Flying on the Edge of Sea, Land and Sky

A new passenger terminal for the Grand Bahama International Airport

Serge Ambrose

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This thesis is submitted to the Faculty of the
Virginia Polytechnic Institute and State University
in partial fulfilment of the requirements for the degree of:
MASTER of ARCHITECTURE

William Galloway, Committee Chairman - Associate Professor, Architecture

Antonio Trani, Committee Member - Associate Professor, Civil and Environmental Engineering

Kay Edge, Committee Member - Assistant Professor, Architecture

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A new passenger terminal for the Grand Bahama International Airport

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Ever since the airport was conceived as a permanent building type, airport designers have debated what identity an airport should embody. As a threshold of first impressions, the airport should not only introduce the visitor to the local environment but also represent the identity of a country. The aim of this thesis project is to design an airport terminal that reflects the natural and cultural environments of the islands of the Bahamas. Through its architecture, this building attempts to create an engaging experience for its users: passengers, employees and visitors. Local culture and sense of place are abstracted through architectural ideas, realized in the language of contextual modernism. The synthesis of the themes and concepts explored throughout the design process are presented through drawings and commentary. Precedents such as the Taino cosmos, color and nature, place and culture are used to inspire structural systems, form and aesthetics. The plan of the new airport terminal fulfils the functional program while interpreting the land and sea formations of the Bahama islands; ocean currents and land-sea patterns may be associated with movements of people and machines, converging and diverging within the airport environment.

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Kay Edge, Assistant Professor of Architecture

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Ideas:

Having experienced so many banal airports, the aim of this thesis project is to design an airport terminal that reflects the natural and cultural environments of the islands of the Bahamas. Local culture and sense of place are abstracted through architectural ideas, realized in the language of contextual modernism.

The airport, as a threshold of first impressions, should not only introduce the visitor to the local environment but also represent the identity of a country. Through its architecture, this building attempts to create an engaging experience for its users: passengers, employees and local visitors.

Traveling is an act of discovery. Just as Christopher Columbus arrived in the Bahamas in 1492 and discovered the New World, passengers arriving at the new Grand Bahama International Airport will be introduced to a new place and culture. Acting as a transitory space between ground and sky, this airport emphasizes the excitement of travel and flight by making the users more aware of their surroundings and of the aircraft. Views looking out from the building are selected as compositions of machine, land and sky.

The culture of the Bahamian people is revealed through the use of color, material and art; these reflect the different traditions of its people through history (the indigenous Lucayans, Eleutheran settlers, the African migration, the British colonial rule and finally the independent nation). The interior colors and textures reflect the natural environment of the Bahamas; the colors of the sea, sun, plants, shells and the artifacts of the Junkanoo festival that is one of the most popular expressions of Bahamian culture. Wall murals portray images of Bahamian life and terrazzo floors depict scenes of nature.

Structure:

The building's structure utilizes a basic system of column and plate. The field of columns, a loose representation of the Grand Bahama pine forrests, raises the building off the ground safely above hurricane storm surges. The concrete floor plate, supported by these columns, hovers over areas of water; this gives the impression that it is floating on a shallow sea and serves as a metaphor of the Bahamian islands. The columns act as the ground/ sky connector, modeled after the cosmos of the Taino Indians. The inner column of concrete, grounds the building while the surrounding column of light links it to the sky.

These columns elevate the building off the ground to facilitate air circulation and passive cooling thus responding to the climate. The large overhanging roof resembles an aircraft wing and acts a shield from sun and rain while letting light into the column apertures. The large surface area is covered with photovoltaics, acting as a power generator for this airport.

Form and Space:

The "fractured" plan of the new airport terminal fulfills the functional program while interpretating the land and sea formations of the Bahama islands as seen from the skies above. The view of the Bahamas from air and space is unique; ocean currents and land-sea patterns may be associated with movements of people and machines, converging and diverging; in the design of the airport these are translated into built form.

The plan of the airport terminal is conceived to be flexible; all interior partitions can be moved as the airport adjusts to its changing functions and future growth. The autonomous "island" arrangement allows a more flexible and non-confining approach to expansion. This building addresses ever increasing airport security requirements while ensuring that these do not overshadow the poetic experience of the new airport.

From Metaphor to Context: Positions in Airport Design

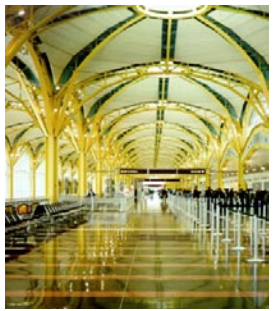
From Metaphor to Context: Positions in Airport Design

Ever since the airport was conceived as a permanent building type (early airfields had only temporary structures), many different positions regarding its design have been adopted.

Designers of airports have debated what identity an airport should have. These different directions can be categorized into five groups:

1 Evoking Flight and the Form of the Aircraft
2 Monumentality: High-Tech vs. Low-Tech
3 International Modernism
4 Reflecting the Local
5 Contextual Modernism

1



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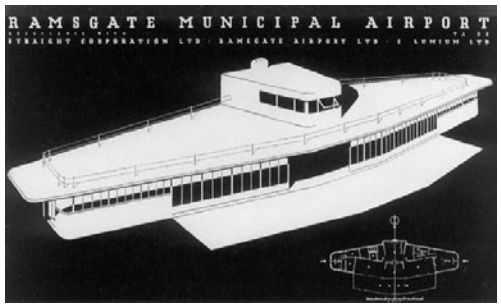
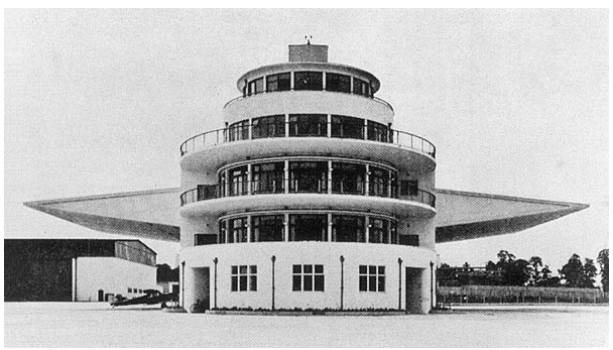
Evoking Flight and the Form of the Aircraft

Through history, many architects and engineers have taken the approach of making the airport building evocative of flight. Others have even attempted to design the airport to look like the aircraft itself. In 1937 architect D. Pleydell-Bouverie designed the Ramsgate Municipal Airport (ill. 1) in a wing shape that would be recognizable both on the ground and from the air.



1 Ramsgate Municipal Airport
Kent, England (1937)



2 Elmdon Airport
Birmingham, England (1939)

Similarly, the Birmingham airport of 1939 (ill. 2) had wings that cantilevered from a central core to protect passengers and cargo from the weather.

In 1963, Eero Saarinen's TWA terminal at New York's JFK airport (ill. 3) opened to great acclaim. Constructed of cast-in-place concrete, the expressionist form is a symbolic suggestion of flight.

Completed in 2000, Sondica airport in Bilbao (ill. 4), designed by Santiago Calatrava, utilizes a steel structure to create its soaring futuristic aerodynamic form.

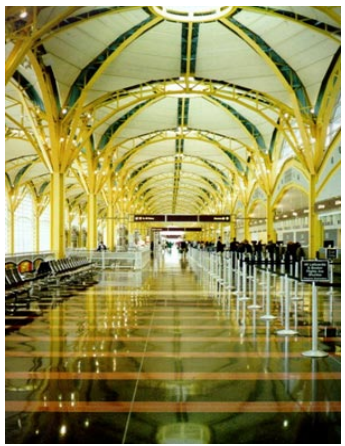
4 Sondica Airport
Bilbao, Spain (2000)

5 Domestic Satellite Terminal
Heathrow Airport, London (1993)

3 TWA Terminal, JFK Airport
New York (1963)

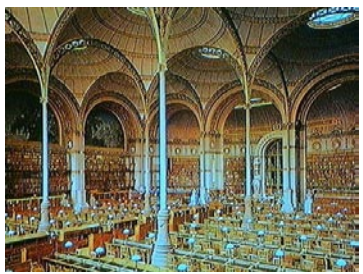
Nicholas Grimshaw & Partners design for a new domestic satellite terminal at London's Heathrow airport (ill. 5) mimics the fuselage of an aircraft. This approach has garnered criticism because it has been viewed as too literal.

Rather than seeking to evoke flight, the monumental examples presented here seek to create expansive public spaces by employing high-tech or low-tech methods and materials.



1 Washington National Airport
Wasington D.C. (1997)

The monumentality of Cesar Pelli's design for the Washington National Airport (ill. 1) recalls the lofty iron domes of Henri Labrouste's reading room for the National Library (ill. 2) in Paris (1868) .



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Stuttgart Airport
Stuttgart, Germany (1997)

3

In the Stuttgart Airport by von Gerkan Marg & Partner (ill. 3), giant tree-like structures support a monumental roof canopy over the large airport hall. The experience evokes both the natural and the man-made world.

The architect Rafael Moneo takes a different approach towards the materiality of monumentality for the Seville airport (ill. 4). He looks to ancient Rome and Moorish traditions to give solidity and grounding to the building.

"Experience has taught us that an airport cannot be compared to an airplane, whether in terms of materials or in terms of form." Rafael Moneo, Architect

4 San Pablo Airport
Seville, Spain (1992)

International Modernism

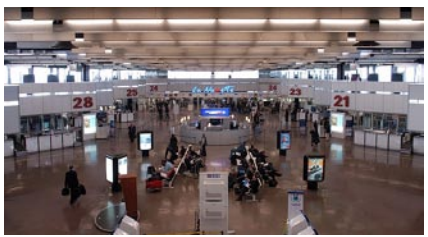
This approach goes back to the 1950's when the International Style became the desirable common expression for airports. During those years progress was associated with modernism based upon an architecture of efficiency at the expense of tradition. Even today many new airports are designed in the manner of International Modernism which continues to disregard the specificity of site and culture.

1 International Arrivals Building, JFK Airport
New York (1957)

The International Arrivals Building at JFK by SOM (ill.1) is a quintessential example of corporate international style in America. The tower and the curtain wall are hallmarks of this approach.

Following the lead of America, many European airports such as Schiphol (ill. 2) and Orly (ill. 3) embraced the International Style. While this architecture has its origins in European functionalism and rationalism, the Americans offerred a distilled language that reflected their jet-age ideals.

2 Schiphol Airport
Amsterdam, Holland (1967)



3 Interior of Orly Airport
Paris, France (1961)

Renzo Piano's solution for the Kansai Airport (ill. 4) is driven by the artificiality of its man-made island site. Not unlike previous examples of International Modernism, Kansai uses glass and steel to create an abstract place for global travel.

4 Kansai Airport
Kansai region, Japan (1994)

Reflecting the Local

Many airports that are located in countires with tourist based economies take their design cues from traditional and vernacular architecture. More often than not, traditional materials are used to evoke a romantic ideal of the country and culture. Rather than interpreting tradition, this picturesque approach can offer an all too literal solution to the modern airport design.

1

2

Punta Cana Regional Airport
Punta Cana, Dominican Republic (1984)

3

At the Punta Cana airport (ills. 1-3), in the Domincan Republic, the forms of vernacualr dwellings are rescaled to create a series of open-air pavillions.

At Bali's Ngurah Rai airport (ill. 4) traditional Balinese palace and temple architecture is used to create a sense of place. In this design the traditional tectonics of wood are replicated using re-inforced concrete and steel tube (ill. 5). Traditional clay tiles, brick and stone are used for cladding of roofs and facades.

4

Ngurah Rai Airport
Bali, Indonesia (1992)

6

The use of traditional pagoda - like structures (ills. 6-7) allow for the creation of open air walk-ways that take into account the tropical climate.

5

7

Contextual modernism

As a reaction to globalization many countries, regions and cities have adopted a contextual modernsim as a way of dialoguing with the past, present and future. By recalling important environmental or cultural identities, using traditional forms in modern materials and technology, these airports foster an experience that is both local and global.

1 Denver Airport
Denver, Colorado (1995)

At the Denver International Airport by Frentress-Bradburn (ill. 1), tensile structures playfully evoke the peaks of the Rocky mountains. Here the users are continuously reminded of a regional identity that is based upon the landscape.

3

2 Haj Terminal
Jeddah, Saudi Arabia (1981)

SOM's and Fazlur Khan's design for the Haj Terminal at the Jeddah International Airport (ill. 2-3) employs a modern form of the traditional desert tent found in the Middle East. The tensile fabric roof structures allow for light and shade in the extreme heat of the desert.

5

4 Kuala Lumpur International Airport
Kuala Lumpur, Malaysia (2000)

In his design for the Kuala Lumpur International Airport (ill. 4-5), Kisho Kurokawa takes into account the tropical climate of the region and clads forms inspired by Arabic sources with indeginous wood. By doing so he creates a symbiosis between climate, culture and a global modernity.

How an Idea Developed: Origins and Possibilities

How an Idea Developed: Origins and Possibilities

The Bahamas is a realm where sea, land and sky converge and where the natural environment should be revered. The built environment should be acutely aware of this context. In developing the ideas for this airport project, several themes and criteria were identified as sources of design inspiration.

1 Formed by Water
2 Climate
3 Flying into the Site
4 Land
5 People and Culture
6 Tectonics
7 Color and Nature
8 Color and Places


1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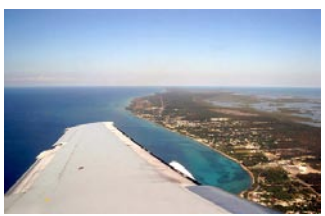
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Formed by Water

The islands of the Bahamas were formed by the calcified build up of marine organisms over thousands of years. Currents of wind and water have shaped them.

