Urban ORD: Airline Infrastructure as Public Ecology

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> The terminal concourses are the rambles and agoras of the future city, time-free zones where all the clocks of the world are displayed, an atlas of arrivals and destinations forever updating itself, where briefly we become true world citizens. Air travel may well be the most important civic duty that we discharge today, erasing class and national distinctions and subsuming them with the unitary global culture of the departure lounge.[1]

How can the discipline of architecture participate in a city that is increasingly organized by infrastructural work? Architecture's claim to the infrastructural city is through the design of alternative typologies of space in the flow networks that organize the contemporary metropolis. 60 million people travel by air every month in the United States, and low cost airline travel in Europe doubled between 2003 and 2004. Deploying air travel as a vehicle for urbanism demonstrates that airline infrastructure is a latent site for new opportunities in architectural research and practice.

A NEW, NEW DEAL FOR ARCHITECTS

The promise of the Obama stimulus package is the opportunity to move beyond the legacy of the New Deal era to contemplate alternative models repositioning architecture's role in the design and execution of infrastructural space. Highways, waterways and rail corridors are examples of 19th and 20th century infrastructure, and the scope of the architect is already well documented and tested in this arena. Therefore, the discipline might do well to examine other transportation networks such as cargo flow, information flow, e-retail, and low cost airline travel as territory for architectural work. President Franklin Delano Roosevelt's New Deal in the 1930s produced many national landmarks, including the Hoover Dam, the projects of the Tennessee Valley Authority, and the Merritt Parkway. All of these have become iconic examples of civic design. More important than their status as infrastructural monuments, these projects exemplify the integration of architecture with infrastructure. For example, the bridges of the Merritt parkway, the pumping stations on the Tennessee River, and the iconography of the Hoover Dam demonstrate the deployment of architecture in infrastructure through structure, decoration, and monument, respectively. These visions still hold up today as models for architecture's role in large scale public work projects, but architects can pursue alternative models that reposition architecture within infrastructure by "piggy-backing" on the performance logistics of contemporary flow networks. One method would be to expand the civic role of utility and network infrastructure to generate new forms of urbanism. This essay utilizes air travel and its associated infrastructure as a site for new urban initiatives. While airline transportation was conceived in the 20th century, the massive increase in travel over the last twenty years and the expansion of airline routes, particularly low cost airline networks in Europe and the United States, suggests that airline travel is an even more significant transportation infrastructure for the 21st century. Yet save a few recent high profile competition projects for the re-use of abandoned airfields, broad based and conceptual analysis of the airport as an emerging urban organization largely remains outside of architectural practice. Airline travel provides a rich site for design research to demonstrate how

transportation networks construct a public realm at global, national, regional, and local scales.

"The airport will be the true city of the 21st century[2]"

RE-THINKING ORD

The city of Chicago is spending $18 billion over the next ten years on expanding and upgrading facilities at O'Hare Airport. This includes a new parallel runway configuration, but future phases of the work include plans for another terminal and a high speed rail link. The sheer scope of these plans – the second largest public works project after the Channel Tunnel - merits a broader conceptual approach to the airfield as a public ecology in the city and region. The O'Hare Modernization Plan (OMP) is a departure point for a graduate research studio at the University of Illinois at Chicago to conceive a series of alternative plans for the airport as a public ecology at the global, regional, and metropolitan scale. Using O'Hare as a test-bed site, students were asked to respond to the following:

1. Can a variety of future scenarios stimulate new urban collectives that amplify the role of the airfield as an urban ecology?[3]

2. What topics and scenarios can stimulate the airport not just as a transportation terminal but as an integrated metropolitan landscape?

3. Can airports become creative in implementing civic, operational, and economic facilities into the existing and adjacent urban fabric to stimulate new public life?

