RICE UNIVERSITY

Offshore Concourse:
New Ground for a Landless Urbanism

by

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ABSTRACT

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‘Offshore Concourse’ is an urban proposal for a response to changing ecological, economic and political conditions in Alaska and the Arctic. Since 2007, the Northwest Passage has been navigable without need of an icebreaker. As climate change rapidly redraws the world’s coastlines, it poses both opportunities and challenges for global trade: melting ice caps yield new trade routes, markets and resources, but thawing permafrost renders the land an unstable ground upon which to build emerging economies.

Sited on the open ocean near the Bering Strait, the Offshore Concourse presents a new model of flexible, dynamic urbanism. The port is re-envisioned as a reconfigurable platform for both trade and occupation: an aggregation of floating modules that can move, expand and submerge in response to economic demands and climatic conditions. Operating as a point of exchange, the Concourse stages a unique confluence of goods, users and natural phenomena.
Thank You

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# TABLE OF CONTENTS

1  **ON THIN ICE**  
*Changes in the Arctic*  
- Project Statement  
- Background  

2  **THE AMBIENT SITE**  
*Circumstantial Specificity*  
- Location  
- Climate  
- Temporality  

3  **AGGREGATE URBANISM**  
*Assembling a New Port City*  
- Program  
- Orientation  
- Circulation  
- Structure & Flotation  
- Module Variation  
- Growth & Evolution  

4  **NEW GROUND**  
*Realizing the Offshore Concourse*  
- Plans  
- Sections  
- Perspectives  

5  **REFERENCES**  
- Bibliography  
- Image Credits
ON THIN ICE

Changes in the Arctic

Project Statement
Background
Climate change has the potential to devastate ecosystems and economies around the world; however, it holds unique opportunity for Alaska. The melting of the polar ice cap and the consequent opening of the Northwest Passage open up a new territory still to be mapped with new navigational routes, new social orders, new political structures, new ecological landscapes and new economic implications.

While these circumstances create great incentives to develop new trade hubs along the coast of Alaska, landward manifestations of rising sea levels and temperatures cause subsidence, erosion and soil decompression, rendering the land an unstable ground for future development. The sea, with its constant variation, is a much more stable ground: a new ground for a landless urbanism.

This thesis interrogates the potentials of urbanism in the absence of terra firma. Without the land availability and geological stability that have historically predicated the urban condition, this new model for a detached port city exploits density as well as the dynamism of its new foundation upon the sea. No longer constrained by the immutability of solid earth, this new ground capitalizes on the smoothness of its ocean foundation, which allows it to grow and shrink, reconfigure and negotiate its position between sea and sky.

These condensed and fluid conditions yield a laminal urbanism that collapses the spatial and social demarcations of our contemporary urban condition in favor of more synergetic relationships between inhabitants. Multifunctional overlaps and flexible social spaces operate in concert to simultaneously expand the public realm and condense the urban order. The temporalities, flows and agendas that converge in this new Offshore Concourse amplify both the diversity and interconnectivity of natural and civic life.
Background
The melting of the Arctic ice cap will have profound effects felt around the world: ecosystems will falter; resources will be discovered, new economies will emerge, and political agendas will shift. Alarmingly, actual sea ice decline is occurring even faster than predicted by the Intergovernmental Panel on Climate Change (IPCC) in their latest assessment report. If current estimates hold true, the Arctic may be completely free of summer sea ice as soon as 2030\.1

Currently, the shortest maritime routes between Asia and Europe, and between two American coasts, are via the Suez and Panama Canals. The opening of the Northwest Passage through the Arctic holds great potential as a catalyst for new commerce along the Alaskan coast not only because of the physical distance this route cuts from transcontinental journeys, but also because it does not impose limitations on ship size as canals do.

Trans-Arctic Shipping Routes via the Northwest Passage
The opening of the Northwest Passage holds great potential as a catalyst for Arctic commerce. The route cuts nearly 5,000 nautical miles from the current shortest route between Europe and Asia via the Suez Canal.