When the sea and land formations of the Bahamas (ill. 1-2) are seen from above (either from space or sky) one can observe ocean currents and sand rills (ill. 3), endlessly converging and diverging. An infinite palette of blue and green characterize an environment that is in constant flux.

Arguably, these flows and patterns (ill. 4) are similar to the movements of people, cars and aircraft at an airport (ill. 5-6).

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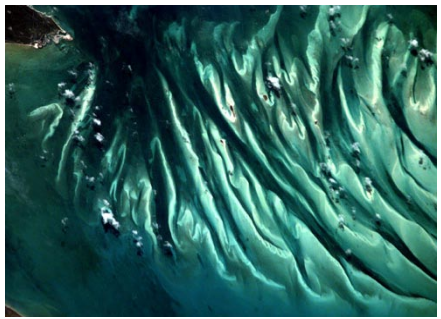

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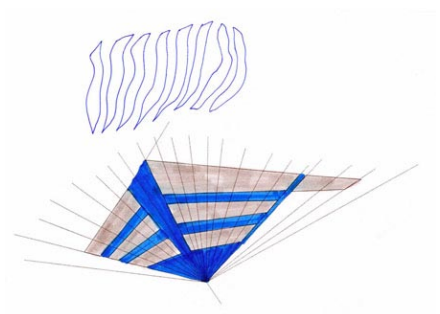

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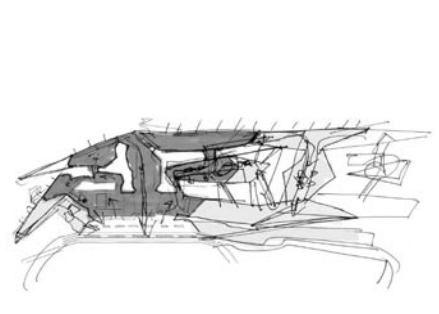

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Formed by Water (cont.)

Currents of water and wind sculpt the grains of the great Bahamian sand bars. The formations produced are everchanging; while seemingly endless, they are ephmeral and will be washed away by the next tide.

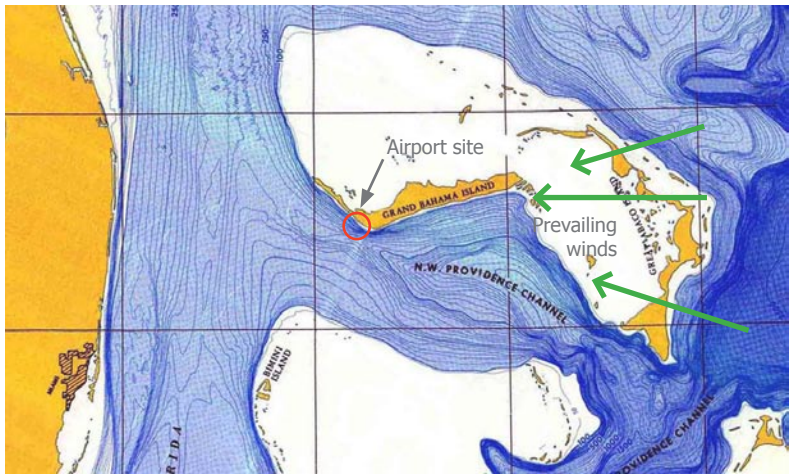
These images were photographed on the east end of Grand Bahama island over a period of two years.

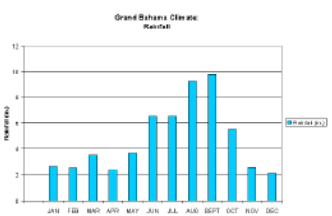
Climate

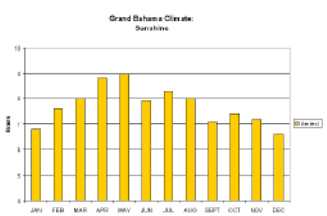
Located approximately 70 miles off the coast of Florida, Grand Bahama island forms the northern end of the Bahamas archipelago.

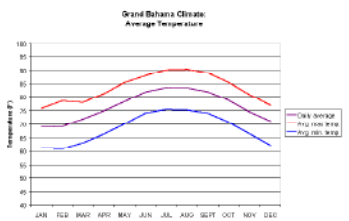
The climate in the northern Bahamas is classified as subtropical maritime with wet and dry seasons. Prevailing winds generally approach from the East, ranging in between Northeast and Southeast directions.

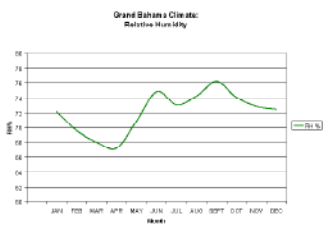
The ocean waters are warmed by the current of the Gulfstream passing in between Grand Bahama and the Florida coast. Although relative humidity can reach levels of seventy percent, a steady breeze makes the air feel less humid. The rainy season runs from June to October. Severe weather can occur in the form of thunderstorms and hurricanes.





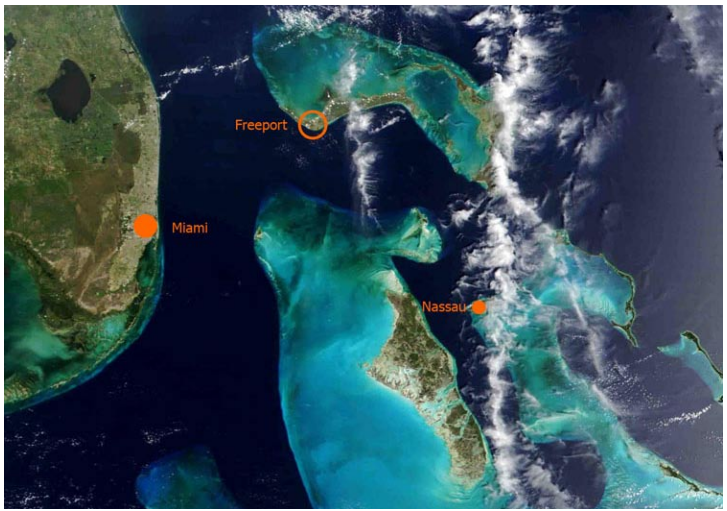


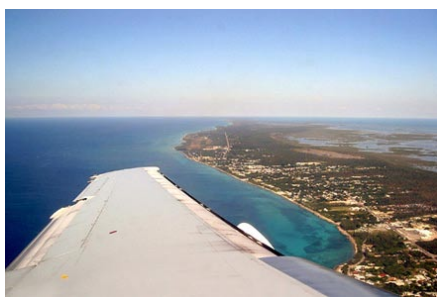




Flying into the Site

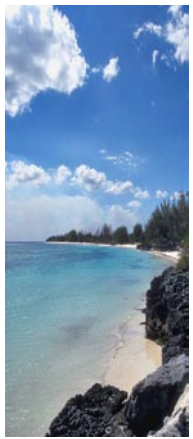
The turquoise waters and shimmering sand banks that one sees when flying over the Bahamas makes for a visually rich experience. Since this landscape is always in flux one would expect an important public building such as airport to capture the spirit of place by engaging this quality. The existing airport is a static building that could have been built anywhere.

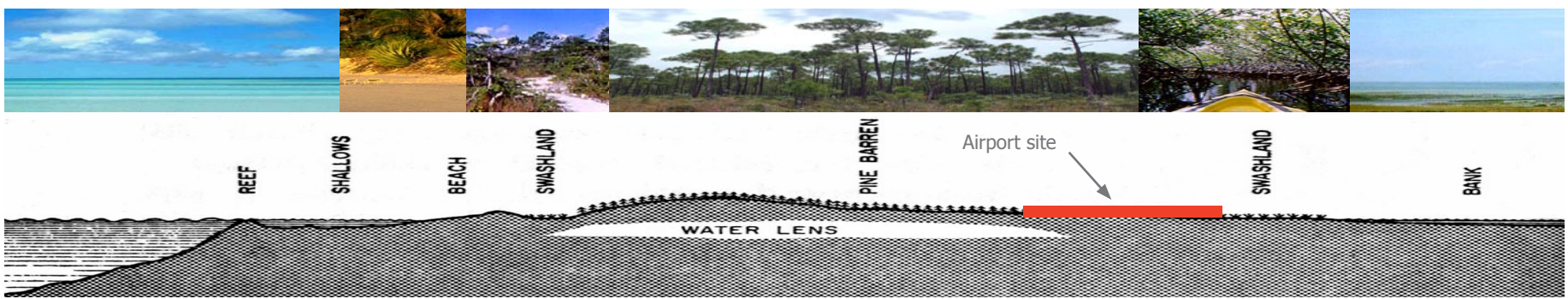




Land

The islands of the Bahamas were created over thousands of years by layers of sea fossils deposited as sedimentary limestone. Blue and green waters, white sand beaches, rocky outcrops, pine forests and mangrove swash make up the landscape of Grand Bahama island. The airport site is located in between the pine forest and swashland regions. With an average elevation of seven feet above sea level, the airport is prone to flooding during the frequent tropical storm surges. All new buildings in the region must be raised off the ground using pilotis or a plinth.





Topograpy of Grand Bahama Island (North-South cross section)

People and Culture

The first inhabitants of the Bahamas were the Lucayan Indians (part of the Taino Indian group). In 1492 Columbus arrived in the Bahamas; he was the first European to see these native Caribbean people. Not long after, the Spanish conquest began leading to the transfer of the indigenous population to the gold mines of Hispanola. In the 1650's after a period of complete depopulation of the islands, the Eleutherian Adventurers arrived and settled the Bahamas and laid the ground work for the islands to become united as a colony of the British crown. During the 18th century the African population arrived as slaves. By the mid-nineteenth century slavery had been abolished in the Bahamas and in 1973 the Bahamas became a proud independant nation.

Given the history of slavery and colonialism, an authentic identity for the contemporary Bahamian people has been difficult to pinpoint. The Junkanoo festival is an exception; with it's riotus color and lavish costumes it functions as the most popular expression of Bahamian culture today (ill. 1-2).

3

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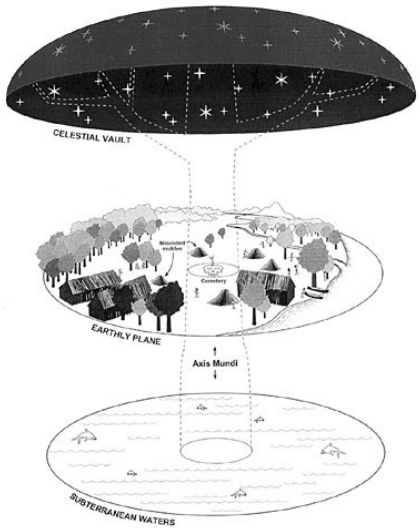
The indigenous Taino Indians conception of the cosmos is based on a tripartite system (ill. 5). The three elements are: the celestial vault (the heavens), the earthly plane (the ground) and the subterranean waters (the ocean depths). The earthly plane hosts the dwellings of the Taino (ill. 3). Over time these temporary dwellings evolved into the current day vernacular Bahamian dwelling (ill. 4)

The concept of the Taino Cosmos strongly influences the structural system of the airport building.The "earthly plane" relates to the concrete floor plate of the building while the "subterranean waters" relate to the reflecting pools and the celestial vault relates to the roof structure. The central "axis mundi" or the tree of life relates to the column of light that functions as a conduit of light and environmental systems.

An important Taino artifact that also served for design inspiration are the carved stone Zemis (ill. 6). This three-pointed bird-like form recalls an organism in flight.



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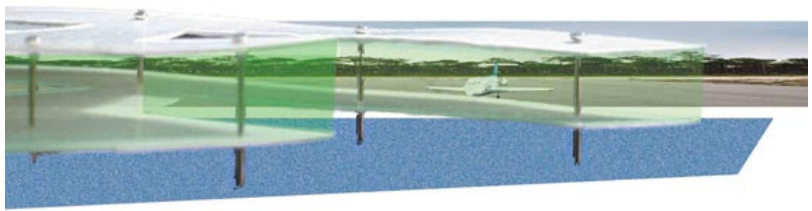
The column is a basic element of architecture and appears in both natural and man-made forms. The Bahamian fishing trap (ill. 1) is a primitive construction of vertical wood elements bound together and traversed by currents of water. These vertical elements support a horizontal platform. While this is a non-inhabitable construction, the structural schema can be replicated on a larger architectural scale. This primitive example of column and plate inspired the preliminary concept collage for the airport (ill. 2).



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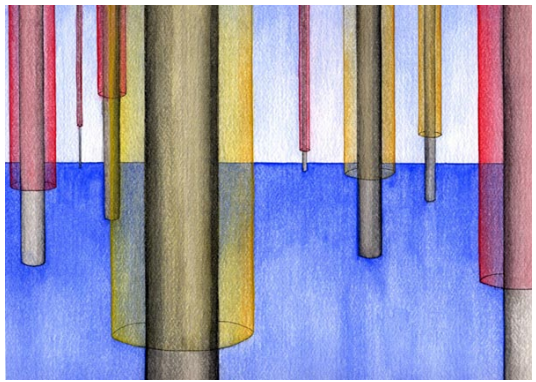
When a building is vast in scale (whether ancient of modern) and columns are used as the main structural element, they inevitably create the impression of a field of columns; seen for example in the ruins of Chichenitza (ill. 3). Combined with horizontal elements, the column can be used to elevate a building off the ground (as with Le Corbusier's pilotis). Since GBIA is located in a flood-prone area of the island, it is mandatory that all future buildings be raised above the ground (as depicted in this early model) (ill. 4).



