38N 82W Regional Airport: Processes and Methodology

by James Diewald and Michael Frederick

1. The Project

38N 82W Regional Airport is a one million square feet, 24-gate facility designed as a submission for the ACSA and the Department of Homeland Security sponsored 'Airport Security Circulation' competition[1]. The project was a research-intensive investigation aiming to develop a new paradigm for air travel in the future. The spirit of the project centered upon improving the experience of contemporary air travel.

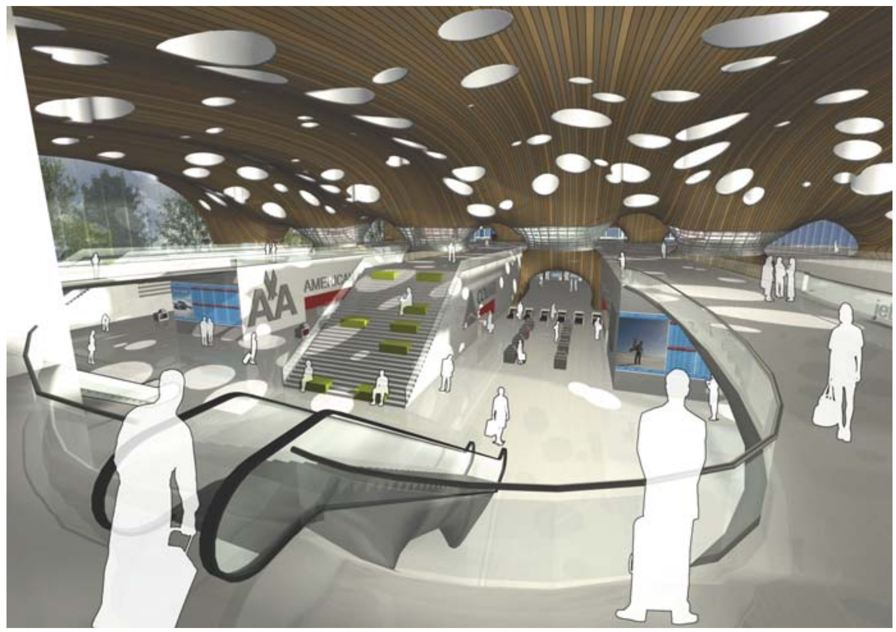

Figure 1.1: **Entry to Ticketing Hall**

Many of the problems associated with today's airports stem from a boom in airport construction during the sixties and seventies, at a time when planners and architects anticipated neither the passenger volumes, nor the security concerns that are associated with air travel today. The spatial layout of those airports relied heavily upon relatively low security and a reasonable number of passengers to provide a smooth and enjoyable transition from the curbside to the aircraft. The changes imposed by increased volumes and 911 security concerns have forced these outdated structures to the brink. Still, particularly in the United States, these airports do not bear the stamp of innovation. The scars of retrofit after retrofit in an unending struggle to keep up with the times are abundantly visible.

38N 82W Regional Airport attempts to rectify many of the pitfalls associated with contemporary air travel through a number of emergent technologies as well as innovative planning themes. Key initiatives include ecologically sound, or sustainable design principles, a distinctive, legible spatial structure, and a minimally invasive security solution that increases safety and eliminates many of the hassles commonly associated with conventional systems. Beyond the processes and ideas behind the design of this project, we hope to elaborate upon the some of the techniques involved in realizing this design competition submission and more specifically, the benefits of working between a variety of media and software.

Through our research, interviews with airport officials, and personal reflections we identified several core problems with existing airports. One article in USA Today even noted a wish list of features and amenities that would make travel more enjoyable, including fitness facilities, fireplaces, free Internet, and places to nap among others[2]. The problems we discovered were actually quite simple. First, nobody likes to wait in a line, particularly right before an impending departure. Second, the duty free shops and spartan waiting lounges that have come to characterize most US airports have failed to satisfy people's needs and interests. Finally, security solutions, as they stand today, are lacking an adequate level of security and fail to accommodate the massive flows of passengers that currently bombard today's

Figure 1.2: **Baggage Claim**

Figure 1.3: **Ticketing Checkin**

airports. What we need is an airport that does not compromise the experience of travel with security concerns. We wanted to minimize the times spent waiting in lines and make waiting periods more engaging and pleasant all while providing the highest possible level of security.

