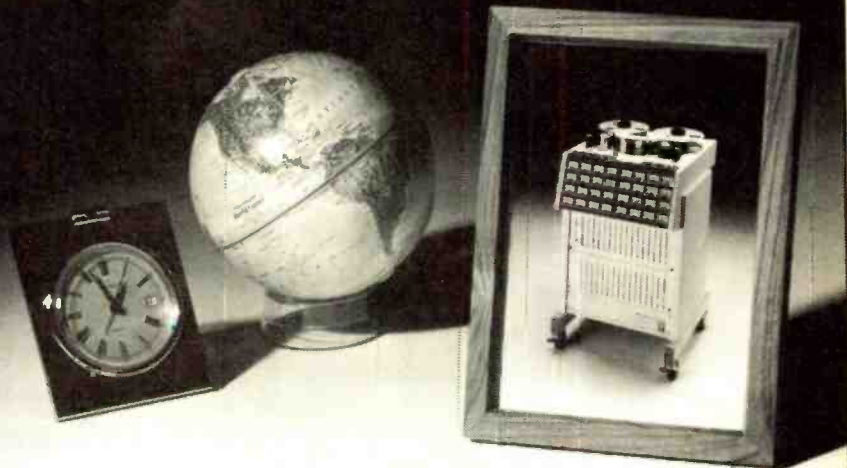
cult, yet most rewarding, aspects of the project. Quist informed Christensen that he wanted the system to be able to operate at very high sound pressure levels. Although such a request is not that unusual for a monitor system designed to handle the frequency response and dynamic range of digital playback, it

would be quite a design challenge.

When Christensen and Munro worked on the basic room design in 1982, both realized that Puk probably was the first digital-capable control room being designed from the ground up.

The design parameters upon which they agreed were: a dynamic range of

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around 120dB, an extended (flat) frequency response and a negligible amount of background and monitor noise. The only way these exacting criteria could be achieved was to build a very large room, which would eliminate low-frequency standing waves. The end result was 3,200 cubic feet of space in the control room.

Monitor loudspeakers were to extend in frequency response from 17Hz to 25kHz, with appropriate rolloffs at each end. Christensen and Munro wanted a monitoring system that could relate in subjective terms to other, larger cabinets, but with a subwoofer providing another octave on the low end. Such a configuration also had to maintain the 96dB dynamic range of digital playback with transient peaks approaching much

higher SPLs. Using a background noise level of 20dB as a reference—representing the projected noise floor of the control room—it became obvious that no commercially available system could accommodate the dynamic range requirements while maintaining low distortion levels.

Finally, SLT and Munro designed their own monitor systems. Christensen's main role in the project was to carry out the tremendous amount of research required. With a degree in electroacoustics, he was qualified to put together all the personnel and information needed to get the job done.

When attempting any serious acoustical task anywhere in the world, especially in Denmark, one company somehow always comes into play: Bruel & Kjaer. This time it was Peter Ladegaard, a B&K employee using the company's TDS measuring system, who helped Christensen develop the best monitor configuration for the new control room. One of Christensen's conclusions was that to reproduce a 20Hz wave

Recording Area A features a Bosendorfer grand piano. To improve visual communications, at right is a window linking the area with Control Room A.

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