INFRASTRUCTURAL CARTOGRAPHY

"How do you show the Aladdin sign meaningfully in plan, section, and elevation, or show the Golden Slipper on a land-use plan?"[4]

Facilitated by instantaneous access to unlimited data resources, research has emerged as a viable basis for design practice over the last ten years. Yet faster downloads and the abundance of online information demand that architects pursue more rigorous and critical interpretation of research data for a disciplinary argument to emerge. Given our training in critical analysis and our ability to coordinate disparate forces during a project, architects are skilled at simultaneously superimposing and interpolating multiple layers of information to discover relationships not immediately evident. Architects make good cartographers. As a means to understand how research operates in design practice, I have developed the term Infrastructural Cartography, a graphic process that mines neutral data sets to amplify a specific architectural argument. Not unlike mapping,[5] Infrastructural Cartography is the graphic composition and synthesis of analytic data extrapolated into a design proposition. In an era where the discipline has undertaken large-scale urban and infrastructural work, Infrastructural Cartography emerges as a suitable technique to reveal patterns between different information sets such as program, economics, geography, time, and space that uncover spatial possibilities hitherto unimaginable by conventional architectural documentation.

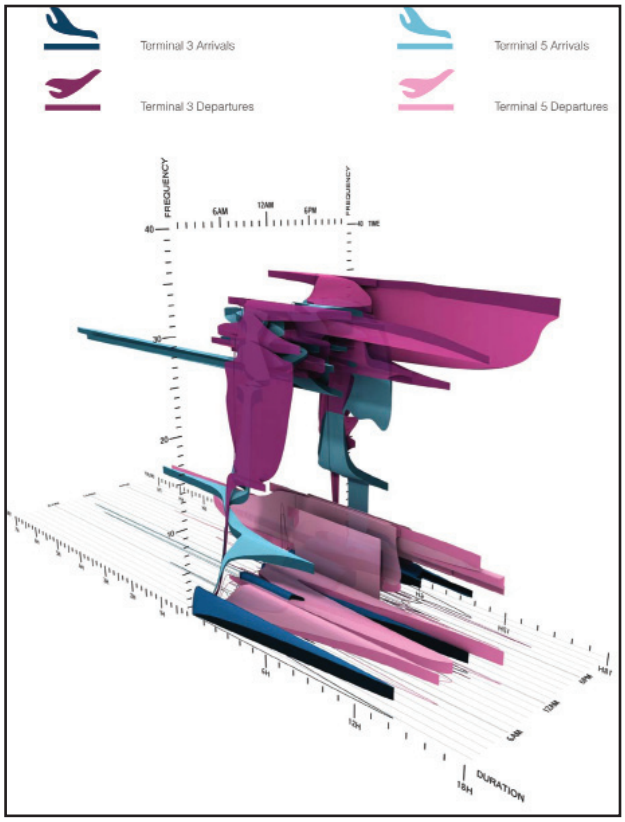

Figure 1: Map plotting aircraft frequency, take off and arrival time, flight duration and delays at Terminal 3 and Terminal 5, O'Hare Airport, Chicago. Thomas DeFroy and Daniel Skrobek.

In our design studio we produced a series of maps, comprising a series of graphic time-space diagrams

that integrate all situational information at O'Hare Airport, Chicago. Ranging from the purely factual to the highly projective, the maps articulate the airport as a diverse ecology through diagrams that analyze and expose the following: acoustic footprint, route density and travel distance, terminal occupancy and flight times (Figure 1), airline stakeholders, ground water pollution, and surface materiality. As the maps develop, factual data gives way to projections, followed by design scenarios that not only embrace problems associated with the development of public space initiatives around airline infrastructure (noise, environmental pollution, delays, and distance from downtown to major airfields) but also challenge how we define the infrastructure itself. Infrastructural Cartography demonstrates ways in which mapping can be used productively to illustrate and interpret architectural analysis. By extrapolating and testing pertinent research data, it is conceived as a pedagogical technique to generate a wide set of design proposals for complex situations. But Infrastructural Cartography goes beyond the mere graphic presentation of site analysis to construct a series of spatial synergies that in the studio shifts the airport paradigm into new conceptual definitions. By recognizing how airline transportation could operate in the contemporary city, Infrastructural Cartography allows us to imagine the airport as a pivotal organism in a larger urban ecosystem communicated here as a manual of design effects at the intersection of architecture, landscape, and infrastructure.