Taking cues from existing airports, we began to develop a new strategy to address the aforementioned challenges. Linear satellite concourses, like those at the Atlanta or Denver international airports, are highly flexible and efficient and offer a physical separation of program, promoting security. However, the transition from the landside services (baggage and ticketing) to the concourse is interrupted and complicated by long lines, security checkpoints, and an overcrowded underground tram system. To counteract these problems, we merged security screening procedures with transit to the concourse. Multiple smaller, pod-like transporters were introduced to replace the larger underground trams, offering flexible capacities and the ability to function on demand. This unifying idea led us to the production of a number of spatial massing strategies that would ultimately inform the architecture. In short, the landside services adopt a hy-

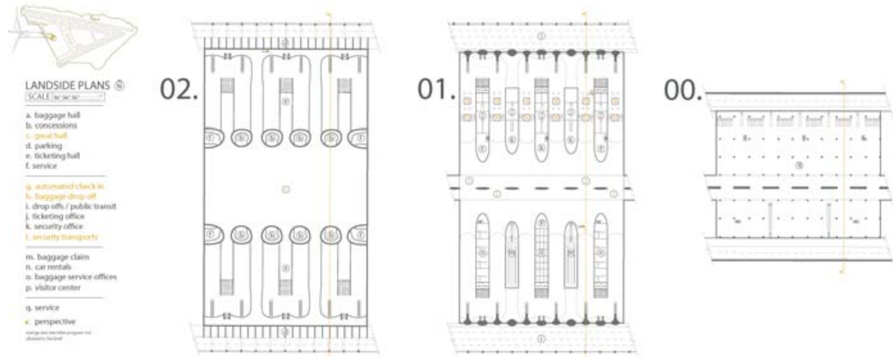

Figure 1.4: **Security Transporter Unit**

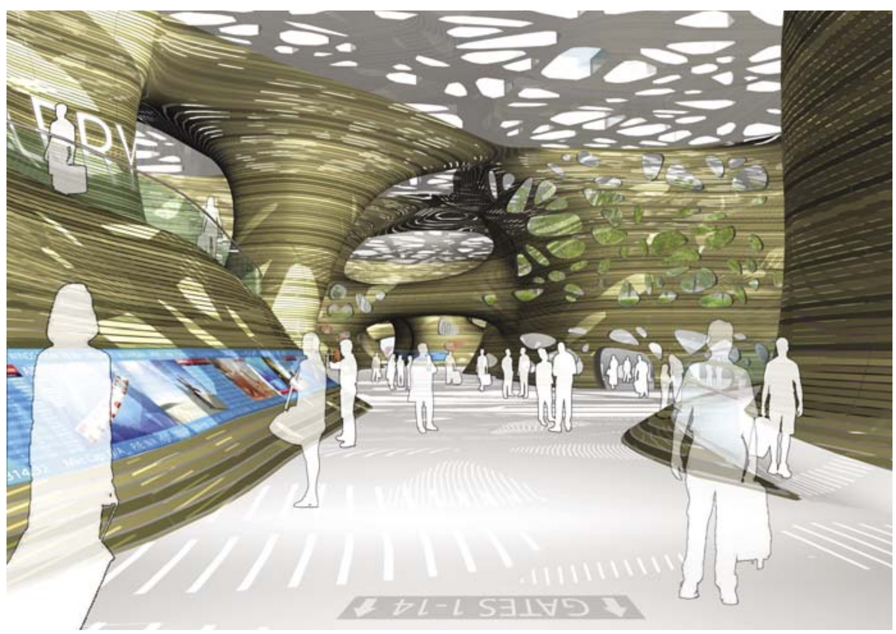

Figure 1.6: **Main Concourse**

Figure 1.5: **Entry to Concourse from Transporters**

brid typology resembling both a railway station and an airport. This space is direct, easy to navigate, and produces a perceptible entry and exit to the airport. The concourse would be reprogrammed to accommodate a variety of amenities including gardens, children's play areas, and a spa among other things that would be arranged along a meandering path we came to envision as a sort of Main Street within the airport.

