

An unwavering belief demands faithful audio



Built to commemorate Indonesian independence, Masjid Istiqlal can accommodate over 120,000 worshippers

The impressive Masjid Istiqlal is the sixth largest mosque in the world – and boasts a standardised TOA sound system across the entire facility

BUILT TO COMMEMORATE

Indonesian independence and with a capacity of over 120,000 worshipping pilgrims, Masjid Istiqlal remains the largest mosque in Southeast Asia. Located in central Jakarta, construction of the national treasure was initially proposed in 1953 by Indonesia’s first minister for religious affairs, Wahid Hasyim. It would take another quarter-century before the sixth-largest mosque in the world would open to the public. Another four decades would pass before the technological management committee, Badan Pengelola Masjid Istiqlal (BPMI), would request tender bid proposals to fully replace the original Siemens audio system.

The North Sumatra architect, Friedrich Silaban, sufficiently understood the Quran to accurately integrate Islamic symbolism into his blueprints. Representing the seven heavens in Islamic cosmology, the mosque has seven entrances and gates called after the names of God. With a nod to the 1945 Proclamation of Indonesian Independence, the rectangular main prayer hall building



The PT Galva Technologies team

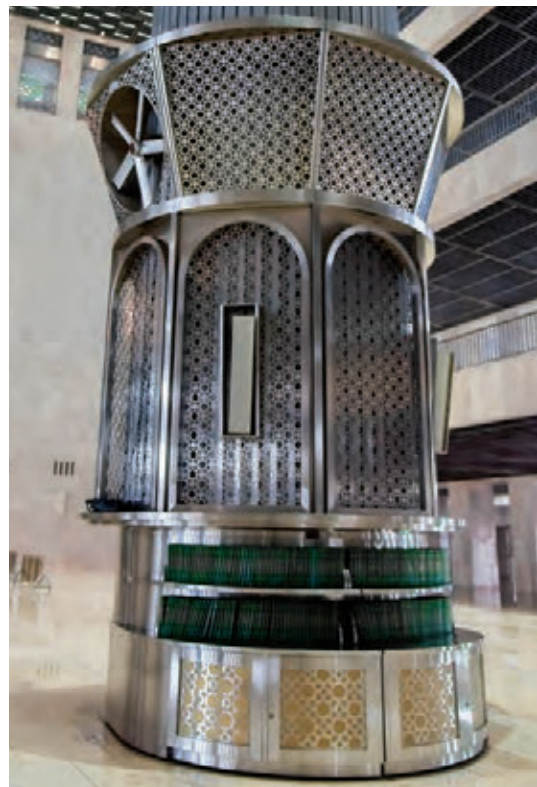
is covered by a 45m-diameter central spherical dome. To enter the main hall, worshippers pass through an entrance covered by an 8m-diameter dome, whose number represents the eighth month of August and the month of Indonesian Independence. Consisting of a main floor and four

balcony levels, the number “5” translates to the Five Pillars of Islam. Located in a rear second-floor room, the original Siemens centrally controlled audio system was designed to enhance speech intelligibility during prayers and provide public address information

throughout the expansive facilities. Serving a distributed network of over 200 loudspeakers in the main prayer room and across the first floor, extensive cabling runs were routed to 26 amplifiers and five mixers located in a glazed rear second-floor control room. From dawn to dusk and beyond,