The opening of the Northwest Passage creates unprecedented opportunities for establishing new trade hubs along the coast of Alaska. Yet while climate change has helped ease the task of navigating Arctic waters, it has complicated matters on land. At the same time that the melting ice cap threatens to cause sea levels to rise and coast lines to migrate, the permafrost that constitutes much of Alaska's land surface is also thawing. Subsidence, erosion and soil decompression caused by permafrost thaw compromise the integrity of man-made structures and upset the balance of complex ecosystems. The increasingly unstable geology of the Alaskan coast renders the land an unsound foundation on which to build. In light of the unpredictability of the land, the sea proves to be a more stable ground upon which to build.

**Effects of Permafrost Thaw**
(From top) Drunken forests, coastal erosion, undermined building foundation, and listing power lines are all symptoms of thawing permafrost in Alaska.
Evolution of the Port City
Around the world, coastal cities have been built on maritime economies. Yet in the last century, ports have become increasingly separated from the cities they support. While detached from land, the Offshore Concourse questions the functional compartmentalization of contemporary cities and seeks to foster greater interactions between distinct industries and user groups.
2 THE AMBIENT SITE

Circumstantial Specificity

Location
Climate
Temporality
Location

At the broadest scale, the Offshore Concourse operates as a point of convergence: a node where the paths of cargo ships and goods intersect. In order to ensure that it is located along all trans-Arctic shipping routes, it is situated at the Bering Strait, which acts as a natural funnel for all maritime traffic moving through the Arctic.

Locating the Concourse here has the additional benefit of supporting a new infrastructure to serve communities in northwest Alaska. Alaska’s major transportation infrastructure is currently concentrated in the south-central part of the state. In fact, the vast majority of the northwest coast is inaccessible by road, making it expensive if not impossible for inhabitants to obtain goods that are taken for granted elsewhere in the United States. By creating a new proximity to foodstuffs and supplies that are in transit through the Arctic, the Concourse is able to serve as the hub for a regional network of smaller air and water transit that makes more goods accessible to these communities.

Infrastructural Concentrations and Shipping Routes

Located at the Bering Strait, the Offshore Concourse acts as a point of exchange where containers are exchanged, redistributed and reloaded for the journey to their final destinations.
Climate
The Offshore Concourse will be most accessible and economically profitable in close proximity to the Bering Strait, but it is not specific to exact geographic coordinates. It is, however, specific to the ambient conditions that exist within this general area. Being located in the sub-Arctic, the Bering Strait goes through drastic environmental fluctuations with the change of seasons.

In the summer months, this area experiences nearly continuous daylight and air temperatures that average around 51°F. In the winter, conditions are far more harsh, with only about two hours of sunlight each day and air temperatures averaging around -5°F. In contrast to the extreme seasonal fluctuations in air temperature, water temperature in this region remains relatively constant at around 30°F for most of the year, and rises briefly to around 43°F at the height of summer. Due to its greater thermal mass, the water of the Bering Sea remains significantly warmer than the air in the winter; the differential can range between forty to sixty degrees and more when wind chill is considered. During this time of year, air and sea are separated by a one-meter-thick sheet of ice, which helps to insulate the ocean water below. Even in spite of global warming, this ice cover will continue to form in this part of the world for many years.

Sectional Mapping of Water Density by Season
Water density and salinity in the Bering Sea follows a seasonal cycle based on changes in air and water temperature. During the summer, the densest, coldest and most saline water lies at the bottom of the sea. Yet in the summer, the significantly colder air temperature causes the water at the ocean surface to freeze. As it freezes, the sea ice pushes its salt content out into the water below, creating an area of super dense, salty water at the surface. Water vapor in the air creates the most clouds at the height of summer; and combines with cold temperatures in winter to produce the unique phenomena of ice fog.
The Offshore Concourse can only currently operate as a port for about five months of the year due to ice cover in the winter. While this window will grow as a result of climate change, it is nonetheless crucial that the Concourse diversify with other programs that operate on different seasonal cycles.

