Concept:
The Ezra Rachlin Summer Pavilion is a multi-purpose performing arts venue, and the summer home of the Austin Symphony. Originally designed to resemble the world’s largest exponential horn, the venue evolved into a conflation of many different cultural, architectural designs and motifs. From the precise intricacies of the of the Iranian muqarnas, to the strong, rigid forms of the pavilion enclosure, to the smooth, curving structure of the pedestrian walkways, the product is a venue that evokes a spirit as unique and diverse as the performances it hosts. Endearingly nicknamed “The Squid” by its designers, the pavilion poses a striking silhouette not only from the ground, but from above. Although it may seem at first glance to be an assortment of concepts for the sole purpose of visual awe, each piece also serves an important acoustical function for the overall health and success of all forms of musical and other performing arts.

Location:
Located in the heart of central Texas, the pavilion enjoys temperate weather during much of the year, with little fear of inhibiting rain and snow. The pavilion is surrounded by a state highway to the north, two county roads to the east and west, and a calm stretch of the Colorado River to the south. In addition, there a large interstate highway located, at nearest, 200 feet from the property line and 1000 feet from the pavilion center. Residing on a geographical slope, the audience outside the covered seating is provided natural stadium style seating, and the nearby residential neighborhood is sheltered from disturbance by the crest of the hill at the north end of the property.
Indoor Features:

The covered seating for the pavilion can accommodate an audience of around 5000 patrons. The stage features an orchestra shell inspired by the muqarnas design originating in modern day Iran in the 16th century. The shell is also capable of being retracted when the entirety of the stage and stage house need to be utilized for non-orchestral performances. With the shell deployed, the stage is capable of accommodating an orchestra of up to 100 musicians, and with the shell retracted, the stage can house large scale theatrical performances complete with pros. In addition, a large orchestra pit located in front of the stage can accommodate pit orchestras ranging from small orchestras for Classical opera to 100 musician orchestras for Wagnerian opera should the need arise. For pop and rock concerts, speakers are located in the ceiling to provide electroacoustic reinforcement under the covered seating.

Stage Design

Roofing Design:

While this structure is designated as the “roof”, it acts more as an inner skin for the entirety of the pavilion. The roof is separated into strips, each of which have panels ranging from 3m to 6m in width, and the largest of which have additional surface textures in smaller dimensions. This provides broadband diffusion throughout the pavilion which is important considering its size, without proper diffuse reflections, especially near the back of the pavilion, late reflections and echoes could easily disturb listeners. The convex structure and open west side of the pavilion also help ensure that no reflective anomalies, such as low frequency room modes, are present. In addition to providing much needed diffusion for the covered seating, the roof also has integrated speakers matching the width of respective roof paneling to provide sound reinforcement when desired.

Variable Acoustics:

As the pavilion will be used for a variety of performing arts, one of the most important features is the ability to adapt the acoustics to fit the needs of the performance. This is primarily achieved via the retractable stage shell. For orchestra performances, the shell is deployed. The muqarnas design of the shell provides diffusion in frequencies from 125 Hz to 20 kHz, and the holes in the shell allow the back of house to act as a coupled space, extending the reverbation time. For performances where speech intelligibility is important, including opera and theater, the shell is retracted and curtains are deployed along the back of house walls. This removes diffusion at high frequencies, which contribute most to intelligibility, and also lowers the reverbation time. As a consequence, the clarity throughout the pavilion is increased quite substantially. Should they be required, speakers in the roof can be used to provide higher sound levels and pseudo-early reflections for speech and performance.
Electroacoustic:

For the largest public performances, it is expected that the entirety of the lawn area will be utilized. For this reason, speakers are affixed across the facade of the pavilion in order to provide sound reinforcement to those not under the covered seating. In extreme cases, portable speakers can be deployed throughout the lawn area. There are also two large TV screens affixed to the east and west walls of the pavilion with integrated speakers to provide additional visual information for those without prime site lines to the stage. Finally, throughout the pedestrian walkways and sculpture garden are speakers for those who wish to browse and listen. Together, these should provide more than enough sound reinforcement for the maximum projected attendance of 25000.

<table>
<thead>
<tr>
<th>Frequency Band (Hz)</th>
<th>63</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
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<tbody>
<tr>
<td>Noise Measurement (dB)</td>
<td>75</td>
<td>76</td>
<td>76</td>
<td>72</td>
<td>70</td>
<td>71</td>
<td>65</td>
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<tr>
<td>Distance Loss (dB)</td>
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<td>-14</td>
<td>-14</td>
<td>-14</td>
<td>-14</td>
<td>-14</td>
<td>-14</td>
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<tr>
<td>Intervention Loss (dB)</td>
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<td>-6.7</td>
<td>-8.1</td>
<td>-10</td>
<td>-12.6</td>
<td>-15.1</td>
<td>-18.7</td>
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<tr>
<td>Net SPL at Site (dB)</td>
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<td>55.3</td>
<td>53.1</td>
<td>48</td>
<td>41.6</td>
<td>41.9</td>
<td>32.3</td>
</tr>
</tbody>
</table>

Environmental Noise:

The largest factors contributing to environmental noise are the roadways that surround the property, particularly the large interstate highway to the west. The pavilion is strategically placed near the center of the site to maximize the distance to each roadway, however additional loss is needed to mitigate noise from the interstate during its loudest hours. To provide this, the majority of the amenities are placed to the east of the pavilion forming a barrier that effectively stops high frequency noise, and lowers low frequency noise to a comfortable level even in the worst case scenario. The other major noise factor is the mechanical room. The plot provided is large enough that mechanical noise can simply be decoupled and placed far enough away that any transmission through the building will be mitigated by distance.

Movement Rehearsal Room:

The movement rehearsal space is meant mainly for rehearsal involving opera, theater, and other performances where movement space is required. The movement room is similarly, effectively decoupled from the rest of the support spaces via its own foundation and single walkway connection. The room is composed of glass and wooden walls that allow for ample natural lighting. The wood walls share a structural connection with the pavilion roof to provide diffusion and deployable curtains line the perimeter to provide extra absorption when desired. This results in a closer resemblance to pavilion stage sound with the stage shell retracted, how it would be for such performances; this includes a shorter reverberation time than its sister space, the orchestra rehearsal room. Seating is also provided for those who wish to observe.

Orchestra Rehearsal Room:

The orchestra rehearsal room provides space for up to 100 musicians to practice and rehearse. The rehearsal room is effectively decoupled from the rest of the support spaces, having its own separate foundation and being connected only via a walkway. The room is composed of a glass outer shell with a wooden inner shell. The glass outer shell allows natural lighting, while the wooden inner shell helps to break up reflections and provide absorption. The roof and walls of the of the wooden shell share the same pattern as the roof of the pavilion to provide diffusion and a closer resemblance to what actual performance will sound like: this includes a longer reverberation time than its sister space, movement rehearsal room. The wooden inner shell also has seating around the rehearsal stage for those who wish to observe.