Worshippers focus on the main wall or qibla

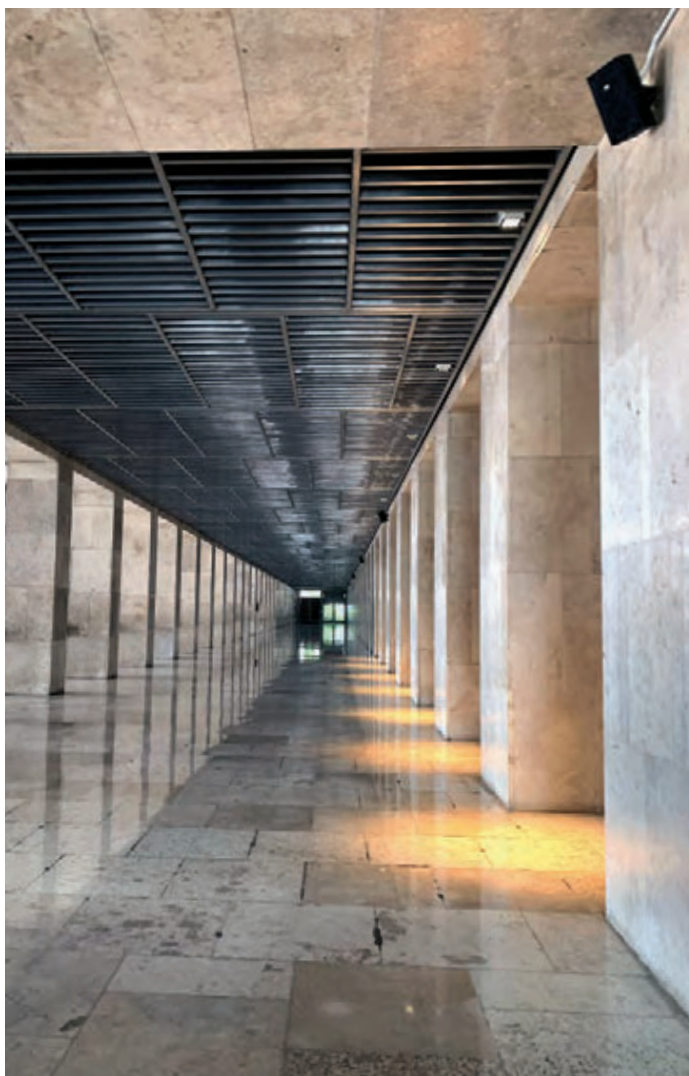


TOA SR-S4S columns are discreetly fixed to the vertical metallic framework pillars

six BPMI technicians have supervised the audio requirements in shifts since 1978.

Appointed as the main fire alarm and electrical contractor, PT Pratama Solusi Armino sub-contracted PT Galva Technologies to design and supply the main loudspeaker system for the project. As TOA's authorised dealer, the call to site in January 2020 was warranted following consistent maintenance upgrades, troubleshooting and demonstrations conducted by the Jakarta-based contractor over the years. This included the replacement of defective amplifiers with TOA high-impedance models. With the goal of achieving optimum audio quality, reliability and ease of servicing, BPMI requested that PT Galva Technologies standardise the audio components throughout, and a TOA solution was approved.

Ensuring that praying Muslims focus on the main wall or qibla, the interior design of the main prayer hall is both simple and clean-cut. Indicating the direction of Mecca in the centre of the qibla is the mihrab and the Imam's minbar. Adorned by ornamental stainless-steel covers, 12 round vertical columns representing the birthday of the Islamic prophet Muhammad on 12th Rabi' al-awwal support the enormous dome above the main prayer hall. In addition to imposing an impressive background, the East Java white marble walls



TOA ZS-F2000 and ZS-760B-AS enclosures in the outdoor under-balcony areas

add a further acoustic reverberation challenge of attaining a Speech Transmission Index (STI) of 0.6s. While enhancing intelligibility, the proposed loudspeaker system would also need to pass the "heard, but not seen" test of unobtrusive aesthetics.

Assisted by TOA Electronics in Singapore, EASE 4.4 modelling performed by the PT Galva Technologies engineers detected optimum coverage by adopting TOA SR-series line array speakers for the main prayer hall. A total of six SR-D8 active line array speakers ensure even coverage across a 130Hz–20kHz spectrum over the first 20m of the main prayer hall. Flush-mounted on SR-TB4 wall brackets on the mihrab, each MDF enclosure incorporates a digital audio input, an eight-channel Class-D amplifier, DSP and eight 4-inch LF woofers together with 24 one-inch HF tweeters that are closely aligned as a continuous linear sound source. Finished in white and operating within a 70Hz–20kHz frequency range, the line arrays provide even coverage across the listening plain with 90° x 10° (HxV) dispersion. Towards the outer left and right flanks of the mihrab wall, a pair of SR-S4S two-way line array speakers ensure even coverage, while a pair of unobtrusively installed SR-H2S cabinets in the minbar wall serve as monitors for the Imam.

Finished in white, SR-S4S columns are individually and discreetly fixed

PROJECTS

onto the 12 vertical metallic framework columns in the centre of the main prayer hall. During the design phase, the PT Galva engineers configured the acoustic outputs beyond the floor area covered by the six SR-D8 models towards the mihrab. This has been achieved by radiating their energies towards the sides, rear and centre of the hall. Tilted 10° downwards on their SR-TB4 brackets, their collective energies are concentrated on the worshippers rather than the marble walls. Housed within the same 160mm x 892mm x 303mm (WxHxD) enclosure and combining the same electroacoustic components as the SR-D8 model, the SR-S4S is a lighter, passive version.