2. Notes on Functional Organic Geometries

A functional, easily legible organization of program was necessary to address the needs of the airport, yet the repetitive, mundane geometry of most airports was not something we hoped to recreate. We began our process with simple massing models in **form•Z** to study and evaluate programming strategies. Using the software allowed us to quickly and accurately 'sketch' ideas in three dimensions. It accommodated the complex programmatic relationships inherent to airport design and planning while allowing for the generation of visuals for presentation and feedback. Figures 2.1 and 2.2 depict the functional diagrams of the landside services that were used to confirm quantitative data, such as square footages, walking distances, and vertical relationships that formulated the groundwork for the development of an architectural language.

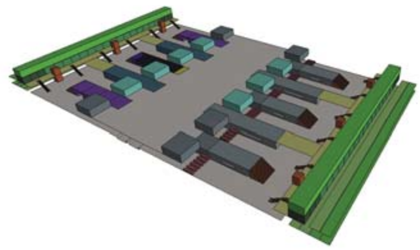

Figure 2.1: **Landside Organizational Massing**

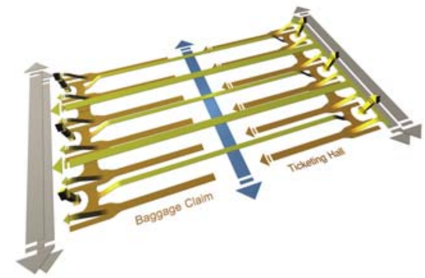

Figure 2.2: **Landside Circulation**

As we continued to develop our formal ideas through sketches and additional models, we found that the smooth modeling capabilities of **form•Z** were not best suited for our requirements. We turned to 3DS Max and utilized low poly modeling techniques, commonly associated with character modeling, to produce highly editable surfaces that could be easily and dynamically subdivided for smoothing. 3DS Max, however, failed to provide us with the necessary tools to accurately construct these surfaces and we began a dialogue between 3DS Max and **form•Z** to produce the final result.

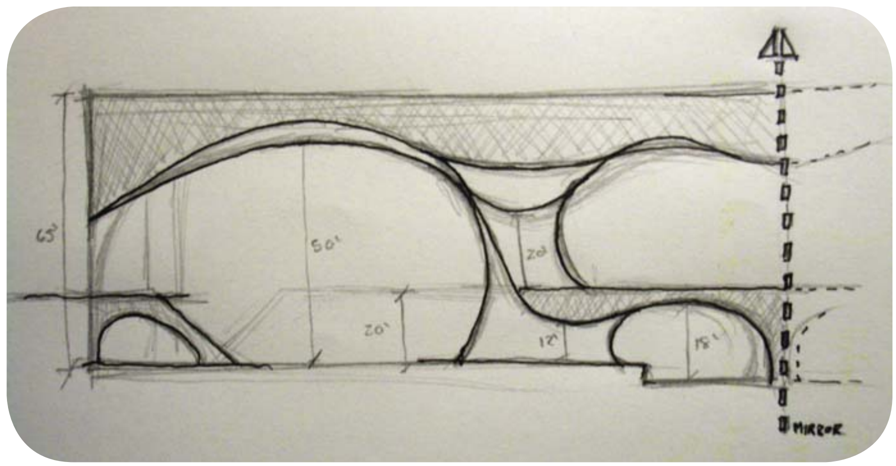

Figure 2.3: **Section Contours Sketch**

The roof structure of the landside services benefited greatly from this synergy. Beginning with a series of sketches (Fig. 2.3), we brought this information into **form•Z** to dimension and scale using the previously developed program massing model (Fig. 2.1). These sketches became the basis for contour lines that established the form of the surface. A triangulated reference cage was constructed in **form•Z** and confirmed necessary clearances, spans, and other information that required accuracy (Fig. 2.4). This reference cage was imported to 3DS Max and reconstructed in quadrangular polygons (Fig. 2.5) and smoothed with the turbo smooth function (Fig. 2.6). Similar techniques were also applied to the interior surface of the concourse (Fig. 2.7).