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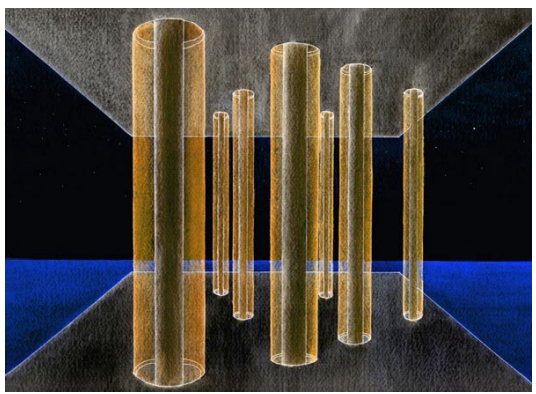


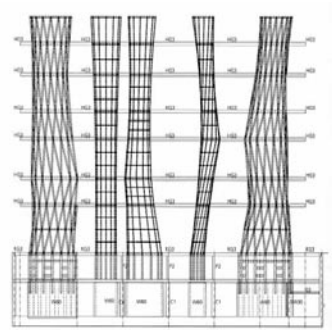
2

The airport is a place of transit between ground and sky. Can a column connect the ground to the sky? If so, how could this be architecturally possible? In the above conceptual drawings (ill. 1-2), columns rise out of the water while shafts of light descend from above. The column creates a connection between sea, land and sky. In this way, light is captured by architecture.

3

The Japanese architect Toyo Ito has explored the idea of columns as conveyors of light and building systems. In his Tower of Winds (1986) (ill. 3) Ito suggests that light and sound can be conveyed vertically. In his Mediatheque for Sendai (2003) (ill. 4-5) tube columns become giant conduits for the movement of people and building systems.

4



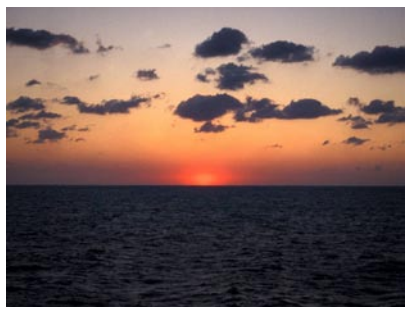
5

Color and Nature

The colors of nature in the Bahamas form an incredibly vibrant palette. Both plant and marine life contribute to the range of colors found on land and in the sea. The colors of the flora and fauna are set against a luminous backdrop of cream sands and blue skies.

While some organisms have subtle shades of color, others are intense. Many of these colors are used for attraction and camouflage.

These colors have inspired the palette of the new design for the Grand Bahama International Airport. These colors reflect the natural environment of the Bahamas and reinforce a sense of place.



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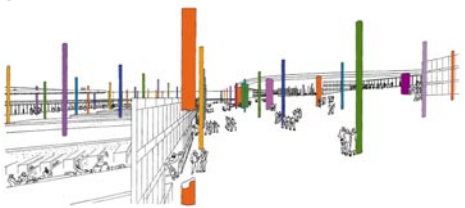
4

As in most of the islands of the Carribbean, the Bahamian people have always used color as a way of distinguishing their dwellings and places of business; they use a vibrant color palette that is found in their natural environment. While some use colors as surface (ill. 1-2), others use color as accent (ill. 3). Island artists like Tiffany Cant have captured this quality on canvas (ill. 4).

Color is the common link between the natural and the man-made environment. The design for the new airport draws upon this relationship; by using colorful columns to create a festive atmosphere and mark specific zones in a vast space. Whether it is a first time visitor or airport employee, the experience of seeing these colored columns should ingnite their imagination about what lies beyond the airport.

3



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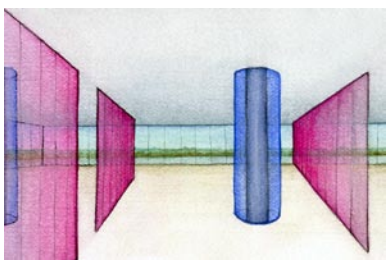
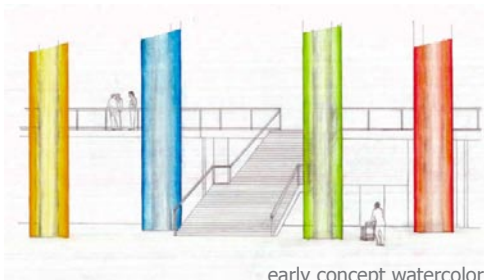


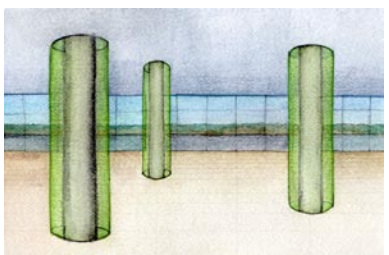
6 early concept watercolor

During the design process the idea of using colored columns emerged as a way of experiencing culture and as a visual wayfinder within the airport building (ill. 5-7). An intervention of color onto Le Corbusier's drawing for the Palace of the Soviets, Moscow (1933) helped to clarify this idea (ill. 8).



early concept watercolor

5



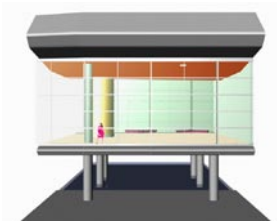
7 early concept watercolor

Designing the Grand Bahama International Airport

The synthesis of the themes and concepts explored throughout the design process can be experienced in the drawings for the new Grand Bahama International Airport.

1 On site
2 Plans (Development and Final)
3 Elevations (Development and Final)
4 Sections
5 Perspectives of Experience
6 Details
7 Special projects

1



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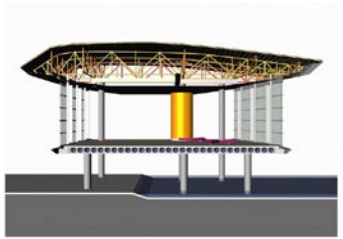

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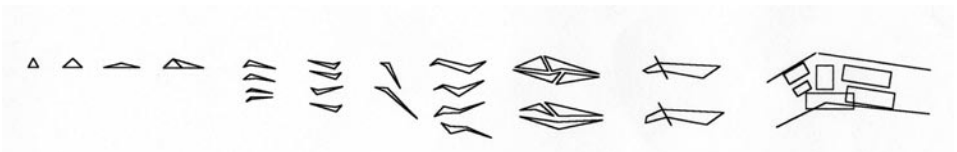

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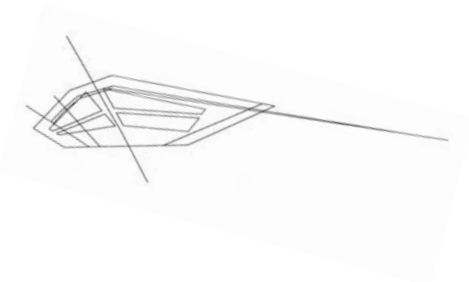


5

6

7

On site

The new terminal for the GBIA will be placed on a green site located to the east of the existing terminal complex. This new site is more strategically located to the primary transportation route and the original planning axis of the city. The existing terminal will subsequently be transformed into a cargo handling complex as it is closer to the air-sea business park.

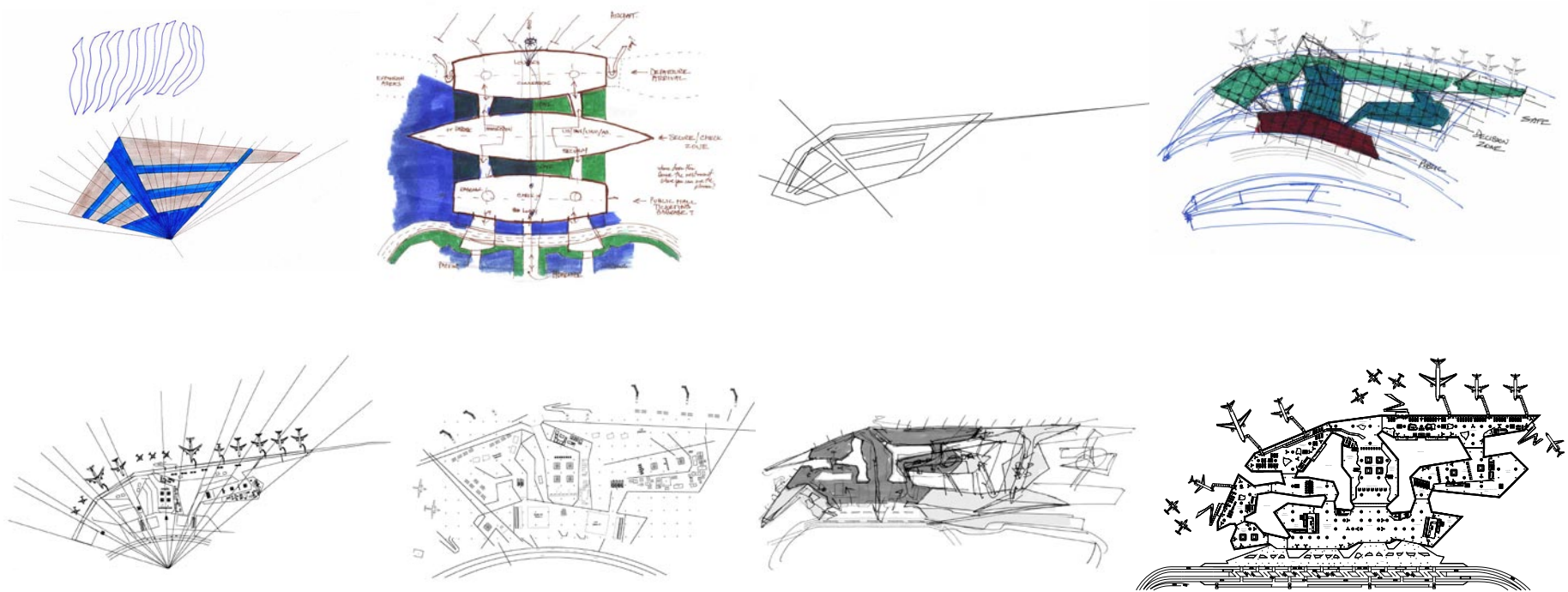
1

The orange dot indicates the proposed location of the new terminal on a green site (ill. 1). The orange circle shows the new terminal as it would be built on the site (ill. 2).

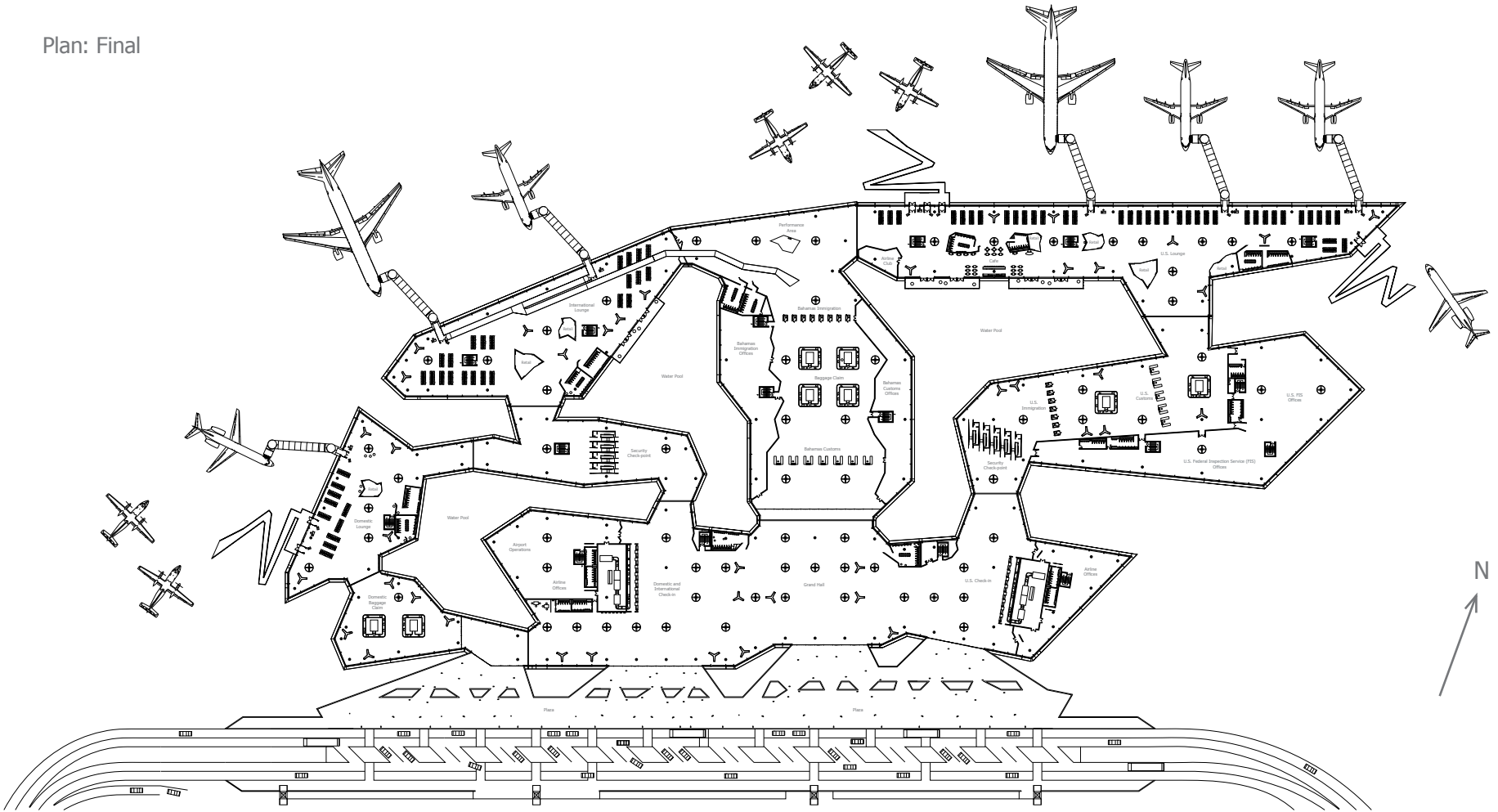
2

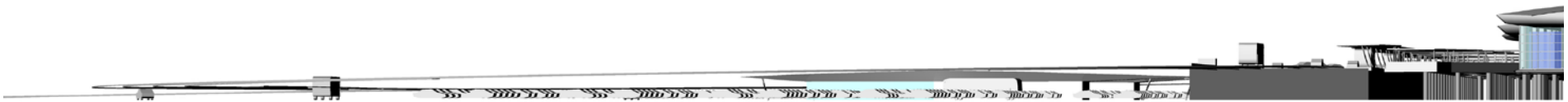
The Grand Bahama International Airport (GBIA) is located in the City of Freeport on Grand Bahama island. The original buildings and runway of the airport were built in 1950's. In the early 1970's an 11,000ft. runway was added to accomodate jumbo-jet service. Throughout the 1970's and 1980's several additions were made without a master plan in mind. In 2004 a substantial expansion was made to the existing terminal. This addition was simply a "decorated shed", which architecurally, left much to be desired. It is hoped that the propsed new terminal will contribute to a renewed civic identity of Freeport.