THICK AND GRAPHIC (Figure 2)

For obvious reasons the airfield of a large airport is a hostile landscape. It struggles with environmental issues such as noise, air quality, and de-icing procedures that threaten ground water quality. A model for an ecological landscape on the perimeter of O'Hare Airport strategically considers these issues by thickening the existing airfield boundary into a new 1,300 acre park. While the park contributes to the ecological operations of the airfield, it is not conceived as a "green" landscape. Research of the surface materiality of the existing airport landscape highlights that 75% of the 7,000 acre airfield is hard-scape. The proposed park is therefore conceived as an equally synthetic rather than a natural territory with a taxonomy of surfaces for different programs that simultaneously address the environmental problems of the airfield (diverting wildlife, treating polluted ground water, and noise). Since earth is a natural sound buffer, geometric landforms diminish noise levels and re-use fill from the OMP's runway expansion program. The resulting graphic landscape allows multiple colors and patterns to create an iconographic reading of the park that is legible from the air. The project identifies new motifs for the generation of an ecological landscape that are driven by aesthetics as well as performance.

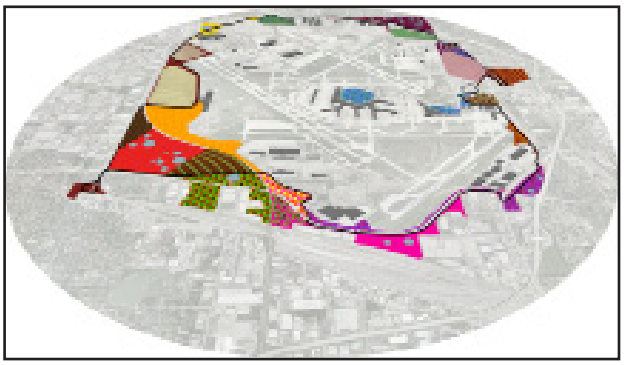

Figure 2: Ecological Park on the perimeter of O'Hare Airport, Chicago. Catrina Knapczyk

SUPERSIZE AND DIG DEEP (Figure 3)

A high speed rail connection, a downtown shuttle, and metropolitan train service make O'Hare the largest transportation hub in the country. The airport is conceived as a second urban center within the Chicago metropolitan area, with the Loop being the other principal financial and civic center. Believing that the city will expand as a polycentric urban model over the next 100 years, the proposal anticipates how the intensification of infrastructural sites emerge as the nuclei of this multi-centric city. Super Strip explores a functioning model for a global airport city. New program is determined by the acoustic zoning of the site and includes sub-surface programming that does not interfere with airfield operations or safety and maximizes vertical connection to the six airport terminals above. As such, Super Strip is a model for an underground city.

The floor area of the strip measures 64 million square feet, which makes it the largest suprastructure in the world. Super Strip is therefore also a model for a large interior city. The current record for the largest building footprint is the Aalsmeer

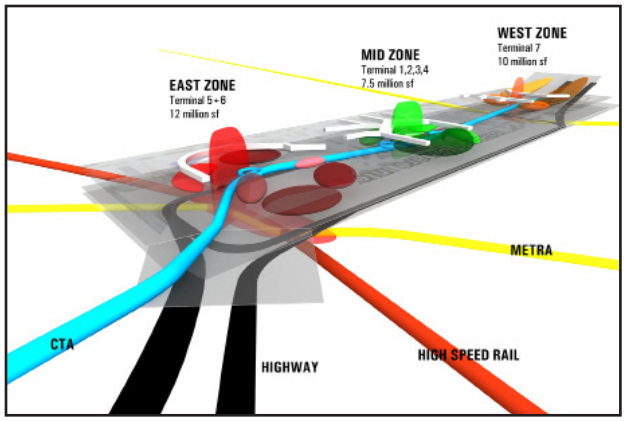

Figure 3: O'Hare Super Strip. Clare Lyster

Flower Market in the Netherlands, which measures 10 million sq. feet. O'Hare Super Strip is 1.5 times the size of New York's Central Park and large enough to accommodate the 25,000 cars that are parked daily on surface lots at O'Hare. Embedding parking within the strip serves to reduce the heat island effect of the airport landscape since it reduces asphalt areas by 176 acres.