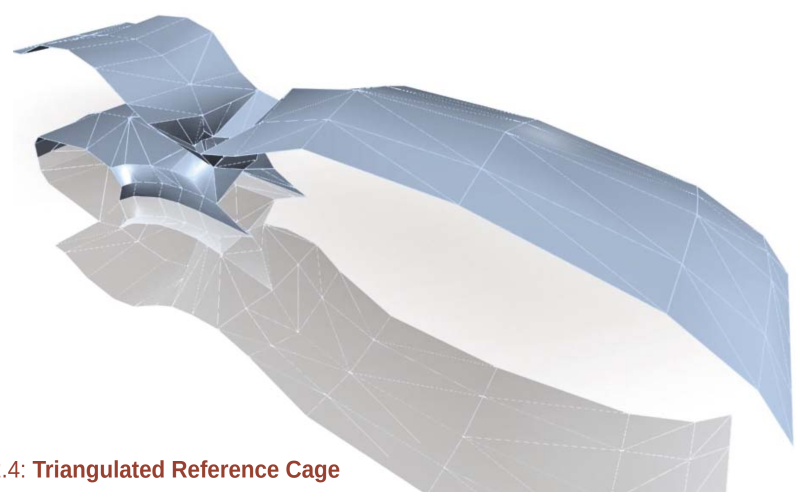

Figure 2.4: **Triangulated Reference Cage**

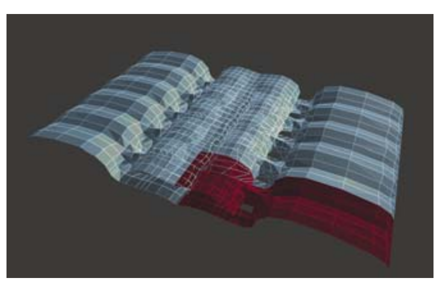

Figure 2.5: **Quadrangular Surface Construction**

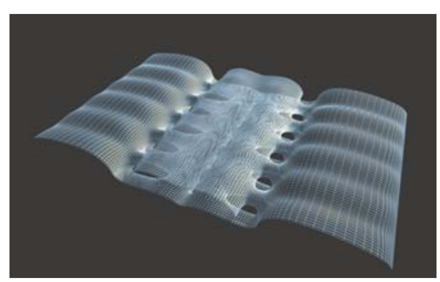

Figure 2.6: **Completed Smooth Surface**

3. Pixels vs. Geometry

The geometry and appearance of each of the surfaces within the airport was intended to reinforce the directional flow of the system. To further this notion, we utilized a parametric map to simulate bamboo slats, giving the surface a 'grain' (Fig. 3.2). To allow for greater levels of natural light in the ticketing and baggage halls, we decided to pierce the surface

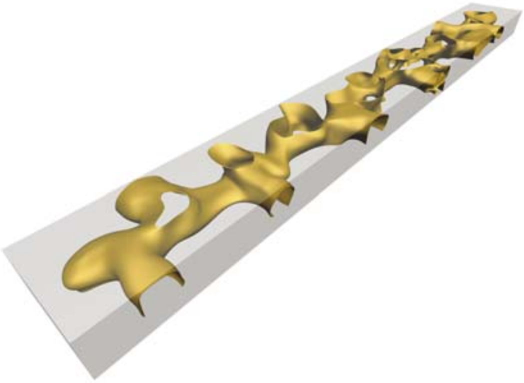

Figure 2.7: **Concourse Surface**

with random circular tubes. Rather than physically modeling this geometry, we opted to produce a transparency map (Fig. 3.1), drastically reducing our rendered polycount and preserving the editable surface. However, when it came to rendering, the surface appeared to be too flat. To maintain the aforementioned benefits, we kept the simple transparency map and constructed 3D solids from extrusions traced onto the surface (Fig. 3.3). These and other elements were rendered separately and later combined in Adobe Photoshop for the final image (Fig. 3.4).