While the basis for the development of the Concourse is rooted in trade, the Bering Sea is only ice-free in the summer, so it cannot operate as a port year-round. In order to make this type of development viable, it must be diversified with program that can sustain it both socially and economically through the winter months. Resource-based industries like fishing, algae farming and salt harvesting peak at different times of the year, creating a diversified economy while also bolstering the sustainability of the Concourse by making it a source of food and energy for occupants. Other industries could capitalize on the Concourse’s unique open-sea location as a base for deep-sea research or military activities. Over time, entirely new industries will emerge as relationships and economies shift both on and off the Concourse.
3 AGGREGATE URBANISM
Assembling a New Port City

Program
Orientation
Circulation
Structure & Flotation
Module Variation
Growth & Evolution
Program

**Function of the Offshore Concourse**

From its location along a major maritime thoroughfare, the Offshore Concourse is a point at which goods can be redirected and redistributed mid-route, thus reducing overall shipping time and cost.

The Offshore Concourse is fundamentally differentiated from contemporary port cities in the way that it performs. Rather than simply serving as a point of destination and departure, the Concourse functions as a point of exchange, streamlining the flow of goods en route. Located directly along the path of all trans-Arctic traffic, the Concourse is a central, convenient point at which cargo can be consolidated, distributed or regrouped into larger or smaller shipments according to specific demand at different destinations.

This mode of operation has particular relevance to Alaska, where most goods are shipped to Anchorage and then trucked to a small number of cities that are accessible by the state's limited highway system. In this case, the benefits of integrating the Offshore Concourse would be twofold. First, as Alaska's primary distribution point, Anchorage could draw a greater variety of goods from Asia, Europe and the Continental United States. The Offshore Concourse creates an opportunity to consolidate small quantities of goods from various locations which would not separately generate enough profit to warrant a shipment to Anchorage. Furthermore, the Concourse could help supply food and other necessities to areas without highway access by redirecting goods from large trans-Arctic shipments into a regional network of small air- and seacraft that are able to make deliveries to these small and otherwise inaccessible communities.
Orientation
The scale of the equipment and facilities used in port operation is so large that it cannot be accommodated in a single sea craft. Instead, the Offshore Concourse is composed of an aggregation of modules that join to create a new urban fabric able to subtly follow the undulations of the sea. The modules follow a rhomboid tiling logic and connect at four designated points around their perimeter. In this arrangement, their chevron shapes create an open area between each module, which allows sunlight to filter through to the ocean below and reach phytoplankton, the keystone species of the Bering Sea ecosystem. The two outer edges are scaled to accommodate the largest contemporary cargo ships, which stretch one quarter mile long, and can accommodate even bigger ships in the future by virtue of the tiling logic. The modules are oriented so that their more solid faces deflect prevailing winds and shades against the midnight sun that comes in from the north in the summertime, while southern-oriented faces are glazed and angled to maximize daylighting.

Module Shape and Orientation
Response to environmental conditions, size requirements and ecological sensitivities informed the module geometry.
Circulation

Tectonic & Joint Studies
Studies of joint locations at module corners (left) and edges (right) demonstrate that edge joints allow for greater freedom of motion, and thus more constant contact with the ocean when modules are aggregated.

In aggregation, the modules form a continuous network of circulation via four connection docks located along their outer edges. Pedestrian and vehicle circulation pass through a reinforced yet flexible joint that allows the modules to stay connected in spite of turbulence from wind or waves. The connection docks are located at the midpoint of the four exterior edges of each module in order to minimize strain on the joints due to resistance to wave action.
Sectional Circulation and Programming

A continuous socialscape constitutes the topography of the uppermost deck of each module. This Concourse Deck gives all occupants access to light and air regardless of weather conditions outside, and features recreational and social facilities that further encourage interaction among distinct user groups.

Circulation is facilitated by Multi-Modal Passages, which run from each connection dock through the center of every module. These passages act as a continuous public forum through the Concourse, accommodating flows of people, goods and equipment. From here, a secondary network of circulation leads through the leasable spaces of each module to a series of Atmospheric Atria. Each atrium is associated with vertical circulation and draws light and air down to the lower decks of the Concourse. Leasable space including tenant program, housing and services radiate from these points of concentrated activity.
Structure & Flotation

Structure and Flotation Strategies
The Offshore Concourse performs like a combination of a cruise ship and semi-submersible oil rig. The concept of taking on ballast is taken to the extreme such that a module can become almost fully submerged in the ocean, which affords significant thermal and wind protection during the winter.