65+ (Figure 4)

If the airport is to evolve as an expanded urban center then spatial typologies that consider noise pollution become an emerging form of infrastructural practice that can be claimed by the discipline of architecture. Research into 13 world airports, many of which have been built in the last 15 years, highlights that the average distance between the airfield and a downtown urban core is 18 miles. Over the past decade, many cities have closed urban airfields (Denver, Kula Lumpur, Bangkok, Dubai) to construct larger airfields further from the city they serve. While relocating away from dense urban areas allows flexibility vis a vis expansion strategies in the future life of the airport, this nonetheless minimizes the airport's capacity to function as a civic space within its immediate surroundings. As a result, development adjacent a large remote airfield is limited to extensive cargo and logistical services. Moreover, the larger the airfield, the greater its environmental impact - in particular its acoustic field. The geographical extents of a large airfield are significantly expanded when the acoustic footprint is also considered, which further minimizes the development of civic programs in and or near the airport.

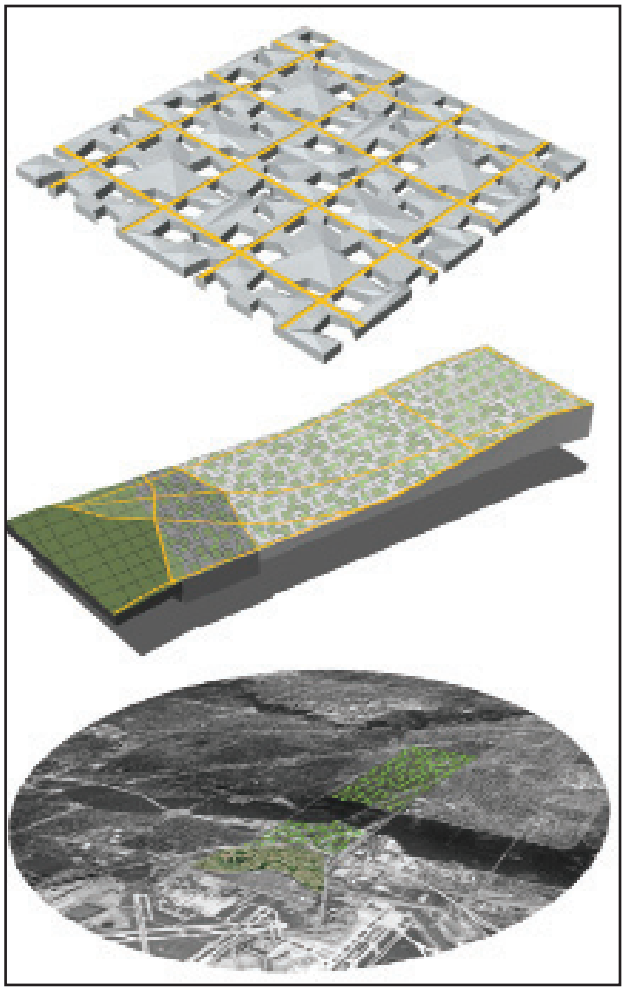

Figure 4: Acoustic Mat on periphery of O'Hare Airport. Vanessa Acobis Ross.

The last twenty five years have witnessed significant reduction in noise pollution at many world airports due to the advances in aircraft technology, yet at the same time acoustic research of O'Hare demonstrates significant and dangerous noise levels on the periphery of the airfield. For example, schools and housing still lie in noisy core areas above the FAA's regulated 65 DNL (Day-Night Average Sound Level) sound limit. The O'Hare Noise Compatibility Commission (ONCC) has spent $435 million since 1996 on noise abatement programs in and around the airport, which primarily includes new windows and insulation installations in nearby residences and educational facilities. A new model for urban development that addresses the acoustic impact of airline flow is proposed for the heavily impacted core zones on the periphery of O'Hare.

A generic set of rules that address core area, DNL levels, and program distribution informs the design of an inhabited acoustic mat whose faceted geometry addresses sound levels in the same way that acoustic calculations generate distinct models for recording studios and theaters. The proposal opportunistically deploys the negative aspects of air travel as a springboard for a new morphology of space that makes living beside an airport an attractive proposition.