4. Physical Geometry from a Bit Map

The roof and facades of the concourse (Fig. 1.6) presented another modeling problem. We wanted to produce a surface defined by linear structural elements in which the openings became a random organic mesh. For purposes of lighting and physical depth we decided that a transparency map would not suffice and this surface would need to be modeled. Given that we already had a transparency map that we liked (Fig. 4.1), we were presented with a new problem; how do you produce physical geometry from a bitmap? The end product would be planar, so all that

Figure 3.1: **Roof Transparency Map**

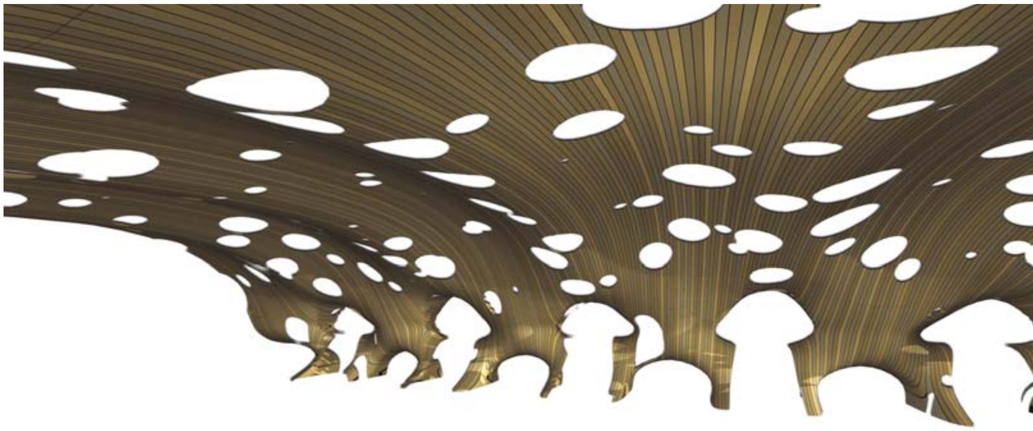

Figure 3.2: **Isolated Roof Surface**

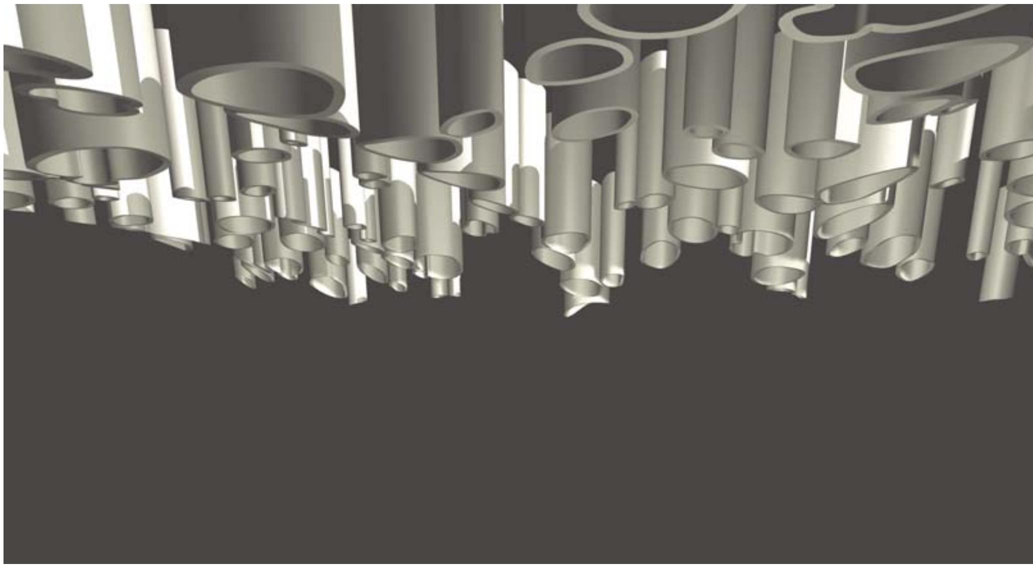

Figure 3.3: **Constructed Roof 'Tubes'**

Figure 3.4: **Completed Rendering**

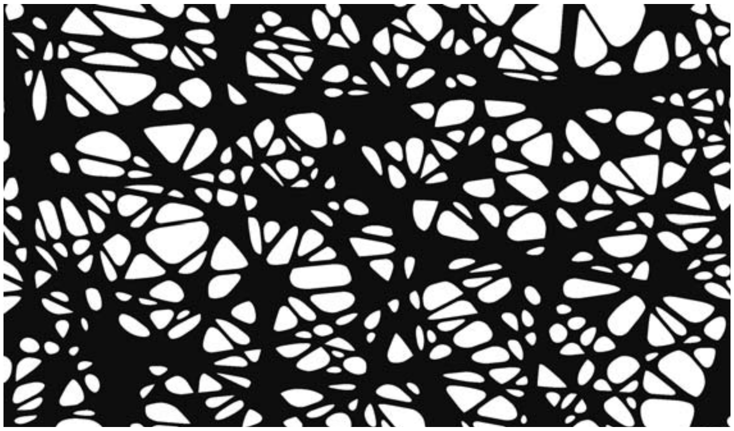

Figure 4.1: **Concourse Transparency Map**

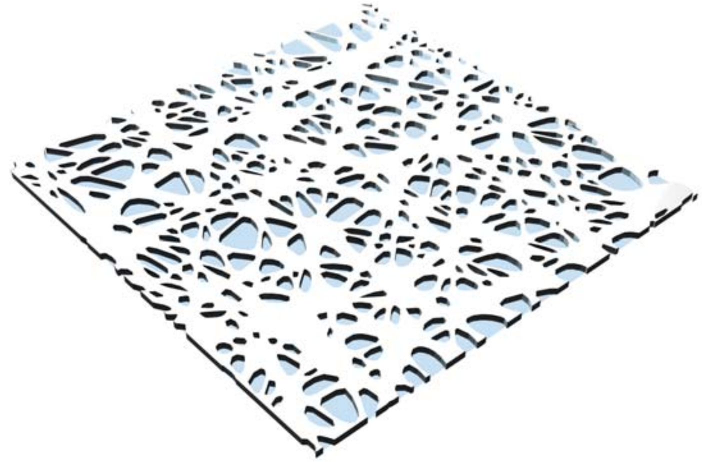

Figure 4.2: **Completed Physical Geometry**

was necessary was a simple extrusion of the bitmap. Instead of tediously tracing each line, the document was brought into Adobe Illustrator and the 'Live Trace' function was used to derive vector data from the raster image. This information was exported as a .dwg and we used controls within form•Z to reduce the number of vertices and control the poly-count of the extrusion. The final geometry was visually pleasing and time effective (Fig. 4.2).

A hierarchy of importance emerged in these approaches. For the landside roof, elements were separated both to enable workable rendering times and to allow for future edits to the surface geometry. For the concourse roof and facades, the dynamic between 2D and 3D, vector and pixel, was employed to allow us to manipulate different ideas within the most adapt interface, in this case Photoshop. Both solutions offered significant time savings and workflow advantages over traditional Boolean modeling approaches.

5. Rendered in Layers

When working on this competition, it was critical to rapidly produce images that quickly and easily conveyed our ideas. There were many circumstances where the time required to complete a modeling operation or rendering forced us to alternate methods. We often found it more helpful to obtain the look or structure of an image by isolating its elements and tackling them separately rather than trying to get the perfect image from a single rendering pass. Similar to Jeremy Birn's process of rendering in layers where one separates highlights, shadows and color[3], we separated distinct elements of the rendering to later be compiled in or produced in Photoshop.