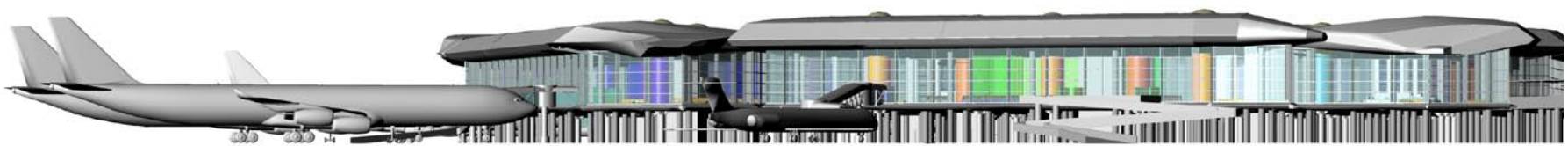
GBIA circa 1969

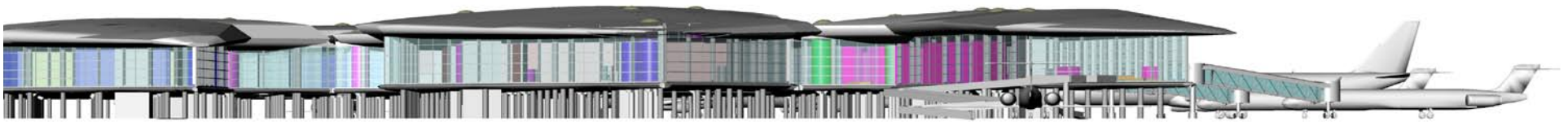


Chronological summary of preliminary sketches for the development of the final passenger terminal plan


Performance Area
Airline Club
Cafe
U.S. Lounge
Retail
International Lounge
Cafe
Retail
Bahamas Immigration
Water Pool
Bahamas Immigration Offices
Baggage Claim
Bahamas Customs Offices
Water Pool
U.S. Immigration
U.S. Customs
U.S. FIS Offices
Security Check-point
Bahamas Customs
Security Check-point
U.S. Federal Inspection Service (FIS) Offices
Cafe
Domestic Lounge
Water Pool
Airport Operations
Airline Offices
Domestic and International Check-in
Grand Hall
U.S. Check-in
Airline Offices
Domestic Baggage Claim
Plaza
Plaza
N

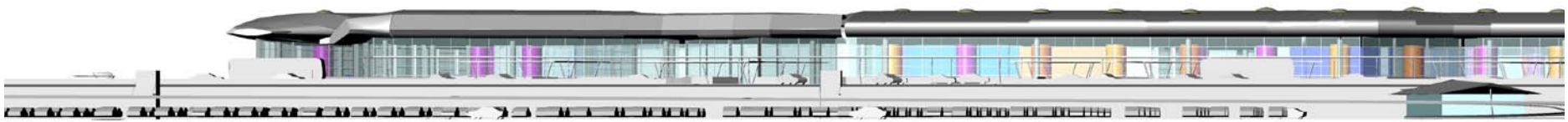


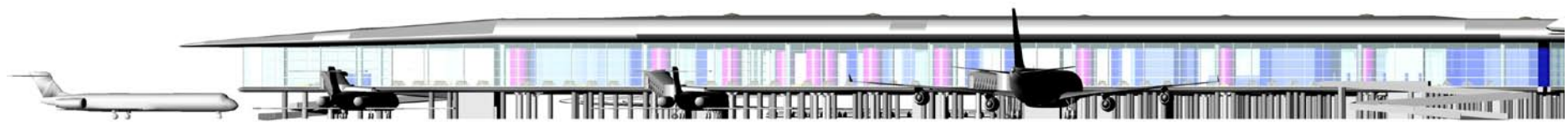


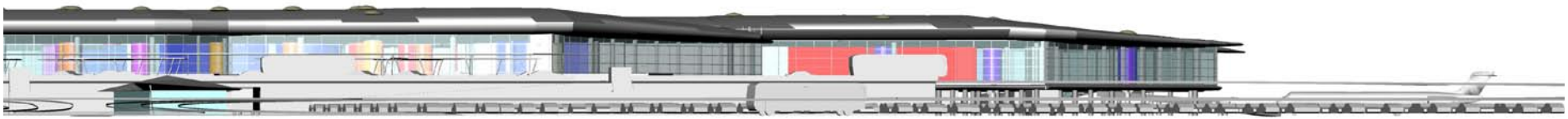


East elevation

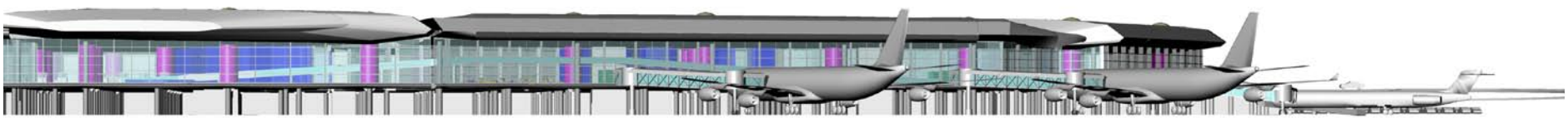
West elevation







Landside elevation

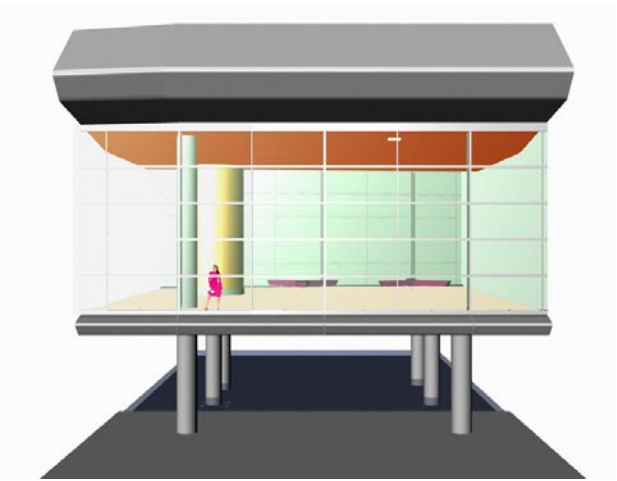


Airside elevation

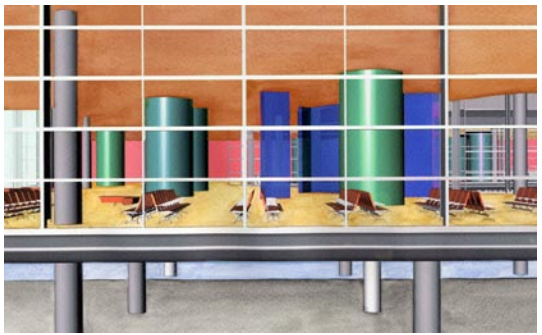
Elevations: Development

As in most modern ariports, the desire for expansive views of land, sky and machine necessitate large expanses of glass. This approach is also taken for the design of the GBIA.

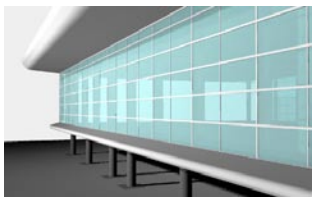
Thus, the elevation is a cumulative result of a large transparent facade and the structural elements that make up the building: column, floor plate and an air-foil-like roof.



Elevation study model



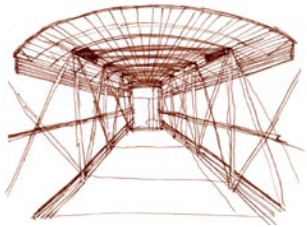
Perspective elevation of U.S. Lounge



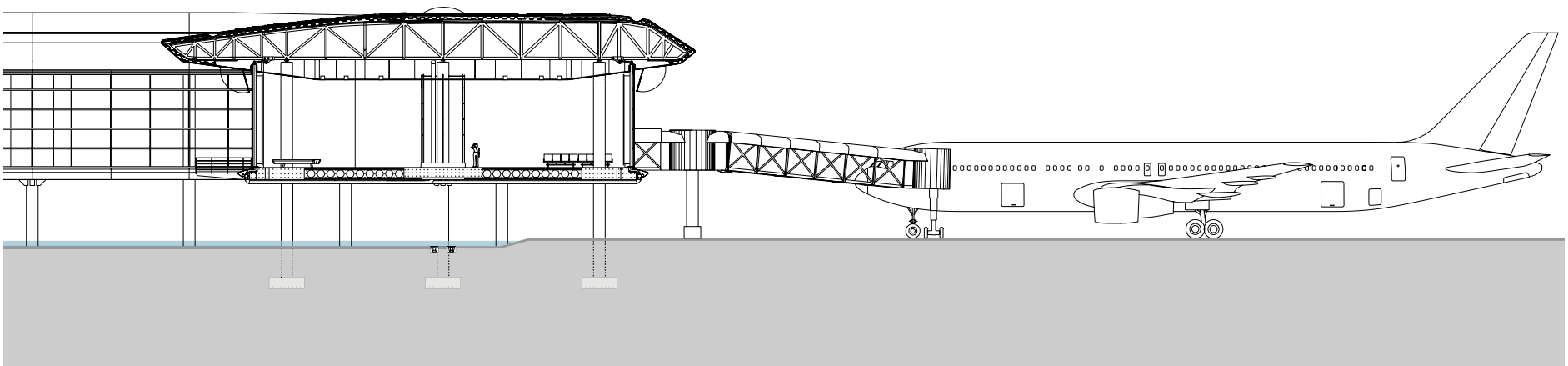
Elevation study model

Sections

Section drawings offer an opportunity to observe different scales and relationships between the building, aircraft and the human being.



The jetbridge serves as a mediator between the building and the aircraft.