DE-COUPLE (Figure 5)

Lower route frequency and higher layover times will follow the airline industry's future plans for larger planes with higher passenger counts. The current Airbus A380 has a double deck along its entire length and holds 840 passengers. Foreseeing large numbers of passengers stranded in disorienting airport lounges, Vertical Terminal is a new airport typology for downtown Chicago that allows travelers to tour the city between flights. Passengers deplane at O'Hare and arrive downtown via a 10 minute high speed shuttle. After check-in at the terminal they receive an electronic tag and hand held PDA, which provides all the necessary information for a tour of the city that is scheduled to fit their layover time. The terminal is located on the upper floors of a high rise allowing pivotal views of the city on arrival. Decoupling the airfield and terminal into separate locations remote from each other allows the terminal to occupy a downtown location and directly interface with the city it serves. Moving check in facilities away from the airfield is conceivable given the increase of high-speed connections between airports and downtown areas (the high speed Maglev train from Pudong International Airport to downtown Shanghai travels at 268 mph and takes 8 minutes). Moreover, augmenting terminal facilities to serve non-travelers that live and work in the city is an attractive model for airlines in difficult economic times.

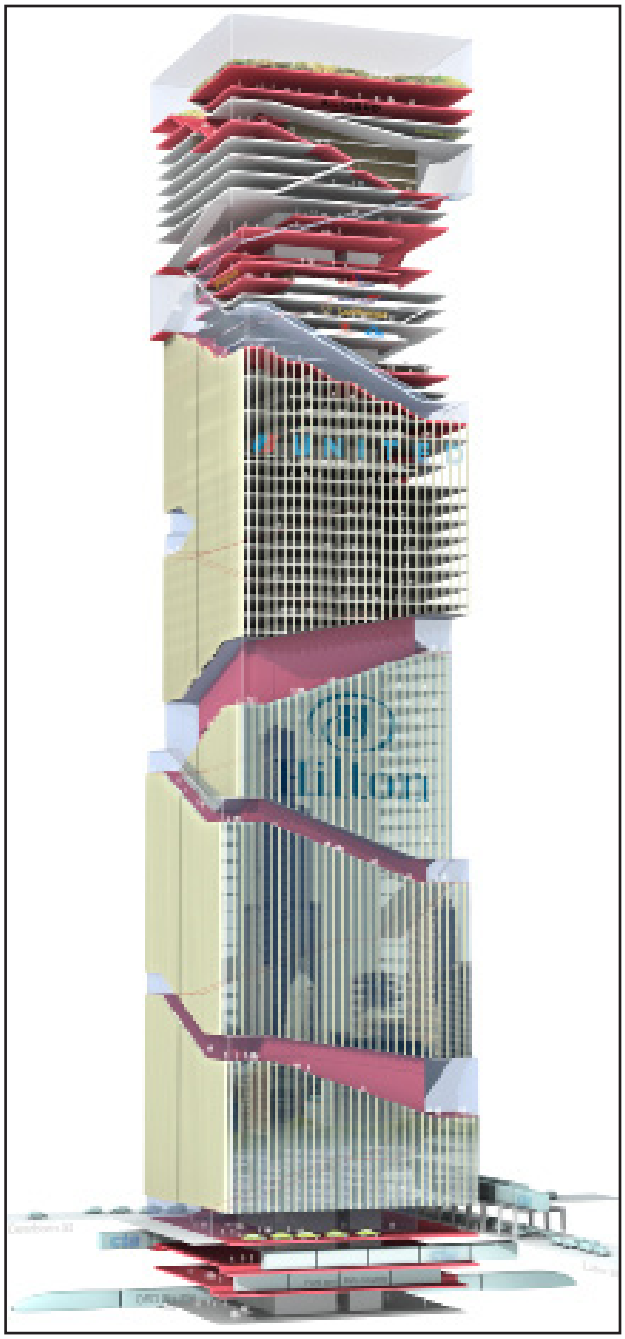

Figure 5: Vertical Terminal. Daniel Skrobek.