The best example of this process can be seen in the main rendering of our concourse. Here, several elements were combined to give an overall feeling of lightness and resolution that would have been impossible to resolve in modeled geometry under the given time constraints. The base image (Fig. 5.1) provided the lighting, shadows, and colors for the scene on top of which other elements could be added. Rather than using complex mapping procedures to achieve the several openings in the interior surface, they were simply masked in Photoshop to expose the wintergardens and shops behind (Fig. 5.2). The illusion of depth was painted in using Wacom graphics tablets and glass was rendered out separately and layered in Photoshop (Fig. 5.3). The info screen which can be seen in the lower left corner of the rendering was flat mapped to the entire interior surface and masked in Photoshop so it would appear as an integrated element and avoid the procedures associated with placing a decal (Fig. 5.4). These and other processes were combined to gain the qualities we desired in the least amount of time. The separation of distinct elements also offered reduced rendering times and flexibility for each element within the final image (Fig. 5.5).

In our experience, architectural competitions are an exercise in graphic communication as much as in design. The processes of producing work for such an end require the creative manipulation of a variety of resources to accomplish architectural tasks within time constraints. Rather than relying upon a singular solution, it seems prudent to judiciously allocate tasks based on the strengths and compatibility between media. Throughout the production of 38N 82W Regional Airport, the design team utilized a variety of available tools to accomplish the end goal, projecting a positive and optimistic image of the future of air travel.

