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Hightech Disco sound reinforcement at JollyTime® in Brunswick

**Pan Acoustics is implementing Beam Steering
with ProAMT in an innovative Line Array**

Dieter Michel

JollyTime® in Braunschweig is a large disco which is preceded by decades of tradition true to its name. First opened in 1984, the building re-opened in the spring of last year after a five-year break. Along with other structural/technical modernization work, the disco also obtained a new sound reinforcement system from the Wolfenbüttel-based speaker manufacturer Pan Acoustics, with technical refinements which make the sound reinforcement system very interesting even beyond disco sound reinforcement.

Jolly Time is located in a former factory hall. For this reason, the basic layout of the interior is not so drastically different from that of an event hall. In fact, the rooms can also be used for guest events, private parties and industry presentations. The audience areas consist, on the one hand, of the hall area on the ground floor, which is practically always used as a dance floor. To the side there are bars and seating areas, and on the first



View of the stage from the dance floor

floor there is an all-round gallery with more bars and quieter areas. A stage is installed on one front, where the DJ stand is normally set up. This also gives Jolly Time a basic multipurpose hall-like layout. This isn't so striking visually, but it naturally affects the possible uses and the acoustic constraints.

In the run-up to the conversion and the new opening, the new operator contacted the speaker manufacturer Pan Acoustics from the nearby Wolfenbüttel, as this has the reputation of being able to design and create innovative sound reinforcement solutions. It also benefited the existing project that Pan Acoustics doesn't work with standard components, but is prepared to create innovative solutions also in detail, if this results in new technical possibilities for sound reinforcement.

In this case, the customer naturally wanted the best possible sound on the entire dance floor combined with a design for the quieter areas also of the best quality, but with a usage profile of sound pressure levels adjusted to the respective areas. Of course, good sound is, just after the DJs - and therefore the quality, compilation and presentation of the music -, the flagship of a disco. It is therefore understandable that the new operators set great store by a first-rate sound reinforcement system.

Due to the layout of the dance floor, they steered clear of traditional solutions from the outset - such as a fourpoint

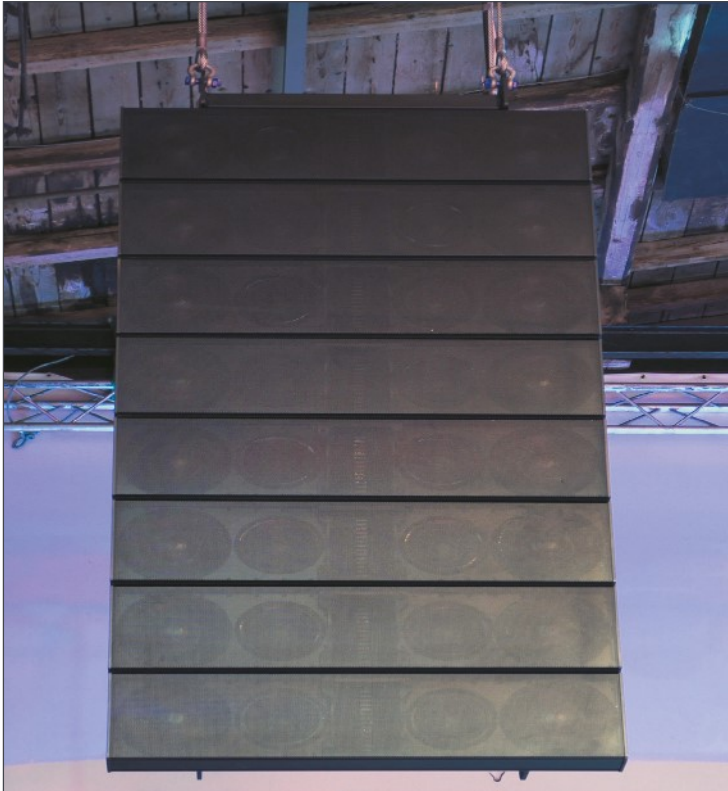
sound reinforcement from the corners of a mostly square dance floor. The new sound reinforcement system would integrate well into the building structure, as there is no separate engineering room for any controller or power amplifier electronics and the like, and the space required for the speakers themselves had to be contained.