CHOP UP AND DISTRIBUTE

Big airports want to get bigger. C.A.T.A. (Chicago Air Transportation Authority) is a proposal for a commuter network that employs US Class D- airspace and is deployed as an alternative model for airport expansion. Research of route flow at O'Hare shows that 34% of flights out of Chicago are to destinations within a one hour radius of the city; the route to Minneapolis being the most common with 35 flights per day. A regional commuter network distributes airport infrastructure throughout the city, producing small air-stations in dense urban areas. Removing a third of flights from O'Hare allows it room to expand without claiming addition-

al land or moving to a new remote location. Airline infrastructure in the city is thus conceived as a confetti-network rather than a hub model. The proposal embraces the increasing takeover of regional flights by low cost carriers that operate inter-city shuttle connections like a bus service. One in 5 passengers flies regionally, a figure that is up 44% over the last five years. The smaller planes used by the low cost carriers have reduced noise pollution and have more efficient fuel consumption. For example, a Cessna CJ3 will burn 60 gallons of jet fuel per hour and needs a runway of 3,000 feet while a Boeing 737 burns 1,100 gallons per hour and a runway length of over 8,000 feet. While the Cessna only holds 11 passengers, at 5.45 gallons per hour per seat its ratio is still lower than that of the Boeing. Since smaller planes necessitate shorter airstrips, they are more suitable for urban locations in a point to point network rather than the traditional hub system.

A model for this system of airline transportation is a compressed version of London's air network that includes not one but a series of medium sized airfields spread out over a 60 mile radius from the city's business center. While Heathrow is still the anchor terminal of the greater London network, airports such as Stanstead, Luton, Gatwick, and City Airport are considered important gateways in their own right. It therefore seems plausible that cities not only consider a single super hub model to address their transportation needs, but a series of smaller scale airport nodes that work together to perform as a larger regional network. Given that it has multiple opportunities to augment, shrink, and/or expand over time, the confetti model is pitched as a highly flexible planning strategy that can easily adapt to the volatility of the airline industry.

MOVE OUT AND RECYCLE

The redesign of abandoned airports facilitates new urban organizations. Recent and popular examples include the Downsview military base in Toronto, which was subject of an international design competition won by OMA with Bruce Mau in 2000. Other examples include Stan Allen's 2008 award winning proposal for the re-use of a decommissioned airbase in Taichung, a competition for Reyjavik's Vatnsmyri Airport (2007) won by the British team of Maisse, Dickson, Keane, and Ingelby, and OMA's conceptual proposal for the relocation of Amsterdam's Schipol Airport into the North Sea so that it could more readily participate and compete in the travel market between Paris and London (1998). Design strategies directed at the re-appropriation of abandoned airfields facilitate the intensification of public program through mechanisms of re-use. Design strategies that consider partially abandoned airports (shrinking airports) can also contribute to this discussion.

United Airlines lost $1 billion in 2008. Unpredictable fuel prices and the cost to upgrade to more sustainable operations, could cause the demise of the air industry. Airports will shrink or close, leaving an abundance of vacant real estate in large cities. For example, the airport in Pittsburgh[6] his only partially occupied after US Airways dropped many of its routes and vacated gates there. Since 2001 it has cancelled 400 flights, and in 2004 reduced the status of the airport from "hub" to "focus". In early 2008 it slashed another 40 flights, and dropped another 18 of its 28 gates. US Airways' reduction from 108 daily flights to 68 cut its workforce in Pittsburgh to 1,800. At one time, the airline operated 542 daily flights and employed more than 12,000. The result of this shrinking route map is the closure of 27 gates, 25% of Pittsburgh's total gate count. The vacant gated areas "will be sealed off with a wall that will be painted and have advertisements," Brad Penrod, executive director of the Allegheny Country Airport Authority, tells the Beaver County Times: "Basically, we won't have to pay to heat, cool or clean those areas on a regular basis." He adds that the airport authority hopes the downsizing will save the airport at least $1 million annually. "It should not affect passengers at all," authority spokeswoman JoAnn Jenny tells the Tribune-Review. "All passengers will see is a wall, but we will realize a million-dollar savings." Pittsburgh International was built for $1 billion 14 years ago, largely to the specifications of US Airways. Syracuse Airport is another terminal that is half empty after US Airways reduced service. It too is currently boarded up, yet is beginning to attract more low cost carrier service. Similar to retailers, airlines live and die, kill and eat each other up in an effort to survive and sustain their business. The competitive ecosystem of the low cost airline industry, seen in the clashes between the low cost carries and the legacy airlines, is cutthroat.