Microphone inputs – including TOA Series 5000 wireless receivers, transmitters, 5325 headsets and 5225 handhelds together with an EM-800 gooseneck fixed to the minbar – are received by a Yamaha MGP32X 32-channel analogue console. The resultant mix is then routed to two dedicated DP-SP3 processors serving the mihrab and column speaker presets, where individual DSP parameters are applied for the two SR-series speaker models. Individual EQ, crossover, matrix, compressor and delay configurations have been digitally applied within the version 2.0.0 software for comprehensive network control. Additionally, precise vertical directivity and acoustic beamwidth parameters are controlled over the Cat5 infrastructure from a remote Notebook PC using the supplied setting software.

The output signals are transmitted within the digital domain from the two-in/six-out racked processors to the combined SR-D8 and SR-S4S network. The 12 passive models are powered by three DA-550F Class-D amplifiers located in the same second-level control room rack. Cabling sub-contractor PT Pratama Solusi Armindo ensured that the Canare 2S11F loudspeaker cable and Cat5 runs routed to the multiple loudspeaker arrays were limited to no more than 100m distance.

The balcony levels of the main prayer hall receive speech reinforcement through a network of smaller quadruple 5-inch speakers. Designed to provide wide horizontal directivity, a total of 14 ZS-202C 20W and ZS-402C 40W models have been wall- and ceiling-mounted on each level. Powered by a combination of DA-550F and DA-250F four-channel amplifiers via three audio distributors, the digital signals are received from a third dedicated DP-SP3 processor that is remotely configured on the same Notebook PC.

The main structure is directly connected to arcades that are spread around the large courtyard by an extensive 70V line public address and voice alarm system. The control room is equipped with an M-9000 digital mixer and CD2011R player allowing different audio signals to be streamed to the various zones. Should an emergency arise, however, the RM-200M microphone takes priority. From the M-9000, the audio signals are routed to six VX-3004F frames via three 10-channel zone selectors. Depending



A 45m-diameter central spherical dome covers the main prayer hall



The rear second-level room hosts multichannel amplifiers, audio distributors and a DP-SP3 processor

on the size of the zones and the number of loudspeaker outputs, five of the panel frames host between one and four DA-250F amplifiers, while a spare 150W amplifier has been added to the main control panel frame for network redundancy.

Each amplifier channel has been configured with unique DSP settings to reflect the acoustic environment, while a smart ANC function adjusts the output according to the ambient noise. In addition to the weatherproof ZH-615 SM horns that are fixed to metal poles throughout the car parks, a number of ZS-F2000 8-inch and ZS-760B-AS cabinets have been fixed to the under-balcony areas of the main building exterior. Within the mosque, a network of ZS-648R ceiling and ZS-062 box speakers were preferred for the back of house corridors, stairs and offices.

A meeting room and two VIP areas have been equipped with bespoke audio solutions. Equipped with eight internal microphones, AM-1B slim array units were selected for

presentations, while additional Series 5000 wireless systems add room flexibility. Equipped with Yamaha MGP16X mixers and DP-SP3 processors, audio is transmitted to the Z-122C ceiling speaker networks via ZA-3212, ZA-3224 and ZP-3248 digital booster amplifiers.

Symbolising the divine oneness of God, a single minaret in the southern corner of the grounds beckons worshippers to prayer. Translating to the 6,666 verses in the Quran, the 66.66m-high minaret was an intention of architect Silaban. Requiring a high SPL solution to extend the message beyond the immediate grounds required the inclusion of weatherproof Z-HA1010-AS long-range slim array speakers. Comprising eight horn speakers positioned in a vertical 1.233m-high array, 350Hz–7kHz coverage extends beyond conventional horns speakers owing to the narrowly focused directivity. Complemented by conventional ZS-760B-AS two-way speaker systems, the minaret outputs are powered by ZP-3248 amplifiers.

Following commissioning and tuning in late 2020, PT Galva Technologies arguably added its most prestigious Indonesian landmark to an already notable reference list. Its meticulous and time-consuming works may be devoid of symbolic meaning, but having achieved the SPLs, coverage and STI stipulated for this highly reverberant house of worship warranted the client's praise. The intelligible audio experienced by the congregation journeying from their homes to the main prayer hall within the Masjid Istiqlal has undoubtedly created a more intimate worship experience.

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The extensive grounds comprise a large number of TOA weatherised outputs