Pan Acoustics has now had 12 years of experience in the conception, development and production of beam-steering and beamforming speaker systems. For this reason, incorporating a speaker system with DSP-controlled beam control into the conception of the new sound reinforcement system for Jolly Time posed no problem for the Wolfenbüttel team.

In fact, this kind of concept proves to be a very viable solution, especially when it comes to meeting the highest quality standards. With conventional line array systems, this is also possible up to a certain level of quality, but the fewer individually controllable speakers are available, the fewer parameters you have to guarantee an equal high-quality supply for the audience areas.

For a good sound quality in all audience areas, a sound supply which is equal and as targeted as possible is naturally an important factor. Another important factor is the audio quality of the speakers, as it should not be about only guaranteeing an equal sound supply, and then settling for a moderate sound quality.

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Front view of one of JollyTime's Pan Beam Line-Arrays

The quality of the speaker components play an important role here - combined with the fact that one should be able to optimally control it with the help of an integrated DSP technology. As far as the quality of the components is concerned, Pan Acoustics founder and manager Udo Borgmann got in touch with the Cologne-based speaker manufacturer Mundorf some time ago, which, along with the crossover components of the highest quality with ProAMT, is also planning a high-range system of very high quality and also of a suitable level for PA purposes, which we have already discussed in Prosound.

ProAMT technology

A quick reminder: the abbreviation AMT stands for Air Motion Transformer. This is a speaker design which resembles the magnetostatic speaker but which works a little differently. In magnetostats, a meander-shaped conductor path is applied on a flat film membrane. When you bring this into a homogenous magnetic field that runs parallel to the film and vertically to the conductor path, in case of current flow the membrane is pushed vertically by the Lorentz force towards the film, thus swinging back and forth. In the Air Motion Transformer, there is also a similar membrane with an applied meander-shaped con-

ductor path. But the film is folded lengthways, and the geometry is designed in such a way that the conductor paths are each placed on the edges of the folds. In the AMT, the magnetic field does not run parallel to the membrane level, but perpendicular, i.e. principally in the direction of sound radiation. The current flow through the conductor path then ensures that the edges of the folds, pushed by the Lorentz force, converge and move away from each other. There is therefore no membrane movement in the direction of sound radiation here, and sound radiation rather takes place in a way that air is pressed or sucked out of the folds. With an appropriate geometry of the folded membrane, a higher degree of efficiency is created by this function principle than in traditional magnetostats - and that is exactly what is aimed for when using magnetostatic operating principle in PA application.

Mundorf distributes the high-performance variant under the name ProAMT, whereby a special design is used for the Pan Acoustics system. More on this later.

For an array element, Pan Acoustics developers combined a ProAMT and two 8" midrange speakers and two 10" woofers each in d'Appolito-like arrangement in a housing 0.90 m wide and approx. 25 cm high. Each speaker is individually controlled by a DSP and its own power amplifier channel according to magnitude and phase, from which the extensive possibilities of beam-steering result - a concept with which Pan Acoustics has a lot of experience.

A benefit of this concept is the fact that no complicated and expensive rigging mechanism is needed, as the array elements don't need to be swiveled mechanically against one another to reach the desired level distribution in the room through the emerging curving of the array.



DJ workplace with Pan Beam monitor system

But with the beam-steering concept, it is important to know that the acoustic pressure and the frequency response in any point of the audience area consists of the contribution of all speakers - here: the whole array. However, this means that the sound radiated from all the speakers must in fact be able to reach the point in question in the audience area.

During my on-site visit in Brunswick, for a moment it wasn't clear to me how this requirement would be observed in the high-range speaker fitted with ProAMT. The ProAMT installed here has a sound outlet area almost 25 cm high at the mouth of the short attachment horn; the membrane is around 20 cm long. This should lead to a noticeable concentration in the high-frequency range. A closer look at the data sheets of the Mundorf 8" ProAMT with short horn shows that you can expect a vertical beam angle of 30° for instance at 5 kHz.

At Jolly Time, the line arrays of the front sound reinforcement are configured with an even front, i.e. flown without angling the elements against one another. The main radiation direction without beam-steering thus runs parallel to the floor area. In this configuration, you would therefore expect in the high-frequency range that at least the area near the stage would no longer be reached by all the tweeters through the noticeable concentration of the 8"-high membrane, and an effective beam-steering would no longer be possible there.