Oil platforms and other large deep sea craft served as a point of reference for determining the scale, structure and flotation strategies for the Offshore Concourse. Although fixed platforms are more common in the Arctic, a float-and-tether strategy is used here in order to give the Concourse the flexibility to relocate in response to weather or economic demand. The fundamental strategy employed by the Offshore Concourse is to use a hull shape similar to that of a cruise ship in order to displace enough water to float, and to use ballast to adjust the degree of flotation like a semi-submersible rig. While taking on and releasing ballast is typically used for purposes of loading and transport, the Offshore Concourse employs this same strategy to a more extreme degree as a response to the extreme Arctic winters. By taking on water in various ballast chamber within each module, the Concourse becomes more submerged in the water; and is better thermally insulated and better protected from harsh winds during the frigid, dark winters. A steel diagrid structures the tapered volumes of each module to diffuse stresses from wind and water.

Negotiating the Ocean Surface
In the winter, the modules take on extra ballast and submerge an additional 60 feet below the ocean surface, leaving only the tops of the modules exposed to the extreme air temperature.
Partial Module, Exploded Axonometric

Each module is sheathed by a stainless steel double hull, which holds the ballast water used to control levels of submergence. The Concourse Deck and tenant space below are enveloped by a steel diagrid sheathed with a double skin of glass and steel panels.
Module Variation

Economic and programmatic diversification is essential to the survival of the Offshore Concourse due to the restrictions that Arctic seasonality places on port activity. While adhering to the same basic form, variations in massing allow each module to be built according to the specific spatial needs of the program it houses. Functional requirements of open deck area, greater occupation density and water access along an interior or exterior edge yield a basic level of variation within the field of modules, which then become further differentiated by other program-specific modification.
Fundamentally, the Offshore Concourse explores the question of how an offshore city differs from those built on land. The ability of the modules to change their relationship to their context – the water level – adds a more dynamic dimension to this type of development. But beyond this, the Offshore Concourse interrogates how cities might grow and develop in a different way. As the Concourse evolves over time, the fabric will expand as more modules are aggregated. Centers of activity will form and then eventually shift or die in accordance with the introduction of new industry or economic decline. Whereas in a land-based city, these areas might fall into a state of disrepair, creating dead zones within the urban fabric, the Offshore Concourse offers an alternative urbanism that is more readily responsive to changing social and economic demands.

**Evolving Aggregation**
Over time, the aggregation of modules that comprises the Offshore Concourse will grow, shrink and migrate in response to the success and decline of different industries.
4 NEW GROUND
Realizing the Offshore Concourse

Plans
Sections
Perspectives
Seasonal Aerial
This conceptual image shows a gradient from the summer condition, in which the Offshore Concourse operates as a port in open water, to the winter condition, when modules submerge and become locked in ice in order to take advantage of the warmer water temperature.
Concourse Plan
Section Detail at Concourse Deck and Ballast Chamber
Section Perspective
Shown in this 300 foot section of a module, the Multi-Modal Passage cuts through the middle of each module and serves as a public gather place as well as the primary thoroughfare for people, goods and equipment. The Passage, as well as the Atmospheric Atria that punctuate the uppermost Concourse Deck, help to bring light and air down to the lower floors of the module. This image shows a module during the winter, when it has been submerged into the water for protection from the harsh climate.
View of Offshore Concourse, from approach by boat

View of interior, from within one of the Atmospheric Atria
Seasonal views of Ballast Chamber
This pair of images shows one of the ballast chambers during summer and winter. These chambers, distributed along the main thoroughfare, serve as occupiable, shaded outdoor spaces during the more temperate months. During the winter, these chambers become filled with water when the Concourse submerges, bringing a new interface with Arctic wildlife to the interior of each module.
Offshore Concourse during summertime port operation
5 REFERENCES

Bibliography
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