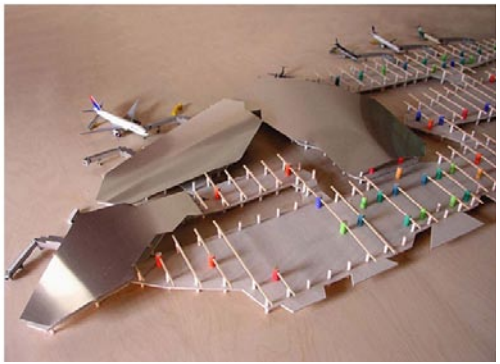


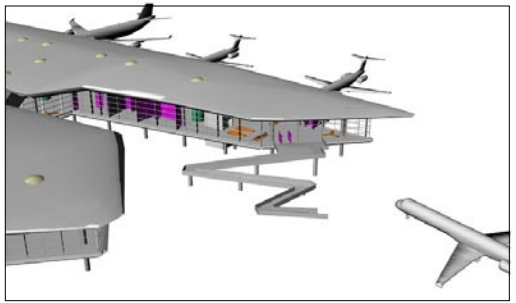
Building section through U.S. Lounge

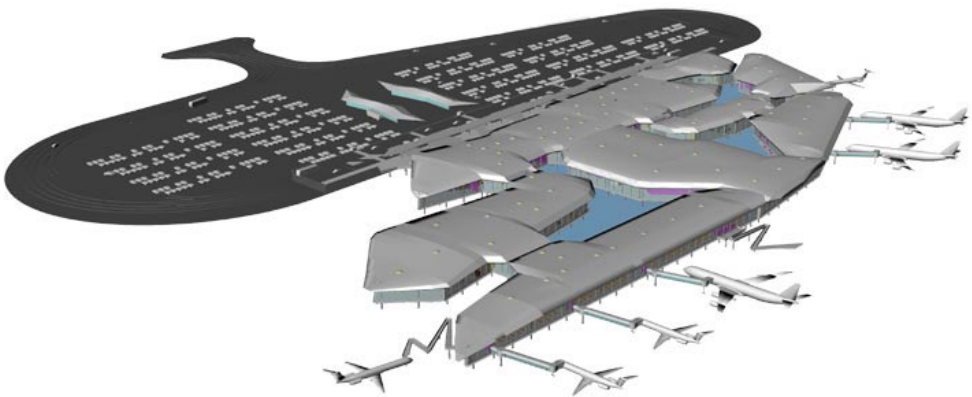
Full building cross sections

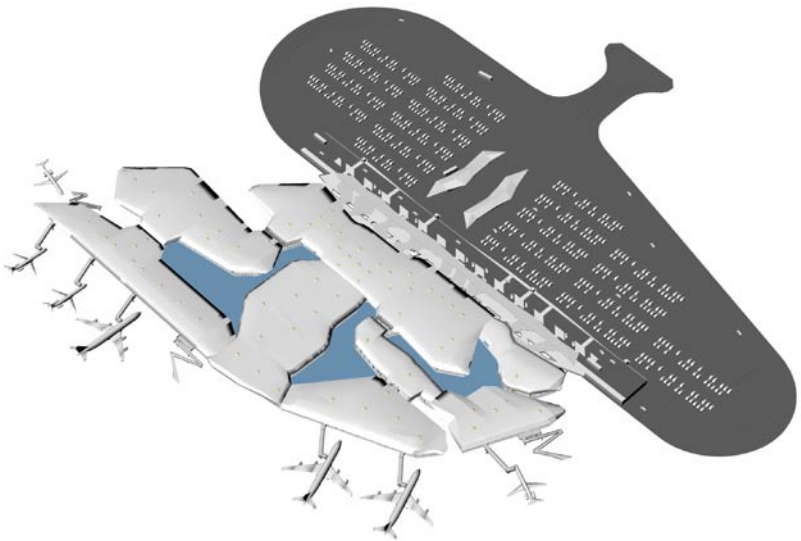
Perspectives: Airport model

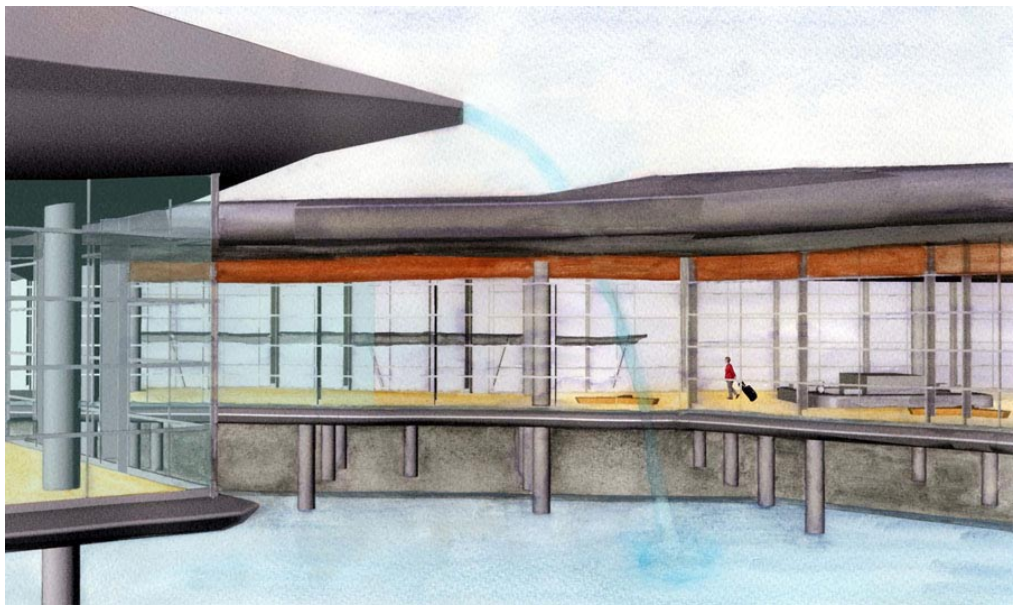
The use of both digital and physical models helped to test design concepts and structural systems. A physical model at 1:500 scale was constructed; a digital model was developed using Rhinoceros 3D modeling software to assist in the design of complex components such as the roof system and curtain wall.



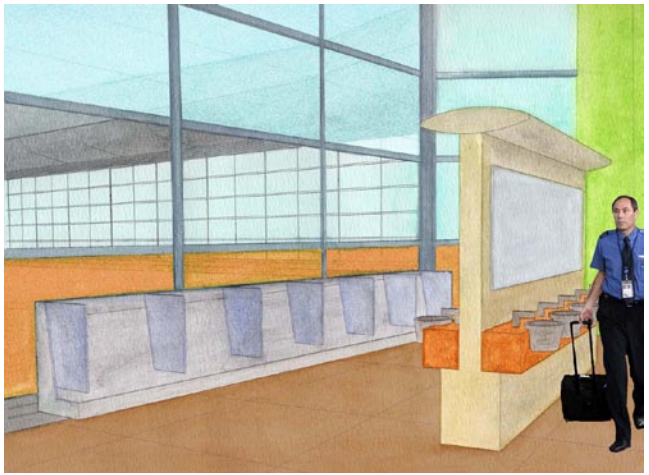








View across water pool towards Domestic terminal baggage claim



Men’s bathroom - Domestic terminal

A view to the water

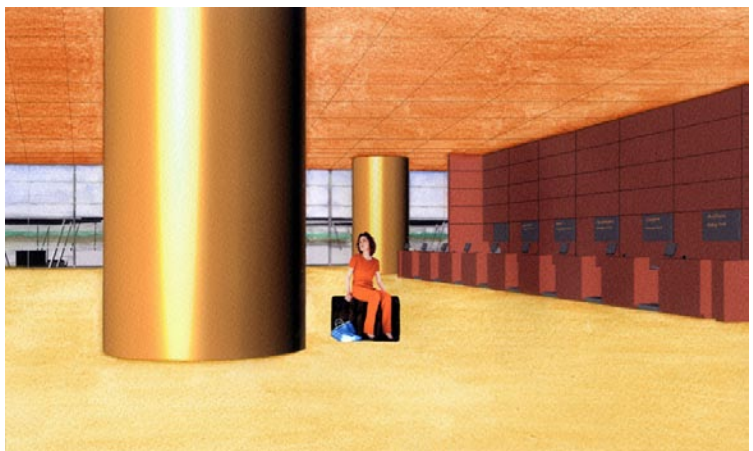
In most airports, bathrooms are windowless and located in the interior of the building. For the GBIA, whenever possible, bathrooms are placed along the building perimeter so that natural light can illuminate the spaces. Users have views to the outside while shoulder height obscured glass provides privacy. In the women’s bathrooms, sinks rather than urinals, are placed along the window.

International and U.S. Baggage Claim Hall

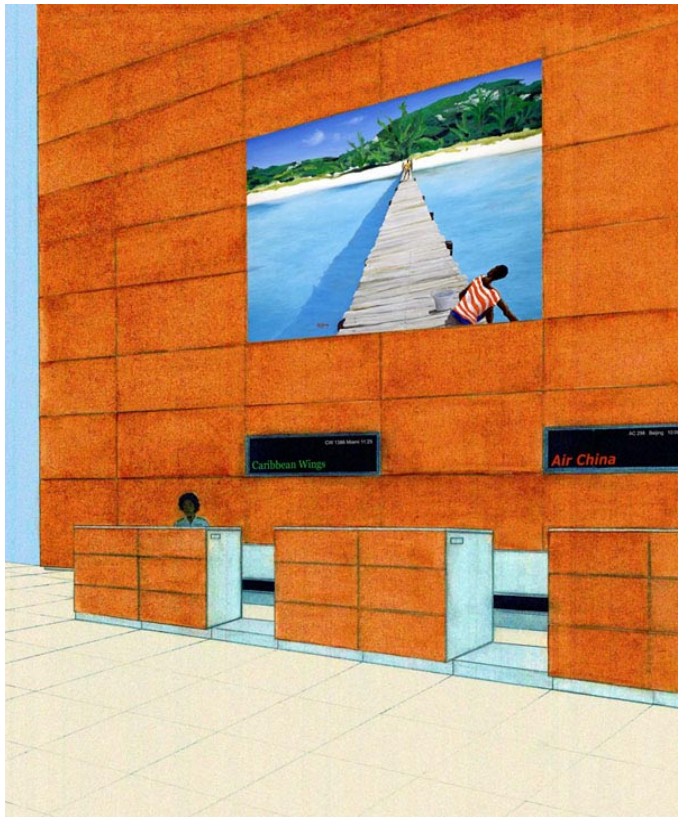
After passing through Bahamas Immigration, arriving International and U.S. passengers collect their bags and proceed through Bahamas Customs.

Leaving Bahamas Customs

Check-in desks at the GBIA can be assigned to any airline that serves the airport. Large LCD screens display airline logos and flight information.

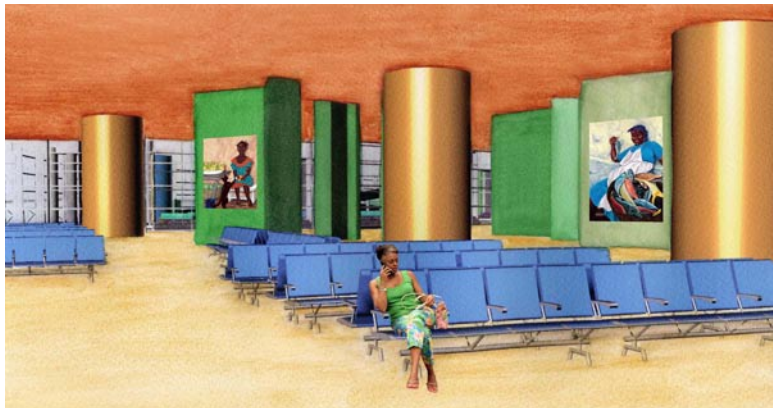


Domestic check-in area

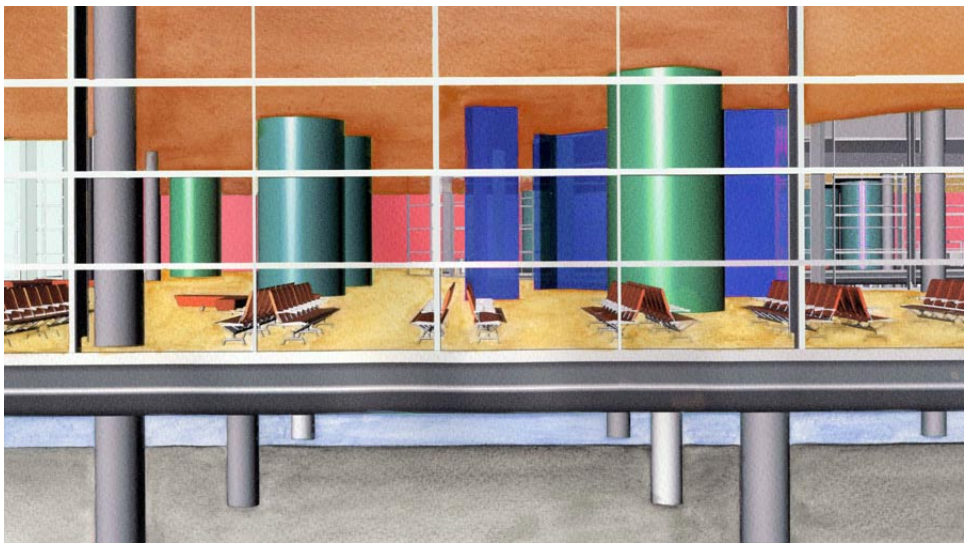


International check-in area

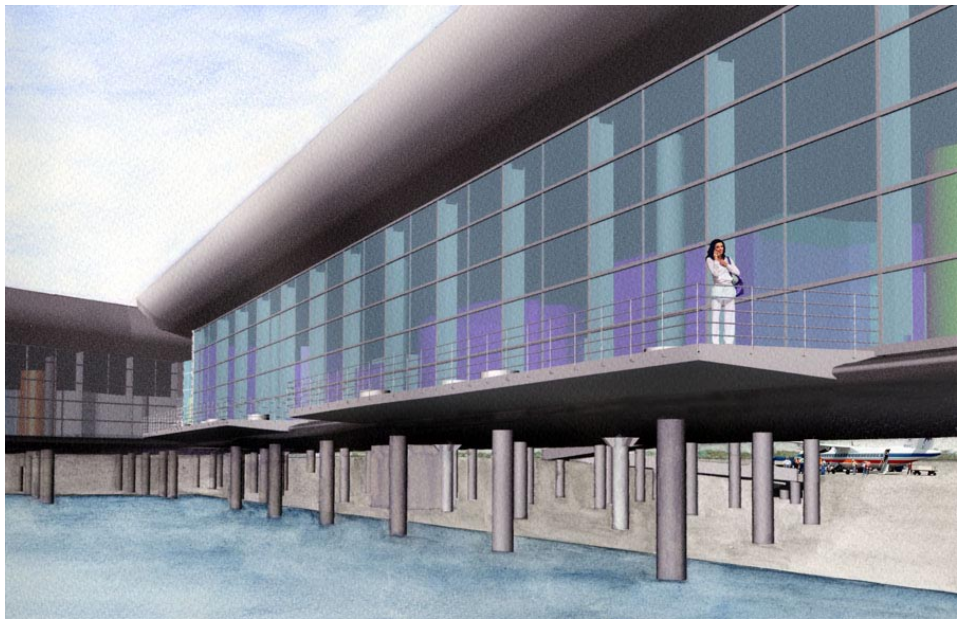
Works of Bahamian art are placed throughout the terminal to evoke a sense of place. Here, "The Dock" by island artist Tiffany Cant is displayed above the check-in areas.