In fact, this effect naturally became clear to the Pan Acoustics developers, and they were able to find a solution which only works by having a very direct and cooperative contact with the ProAMT manufacturer Mundorf. In this way, various ProAMT construction parameters in particular could be adjusted according to customer requirements in order to be able to adapt the high-frequency system to the acoustic concept of the speaker developer. In the present case, the requirement was: we need a high-frequency system with an acoustically efficient construction height of 25cm, but which still ideally radiates like a spotlight in the vertical axis. Mundorf also has these spotlights in the AMT programme, but these use a membrane only 2 inches high. These apparent conflicting goals could be resolved in the present case by separating the membrane of the 8" ProAMT into three areas electrical and mechanically. In fact, the membrane consists of a continuous piece of Kapton film which is however sepa-



Pan Beam PB 224 as DJ monitor

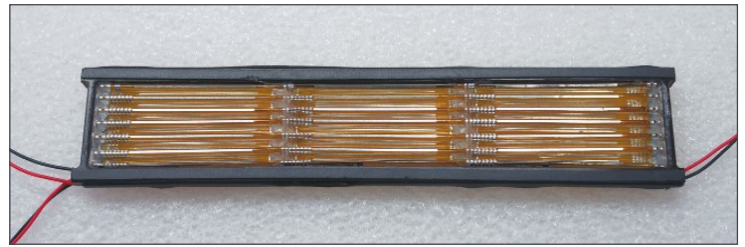


Single Pan Beam Array unit as delay system

rated into three oscillatory sections by additional supporting points. Instead of a single conductor path there are three, one for each section, so that each section can be individually controlled (see image). Since the separating supporting points steadily make the membrane decelerate or cushion it in its direct surroundings, the oscillatory part should probably be even a little smaller than in the regular 2" AMT, which at 5000Hz has a vertical beam angle of around 90° according to the data sheet. In this way, each of the three individual sections of the 8" ProAMT with this frequency should probably ultimately have a vertical beam angle of over 100°, so that the sound radiated by them can also reach the nearby area in front of the array. This, in turn, is the requirement for beam-forming

to work well also in the high-range area in the front part of the audience area. This ProAMT high-range unit is a custom-made product for Pan Acoustics which generally enables to carry out beam steering in the high-range area with a single array element.

A total of seven speakers can be individually controlled per array element, of which two for a woofer and mid-range speaker and three for the ProMAT. On each side, arrays made of eight elements each are flown, making 56 speakers per side or 112 in total. The front sound reinforcement is therefore controlled via 112 individual DSP channels, thus guaranteeing very high fine tuning. This reaches very good beam forming which concentrates the sound very precisely on the dance floor, so that areas planned to be quieter, such as the bars, respectively receive less sound pressure level. In the rear area of the hall, an array element is installed again on each side to refresh high-range frequencies in particular, which lose some level through air absorption. It helps here to already be able to create an active beam control in the high-range area with an array element.



In the above ProAMT membrane, the three individually controllable areas can be easily identified.

Very good sound quality is also required in the galleries, but with less sound pressure level for people to be able to have a conversation. The direct sound level of the front systems above is comparatively low, as desired, due to the precise beam steering. For this reason, Pan Beam line array speakers of type PB 04 and PB 08 are installed here to specifically guarantee the desired sound pressure levels with very good sound quality in the various areas. These systems are respectively controlled in a delayed manner so that no irritating delay effects are created when moving from the supply area of the main sound reinforcement to the nearby areas.

Sound

But all theory is grey - it's better to just listen. During our visit in Braunschweig, we proceeded by first listening to the system with various music pieces, club-like material as well as rock and individual male and female singing

The Pan Acoustics system at Jolly Time is set up in such a way that the entire audience area, from the area near the stage to, in principle, the end of the hall, is covered. Here, the beam is aligned in such a way that it roughly reaches ear height just before the end of the audience area. This should ensure that the complete direct sound is absorbed by the audience and ideally that reflections are not triggered on the rear wall. This even works when the room is empty - there are no direct rear wall reflections, and reflections on the ground reach the listener - so to speak - indirectly; they are therefore reflections of a higher order which respectively reach the listener later. The latter reflections can only be heard in an empty room, and not at all during normal operation, because the audience then provides sufficient absorption. The recording of pure singing voices also created an interesting "aha moment": we had previously recorded a few typical club titles with a higher sound pressure level. When playing the first pure vocal recording, my very first auditory impression was: "if it hadn't been a little too loud, I would have thought that the singer was standing on the stage here, singing only acoustically, without PA".