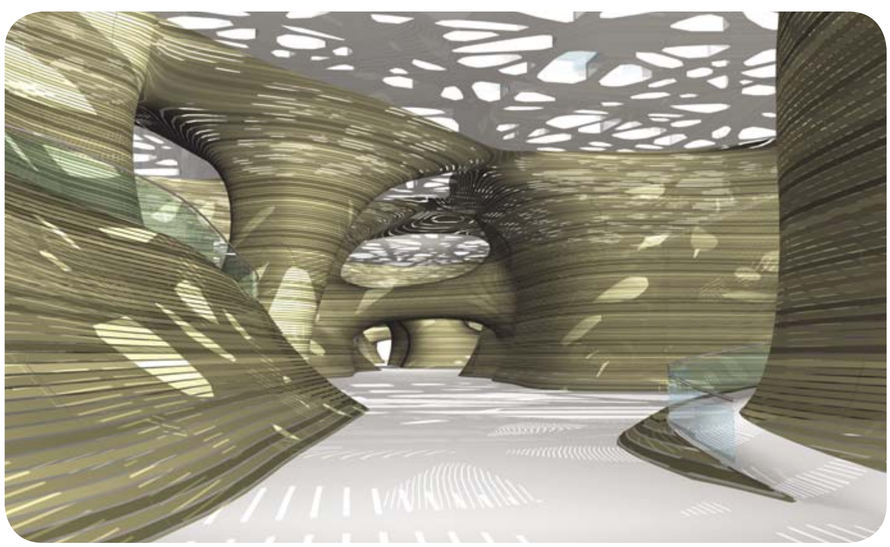

Figure 5.1: **Concourse Base Render**

Figure 5.2: **Photoshop Masked Openings**

Figure 5.3: **Glass for Reflections**

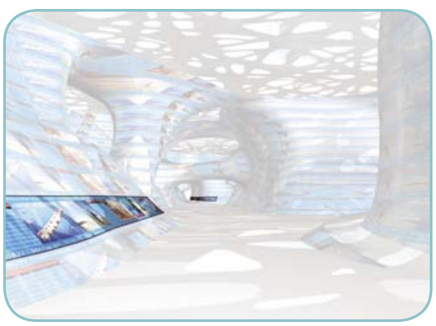

Figure 5.4: **Info Screen Image Map**

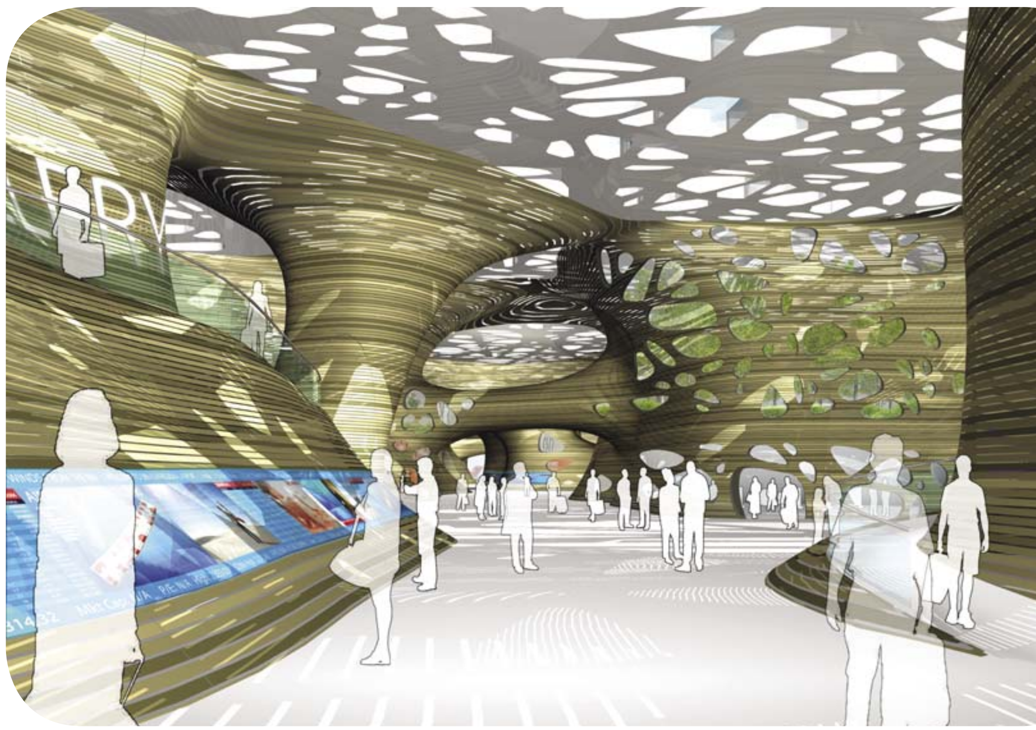

Figure 5.5: **Completed Concourse Rendering**

References

[1] https://acsa-arch.org/competitions/airport.aspx.

[2] Sloan, Gene. "Piecing together the perfect airport." *USA Today*. 24 March 2006, LIFE D 1.

[3] Jeremy Brin. [digital] *Lighting and Rendering*. New Riders Publishing. 2000. Berkeley California.

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James Diewald is an intern architect at Behnisch Architekten of Stuttgart, Germany. He is currently working on Harverd's Allston Science Project, a one million square feet laboratory facility with strong sustainable initiatives. James holds a Bachelor of Arts in Architecture from Miami University, graduating Magna cum Laude in 2006. He has received numerous awards for design excellence and service including the Alpha Rho Chi Bronze Medal in 2006. Most recently, James and colleague Michael Frederick won first prize in the ACSA sponsored, Airport Security Circulation design competition. James' work has received national and international attention and has been published and exhibited at several venues, including the Script, Beyond Media exhibition in Florence, Italy and the 2006 ACADIA Synthetic Landscapes symposium.

Michael Frederick is an architectural intern and a LEED AP for LMN Architects in Seattle, Washington. Originally from Cincinnati, Ohio, he attended Miami University as an undergraduate and completed his BA in Architecture in 2006. While at Miami, Michael received the Alpha Rho Chi Medal and the Potter Maxwell Excellence in Architectural Design Scholarship. Michael spent his time in academe collaborating on a wide range of design competitions and exhibitions. "38N 82W Regional Airport," was the winner of the 2006 ACSA Airport Design Competition as well as the winner of the 2006 Form Z Joint Study Award in the interiors category. Michael also was a contributor to Miami University's 2005 entry that received honorable mention for the EPA's P3 Sustainable Design Competition. Michael has jointly exhibited work at the ACADIA 2006 conference as well as collaborated on the design and production of an exhibition that was part of the Image – Beyond Media Exhibition in Florence, Italy in 2005. Both exhibits showcased important design methodologies, exploration of sustainable principles, and integration of emergent technologies such as Building Information Modeling.