



The centre of the main altar octagon was chosen as point zero – although the smaller altars will be separate entities it will be possible to interconnect them



The use of Axys Intellivox steerable vertical speakers ensures greater intelligibility as unwanted reflections from walls and ceilings can be avoided

Middle Ages to digital age

Florence's 13th-century cathedral is undergoing an ambitious upgrade to improve sound coverage. Stage one, installing an audio system to cover the main nave area, has just been completed, writes **Mike Clark**

A part from recent buildings that have taken amplified sound into consideration from the drawing board stage, acoustics in places of worship can be problematic at the best of times. But if the building in question is a cathedral that can hold 30,000 people, and has a 90m-high cupola and several altars, sound installers and designers will definitely have to do a lot of homework to get things right.

This is the case with the newly completed first stage of an audio update carried out by Studio Cuffaro at Santa Maria del Fiore (Florence Cathedral), now a world-famous tourist attraction, thanks also to its magnificent 90m dome designed by Filippo Brunelleschi and its Giotto bell-tower.

Aldo Cuffaro's studio has been the cathedral's audio contractor for many years. He explains: "It's thanks to Anna Mitrano, the far-sighted president of the cathedral's Opera, that this ambitious upgrade to digital audio is going ahead. We've already completed the first stage, which consists of an audio system covering the first part of the main nave, in front of the huge octagonal area hosting the main altar, and another for the Madonna Altar."

The Opera is a lay institution founded by the Republic of Florence in 1296 to superintend the building of the cathedral and its bell tower. In 1436, when the church was consecrated, the Opera's main task became that of a 'works commission' protecting, promoting and exploiting the monumental complex, which was joined in 1777 by St John's Baptistery.

Mitrano stresses that all the staff feel the cathedral is theirs and do their work with great passion. She continues: "We needed an audio system able to satisfy all our requirements, but with the minimum number of loudspeaker enclosures and the lowest possible visual impact. This, of course, had to be done with the authorisation of the monuments and fine

arts office [the building is obviously classified] and the Florentine clergy. The latter have always had an open attitude on behalf of the Florentine church towards our work and they have always completely trusted the Opera's technical office, headed by Paolo Bianchini, and Studio Cuffaro and its staff, whom they have known for a long time."

Point zero

The systems, which consist of a series of Duran Audio's Axys Intellivox loudspeaker enclosures and Biamp's AudiaFLEX digital audio platform, were designed with the support of engineer Marco Cappellotto from the brand's Italian distributor, Prase Engineering, and local engineer Guido Guidi.

'When the system is completed, the power supply line and mic cables will be the only copper cable left'

Guido Guidi, engineer

Cappellotto takes up the story: "We ran a series of acoustic simulations with the Axys Digital Directivity Analysis software and considered the octagon centre as 'point zero' for a global design for the main body of the cathedral. Each of the smaller altars is considered a separate entity but, when the entire project is completed, they will be able to be interconnected."

A pair of Axys Intellivox DS500 arrays is mounted on each of two columns at a distance

of 15m from point zero, and the 5m (16ft) tall enclosures give a typical throw of 70m. The two 2.8m-high DS280 units at the Madonna altar have a typical throw of 35m. As well as being painted to blend into the surroundings, the enclosures are mounted on special custom-made brackets.

To control the two systems, Biamp's flexible AudiaFLEX CobraNet digital audio platform was chosen, with two different configurations: the unit for the octagonal area has a 16 in, 8 out and the Madonna altar zone's unit features 6 in, 6 out.

Vertical challenge

The Axys Intellivox steerable array concept uses a vertical speaker arrangement with an onboard DSP for each driver, in which specific vertical dispersion patterns can be programmed. This avoids unwanted reflections from walls and ceilings, ensuring greater intelligibility: a speech transmission index (STI) of 0.62 was measured with the new set-up – excellent, if one considers the cathedral has an extremely high reverberation time. This also allows the enclosures to be positioned in an unobtrusive manner, ideal for a historical retrofit such as this.

The installation work, co-ordinated by Marco Mannetti, is all done discreetly with small work groups, to avoid disturbing the constant flow of tourists and the many religious celebrations.

Mannetti says: "Cable runs had to have the lowest possible impact. So, as well as making use of all pre-existing ducts for cable runs, if and when they are removed – bearing in mind the constant progress made in the audio field – they must also leave the least possible trace."

Guidi adds: "The cable runs pass under the floor to a point in proximity of each of the altars, where they are run up the wall and along a cornice. The 500m of 6-fibre multimode fibre optic cable installed so far had to be chosen carefully, bearing in mind the bends it would

have. When the system is completed, the only copper cable left will be the sound system's dedicated power supply line and the microphone cables."

The use of fibre optic cable also helps to reduce the risk of lightning damage, which was another key factor as the cathedral is one of the most probable 'targets' if lightning strikes Florence. Control and diagnostic facilities are also available with the current set-up and, when the system is up and running (a provisional 2009 date is given), an internet link will enable remote diagnosis.

A digital link is being studied to connect the cathedral and the adjacent baptistry, which already had an Axys/Biamp set-up installed, with an STI that Guidi describes as "astounding" – 0.85. With the baptistry integrated in the main Ethernet network, it will be possible to control the entire system from one point.

Concluding, Bianchini enthuses: "This centuries-old cathedral is in fact full of technology; as well as the digital audio set-up currently being installed, it also has an impressive array of sophisticated equipment constantly monitoring the building: temperature, humidity, crack dimensions, movement – over 100 sensors!"

Aldo Cuffaro Q&A – turn to page 66

- www.biamp.com
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Installed

- Biamp AudiaFLEX: 16in, 8 out and 6 in, 6 out
- Duran Audio Axys Intellivox DS280 steerable arrays
- Duran Audio Axys Intellivox DS500 steerable arrays