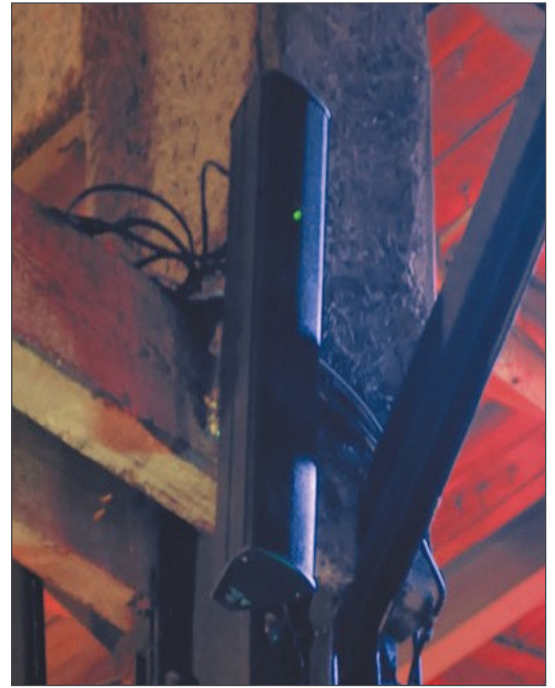
It must be said that this is the editors' own recording, which was produced without compression and other signal processing, which is potentially used in modern sound productions.

Note: this is not a sort of spectacular sound, but, on the contrary, it is the impression of hearing a natural voice. The sound of a speaker is of course always the overall result of all the design choices made by the speaker developer and also of component quality. But, as I once heard a similar effect with a ProAMT-equipped sound reinforcement system in the Royal Albert Hall, I would like to cautiously speculate that this component contributes significantly to the fact that natural sound sources and especially voices are perceived as natural. In electronic music, which is also common in clubs, this benefit cannot be heard so directly because there is no natural "original" sound.

However, you can hear a very good, clear sound quality, thanks to which the song can be heard on the dancefloor exactly as the artists had imagined. The new system at Jolly Time does not lack pressure or level reserves. These are provided by 16 18" subwoofers of type PB S 118 alone, which are placed under the stage. As the main sound reinforcement from the two Pan Acoustics arrays radiates very precisely onto the dancefloor, it is comparatively quiet on the stage and behind the front systems in general. For this reason, it is necessary to plan separate monitor speakers for the DJ. These are also Pan Acoustics systems, of type PB 224. These are installed diagonally on the left and right in the front of the DJ stand on profile housing and prolong the elongate of the actual speaker downwards, so that it gives the impression of a homogenous pillar reaching the stage floor.

All the speaker systems of Pan Acoustics are active and are digitally controlled via their AES/EBU interface. This has the advantage that, on the one hand, it requires no separate engineering room for power amplifiers and the like; on the other hand, the system can't overdrive if the transfer from the output of the disco mixer to the AES/EBU interface of the sound reinforcement system is set correctly. This is naturally also the case for guest events where people bring their own sound technology - even here the correct level must be set only in one point, unless it can be directly transferred from the mixer to the in-house system digitally. The arrays of the sound reinforcement system at Jolly Time are flat and uncurved. They therefore have an installation depth of only around 25 cm. This is of course a dream for installations of a very different kind, for example in theatres with little room in the proscenium arch or in projects in general where visually obtrusive and extensive speaker installations are not desirable from an architect's point of view.

In terms of sound, I have already referred to the naturalness of the reproduction, which is of course also very interesting for theatre installations and other projects where you shouldn't be aware of the speakers at all - which boils down to a natural, clear reproduction without compromising on level stability.



Pan Beam line array speaker type PB 04 and PB 08 are used on the gallery as supporting or delay systems.



Pan Acoustics team with founder and owner Udo Borgmann (3rd from left) and Jolly Time manager Turgay Araz (right)

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