Domestic Lounge



U.S. Lounge

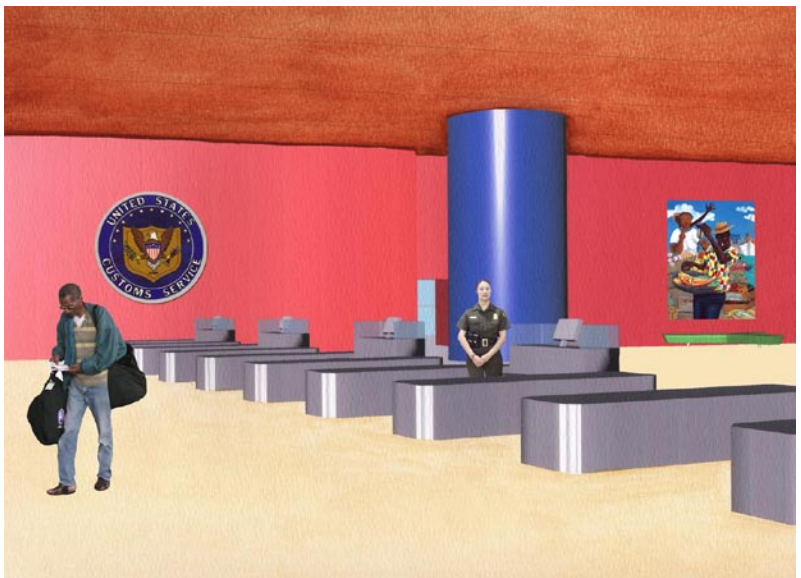


View of U.S. Lounge waterside balconies

These balconies give passengers an opportunity to step outside to relax and enjoy the view of the airport and the water pools.

Experiencing the Column of Light

The U.S. Federal Inspection Service includes Immigration, Customs and Agriculture. At the GBIA, these functions are contained in the U.S. FIS Building located between the Main Check-in Hall and the U.S. Lounge.



Leaving U.S. Customs

Entering U.S. Immigration

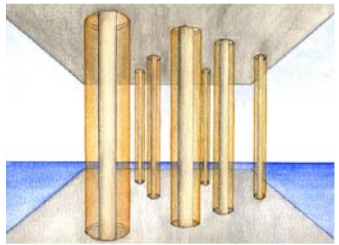
The Bahamas is one of a few countries (including Canada and Bermuda) in which U.S. Federal Inspection Services (FIS) inspections take place at the airports of these countries. As a result flights from these countries can fly directly to most U.S. cities, even those that do not have U.S. FIS facilities.

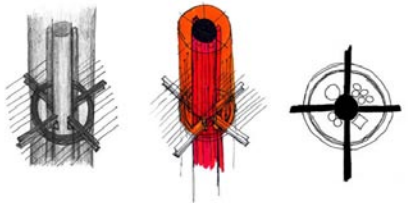
Details: The "Column of Light"

Conceived as a connector between ground and sky, the "column of light" is the primary architectural element of this building. The inner concrete column anchors the building to the ground, while the surrounding "column of light" links it to the sky.

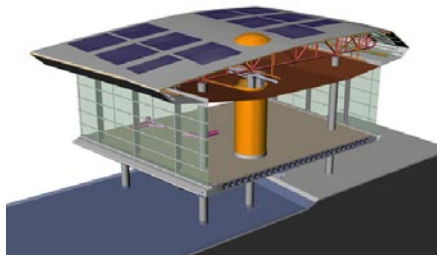
The 36" diameter concrete column is surrounded by a colored and obscured plexiglass shield. The space between the column and the shield acts as a conduit for light and mechanical systems: electrical, HVAC, plumbing, and communications. The piping and ductwork that runs through this space is ambiguously visible when standing near the column. It gives the viewer an understanding of how the building breathes and lives without being too distracting.

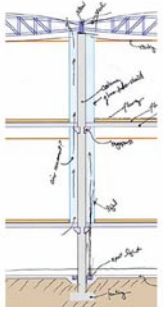
Natural daylight enters the building along the "column of light" by way of rooftop apertures. At night, spot lights located below the water level shine upward along the columns resulting in a shimmering effect from the movement of the water.





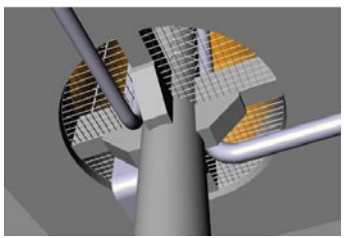
Early sketches of Column of Light



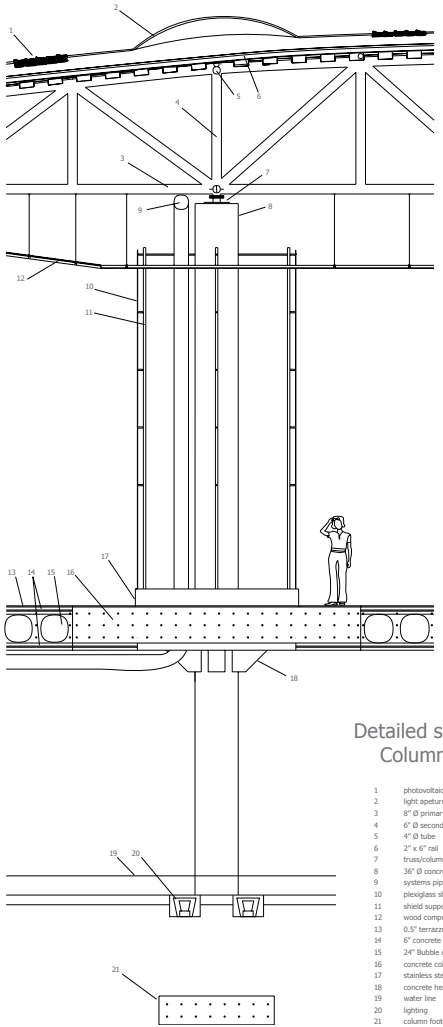


Section model

Column of Light aperture



Underside of Column of Light



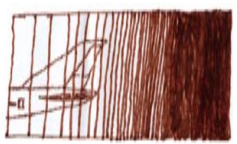
Detailed section of Column of Light

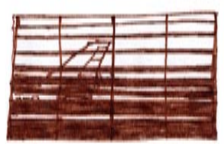
1 photovoltaic panels
2 light apeture shield
3 8" Ø primary truss
4 6" Ø secondary truss
5 4" Ø tube
6 2" x 6" rail
7 truss/column connection
8 36" Ø concrete column
9 systems piping
10 plexiglass shield
11 shield supports
12 wood composite ceiling panels
13 0.5" terrazzo floor covering
14 6" concrete layer
15 24" Bubble deck hollow slab system
16 concrete column head plate
17 stainless steel kick plate
18 concrete head plate supports
19 water line
20 lighting
21 column footing

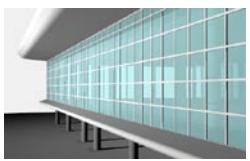
Details: Curtain wall development

The curtain wall acts as a membrane between the interior and exterior environments. When exterior walls are non-load bearing, as in this building, the membrane and its supporting structure only need to be strong enough to support themselves and the wind load. If the support structure can remain minimal, the wall can become a ”veil of glass”.

Since this building has a rather large curtain wall system, opportunities exist for the differentiation and manipulation of the views to the outside. Compositions of machine, land and sky are created by employing various screening strategies and by varying the transparency level of the glass. This also assists in controlling heat gain in the hottest summer months. A glass tint was selected with regard to the luminous blue skies and horizons.

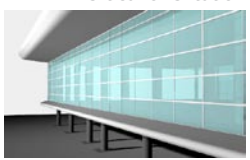






Vertical orientation

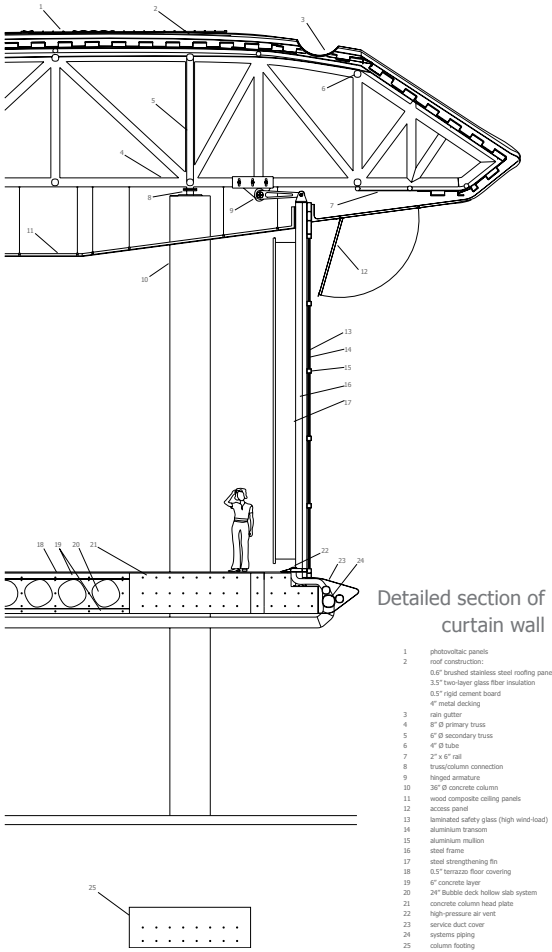
Flat facade



Horizontal orientation

Inclined facade

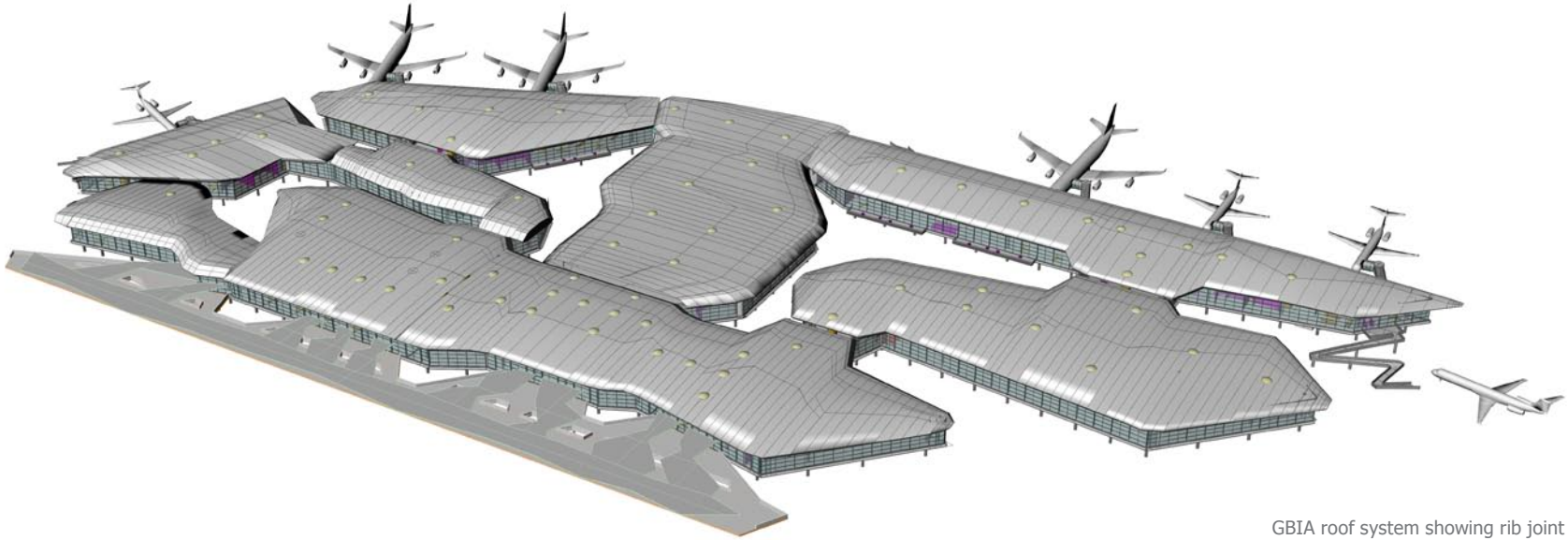
During the design process several curtain wall criteria were considered: straight vs. horizontal mullions and flat vs. inclined facade. The curtain wall is supported by a system of bow trusses holding the mullions.



Detailed section of curtain wall

1 photovoltaic panels
2 roof construction:
0.6" brushed stainless steel roofing panels
3.5" two-layer glass fiber insulation
0.5" rigid cement board
4" metal decking
3 rain gutter
4 8" Ø primary truss
5 6" Ø secondary truss
6 4" Ø tube
7 2" x 6" rail
8 truss/column connection
9 hinged armature
10 36" Ø concrete column
11 wood composite ceiling panels
12 access panel
13 laminated safety glass (high wind-load)
14 aluminium transom
15 aluminium mullion
16 steel frame
17 steel strengthening fin
18 0.5" terrazzo floor covering
19 6" concrete layer
20 24" Bubble deck hollow slab system
21 concrete column head plate
22 high-pressure air vent
23 service duct cover
24 systems piping
25 column footing

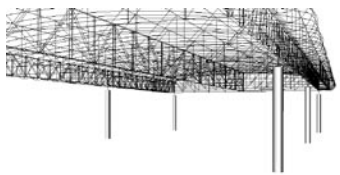
Details: Roof development



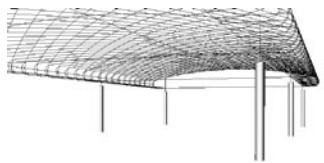
GBIA roof system showing rib joint seams

Acting as a "climate skin", the roof confronts the forces of wind, water, and sun while providing a comfortable interior climate. For many building types, the roof is one of the most visible components; this is especially the case for an airport where the roof is seen from the air and functions as an alternative "facade".

Due to the non-uniform plan the roof must be able to shift according to the building floor plate. Two systems were considered and analyzed for structural efficiency and cost : geodesic and rib/spar.



Structural model of rib/spar system

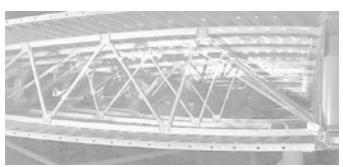


Structural model of geodesic system

Details: Roof development

The most flexible and thus best suited roofing system was the rib/spar; coincidentally, this is the type of structure used to construct an aircraft wing (ill. 1). As the building shifts and tapers, the ribs adjust accordingly. Like an airfoil (a reference to the machine that the building serves), this roof design has both leading and trailing edges. Originally it was planned to have protective "flaps" that tilt down to cover the curtain wall in the event of a hurricane.

The large roof volume can be used as a container for various building systems such as HVAC, electrical and plumbing services, and communications.



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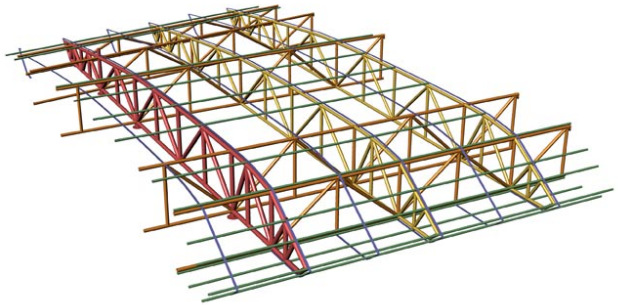
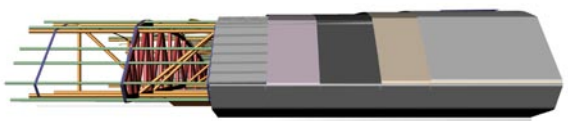
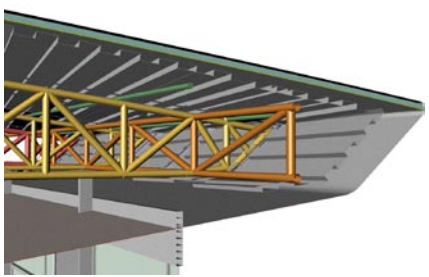
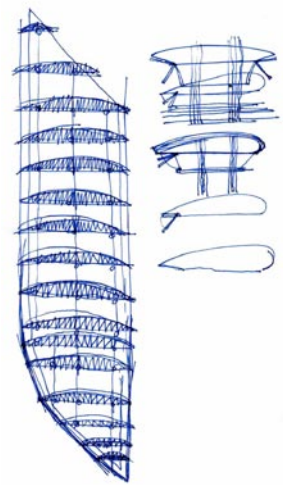
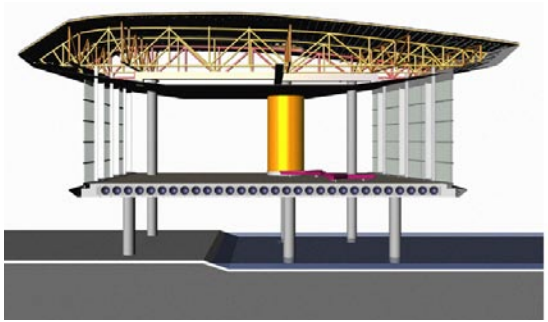


= Primary truss
= Secondary truss
= Tritery truss
= Rail 1
= Rail 2

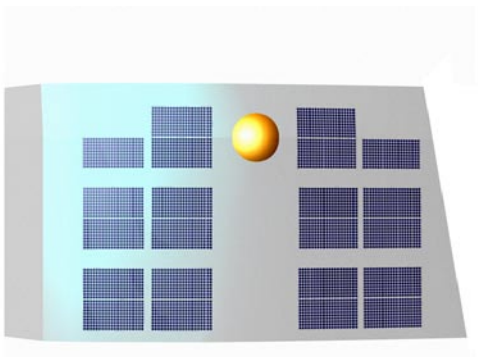








Section model of building and roof system

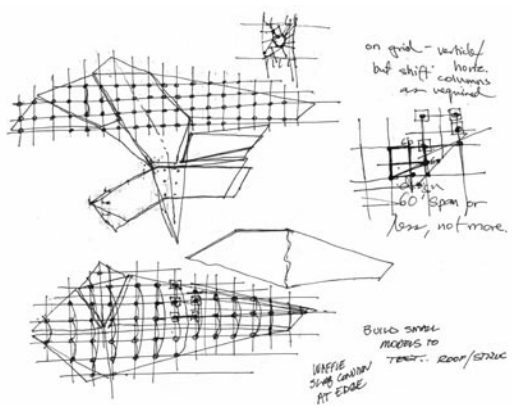


Partial roof plan showing photovoltaics and column aperture

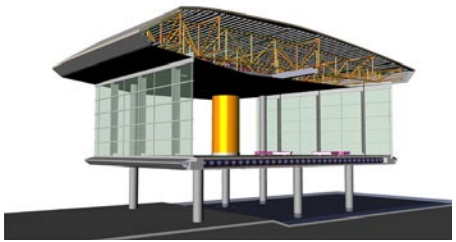
Details: Floor plate development

To create the "island" building concept, a system of shifting floor plates was imposed over an orthogonal 40 ft. square grid of columns. At certain points, the column grid recedes to accomodate the shifts of the floor plate.

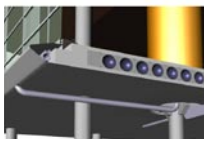
The floor plate is constructed with the Bubble deck system which is a type of hollow core slab system. Large recycled PVC inflated balls are inserted into the form work before the concrete is poured. These spheres remain in the slab permanently, reducing the slab weight.



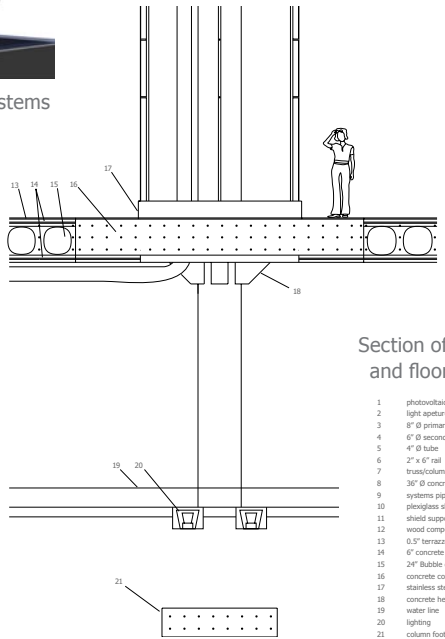
Early sketches of column grid



Section model showing structural systems



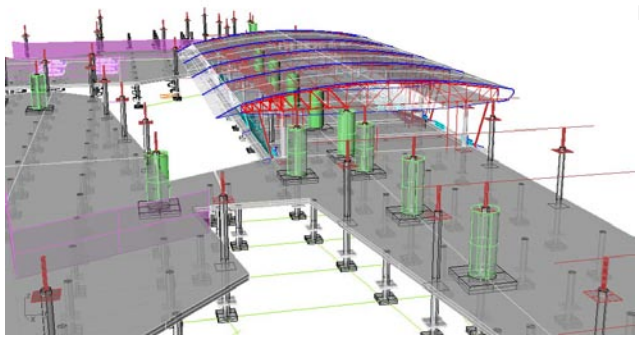
Detail of Bubble deck system



Section of column and floor system

1 photovoltaic panels
2 light apeture shield
3 8" Ø primary truss
4 6" Ø secondary truss
5 4" Ø tube
6 2" x 6" rail
7 truss/column connection
8 36" Ø concrete column
9 systems piping
10 plexiglass shield
11 shield supports
12 wood composite ceiling panels
13 0.5" terrazzo floor covering
14 6" concrete layer
15 24" Bubble deck hollow slab system
16 concrete column head plate
17 stainless steel kick plate
18 concrete head plate supports
19 water line
20 lighting
21 column footing

Bubble deck under construction



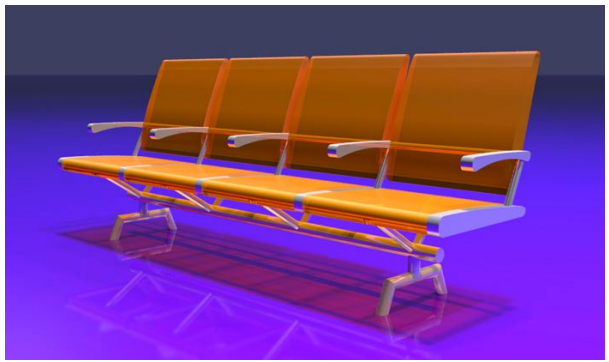
Digital model structural system

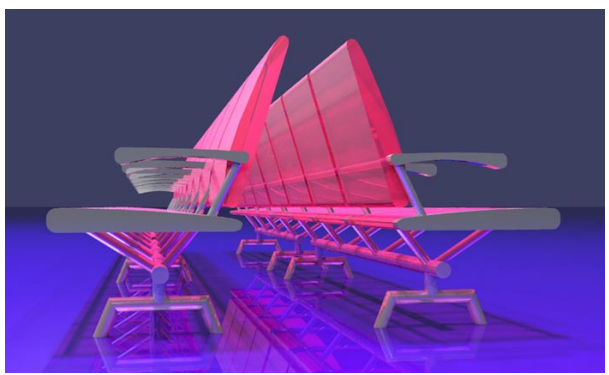
Lucent Dreamer: Bespoke furniture for Grand Bahama International Airport

As part of creating a "total work of art", a system of bespoke furniture was designed for the airport. The Lucent Dreamer furniture line, named for its materiality and its emotional character arrives in a translucent palette of exaggerated tropical colors.

Materiality and Construction:

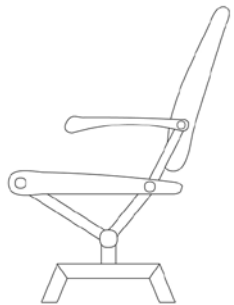
The seating surfaces are made from Softcrylic™, a translucent acrylic resin that is slightly pliable and soft to the touch and also scratch resistant. The resin is cast around the aluminium support structure. Legs and arms are finished in machined aluminum with a polished texture. On a similar theme as the Column of Light, the translucent material lets the user see the internal support structure and thus conveys an awareness of how it is made.



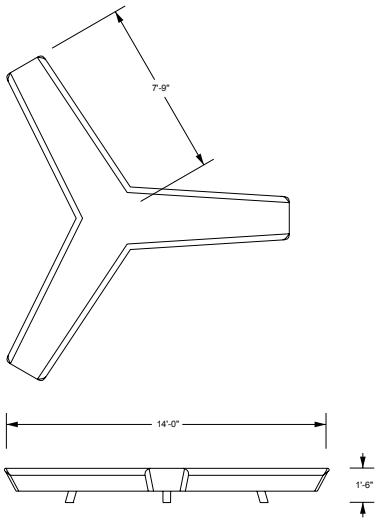


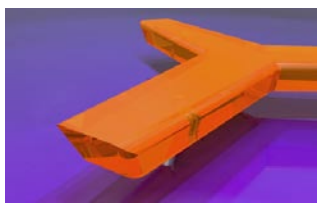
Lucent Dreamer Seating:

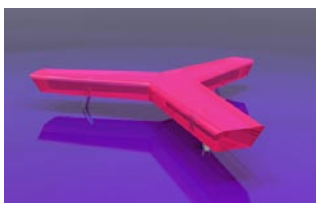
Designed as a module of four seats, the Lucent Dreamer Seating System can be attached in multiple rows.

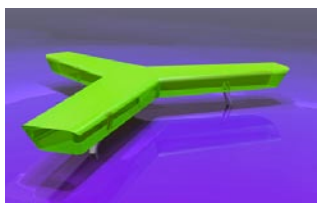


Lucent Dreamer









Lucent Dreamer Bench:

Inspired by the form of the Taino "three-pointer" stones, the Lucent Dreamer Bench can be seen as a jewel floating just above the floor plane.

Lucent Dreamer Bench in the Domestic Lounge

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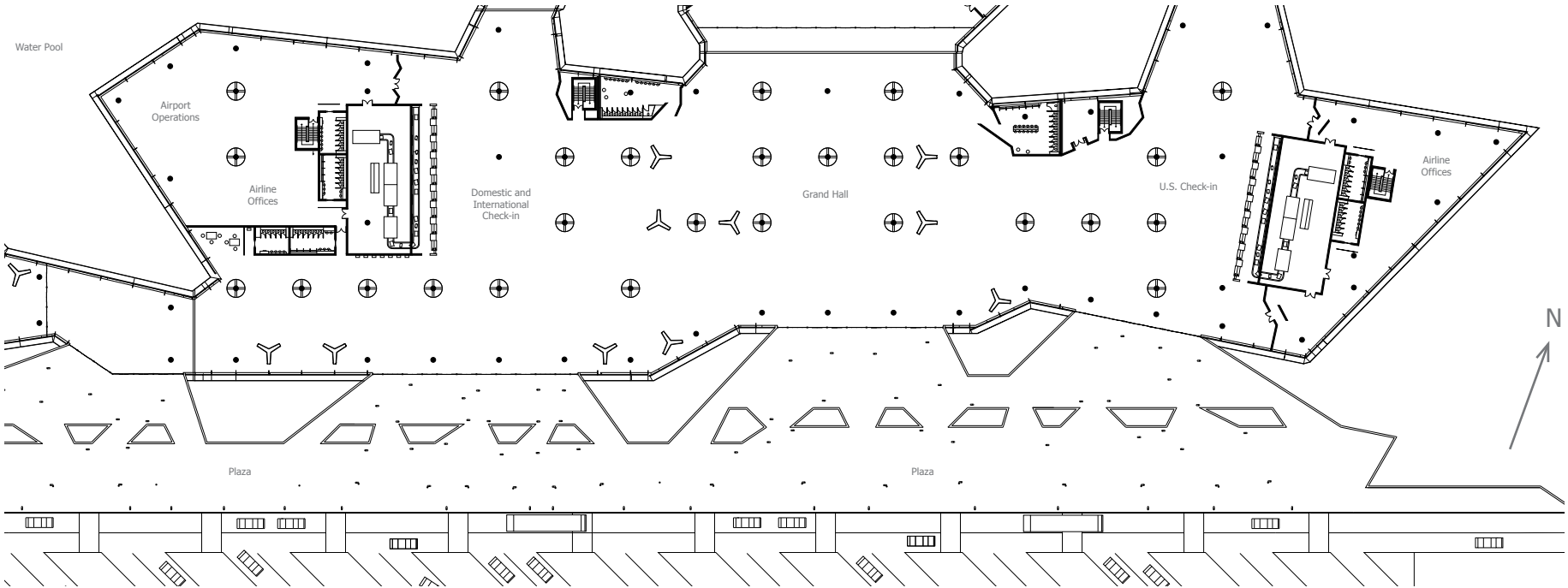
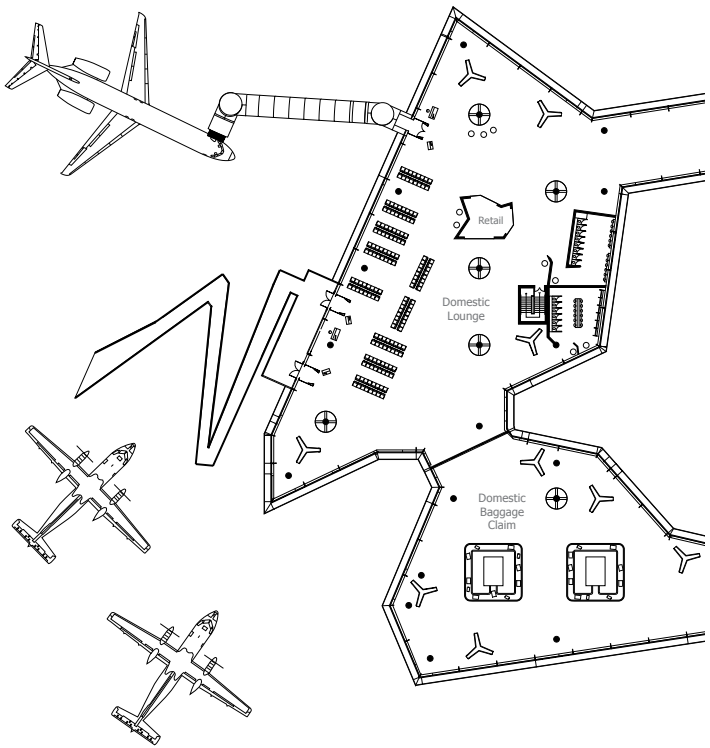
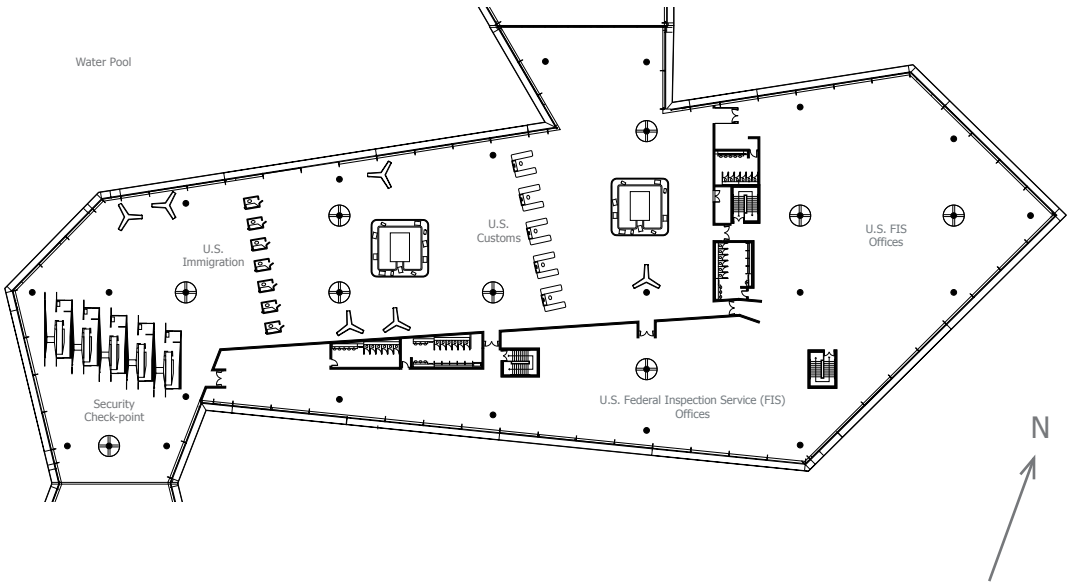
Appendix: Partial plans



Scale 1/16”=6’-0”

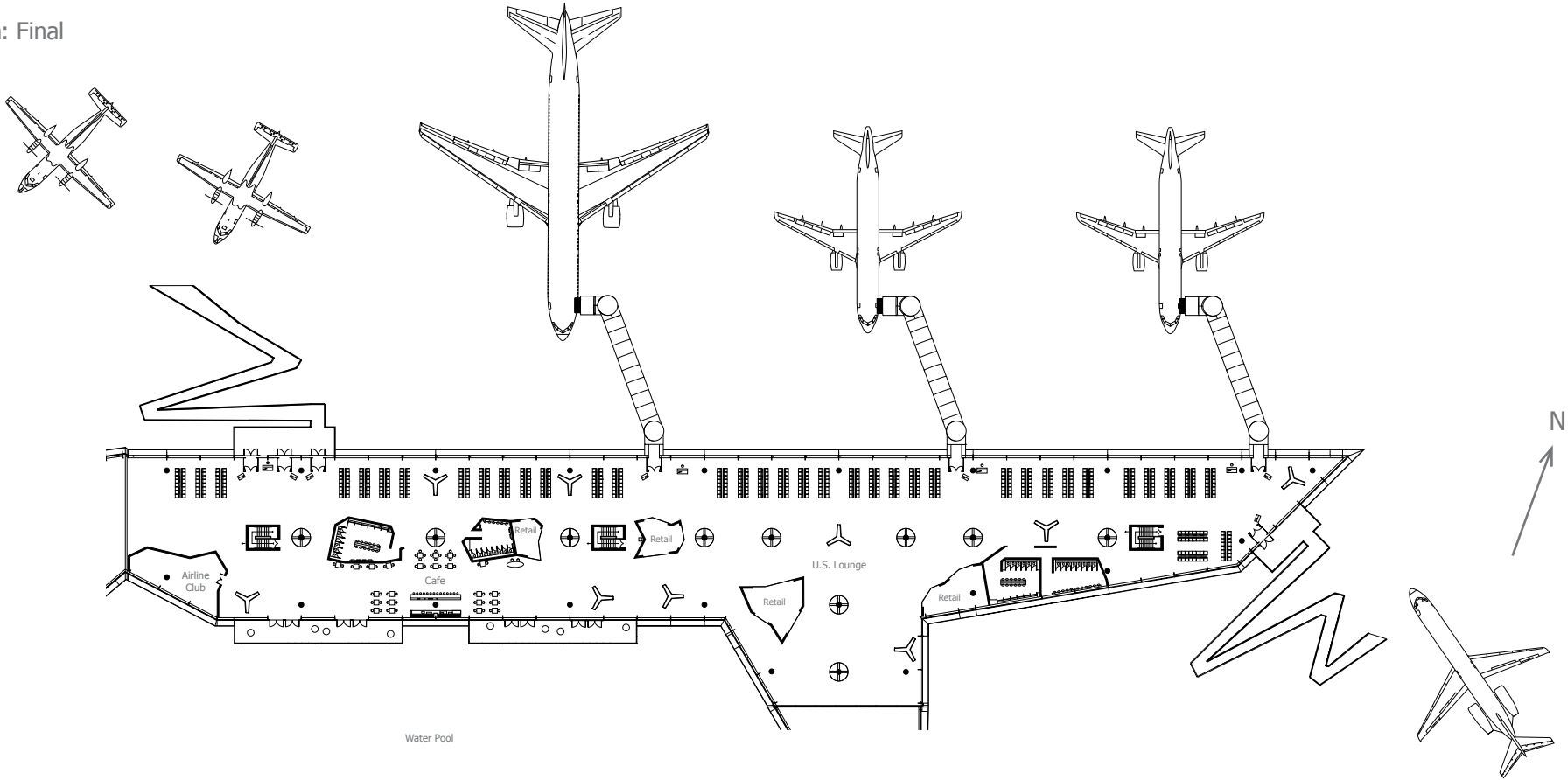
GBIA Grand Hall partial plan





Scale 1/16”=6’-0”

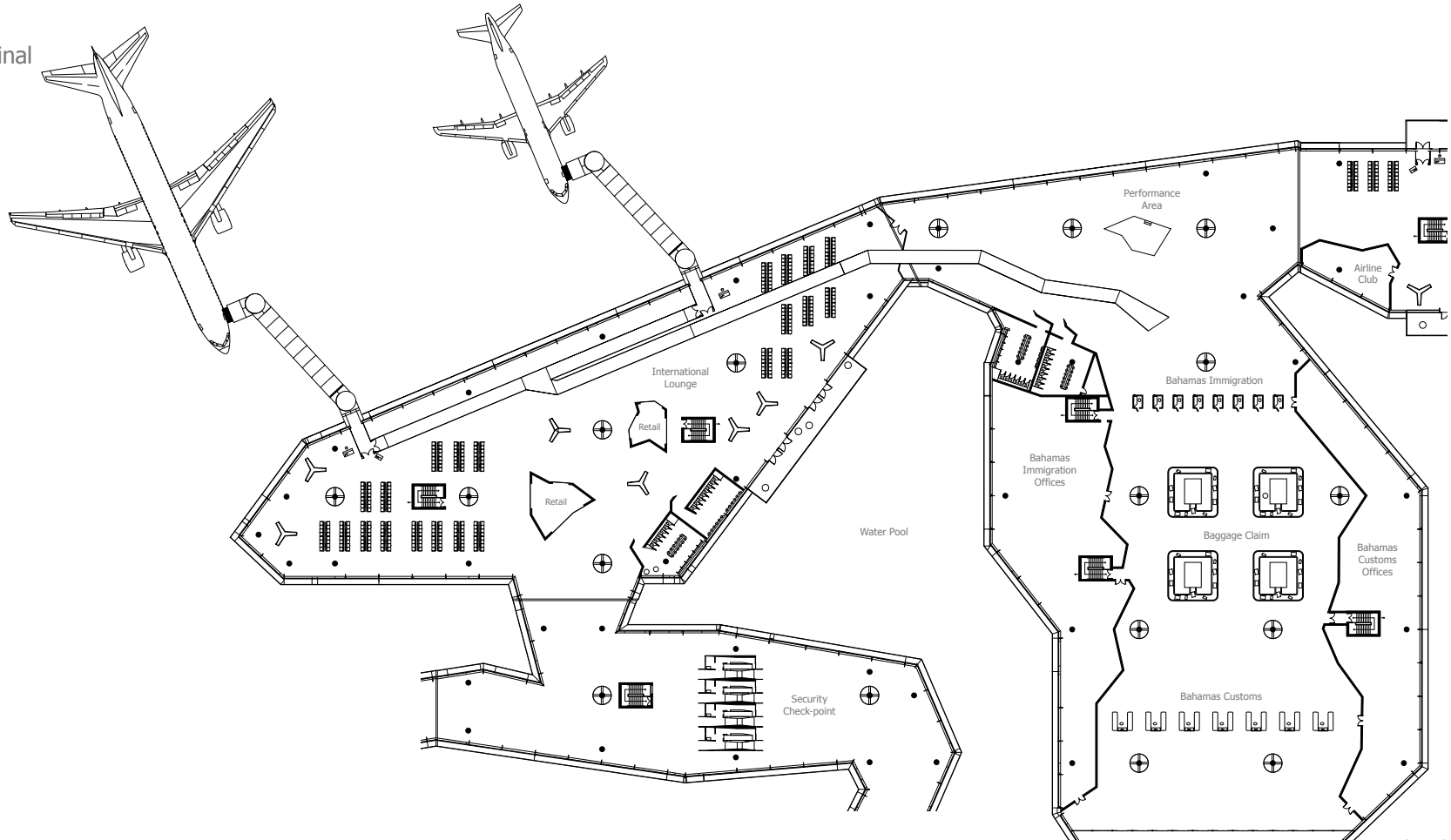
GBIA Domestic Lounge/Baggage Claim and U.S. Federal Inspection Services partial plans



Scale 1/16”=6’-0”

GBIA U.S. Lounge partial plan

Plan: Final



Scale 1/16”=6’-0”

GBIA International Lounge, Baggage Claim and Bahamas Immigration/Customs partial plan

floating on shallow seas
formed by currents of blue and green
this realm of sea, land and sky