Move out and Recycle is a proposal that considers the partial or entire re-use of a functioning airport.

Given their large interior area and extensive infrastructure, airports become centers for institutional networks such as commuter universities, prisons and hospitals. Program that exploits both large scale interior space as well as the need to connect to other locations provide suitable programming options.

While transportation is a primary target in the new U.S. Government stimulus package, there is minimal federal funding sidelined for design research to facilitate alternative ways to rethink infrastructure. Our work is conceived as a think-tank for the infrastructural city. It argues for the optimization of investment in mass-transit by endorsing design strategies that conceive more effective use of funding beyond the maintenance and upkeep of aging infrastructure. Moreover, in an era where building might no longer be considered the primary integer of urbanism the studio looks to the paradigmatic infrastructure of the 21st century city, the airport, as a means to generate spatial morphologies that anticipate architecture's stake in the infrastructural city. The studio's design scenarios for O'Hare combine architectural programming, infrastructural engineering, and landscape design to stimulate the airport not just as a transportation terminal but as an integrated metropolitan landscape. For too long architecture's scope in airline infrastructure has been restricted to solving the procedural complexities of airfield master planning and the communication of a carrier's brand in terminal design. The work here demonstrates that employing a much broader and critical approach to design in airline transportation not only reclaims the airport as a civic infrastructure, but also re-defines how it operates as a network in the contemporary city.

ACKNOWLEDGEMENTS

I am grateful to the students of Arch 567, Spring 2008 at the University of Illinois at Chicago for their contribution to this article.

ENDNOTE

1. Ballard, JG. "Airports: The Cities of The Future", Blu*eprint, #142*, September 1999
2. Ibid
3. The term ecology is used to describe a space produced by the patterns of flow that pass through it. For example, a space that is a station point in the trajectory of a larger flow network. The biological definition of ecology is "the study of a living organism in relation to its environment," which is repurposed here to describe the study of a spatial organism (an airport) in relation to the environmental forces that produce it: flight schedules, route densities, time differences, and mobility patterns in the form of global tourism and business. Recently, the term "Ecology" has been appropriated from its biological and sociological origins by practitioners in many design disciplines as a suitable term for a complex system whose morphology is constituted by many layers of information. (An) Ecology therefore is not neutral in the world, but is constantly adjusting itself in response to some other intelligence. In this way the urban systems (transportation and information networks, utilities, energy flows) of the city are ecologies, i.e., active informational units that are directly shaped and controlled through their relationship with a variety of forces and behaviors.
4. Venturi, Robert. *Learning from Las Vegas: The Forgotten Symbolism of Architectural Form* (Boston: MIT Press, 1977). Page 75.
5. There are many examples of mapping as a tool for research and communication in the disciplines of art, landscape and architecture, including: Venturi and Scott Brown's diagrams of Las Vegas in *Learning from Las Vegas*, artist Marco Lombardi's *Narrative Structures*, UN Studio's *Deep Planning*, MVRDV's *Datascapes*, and James Corner's *Eidetic Diagrams*. Architecture's interest in mapping emerged from a variety of sources. Firstly, it coincided with a move away from ideological approaches to urbanism in the belief that the extrapolation of situational information could generate more suitable proposals for the contemporary city. Secondly, in the case of Corner's work, mapping was deployed as an instrument to generate an idea out of a given situation. *Eidetic Operations* did not yield an explicit picture of a constructed scene in the pictorial sense, but described a method for the making of an image that allowed ideas to "unfold". In a 1999 essay, he describes it as; *specific ideational techniques for construing (imagining) and constructing (projecting) new landscapes*. To Corner, mapping was a way of reclaiming landscape's critical project and a more suitable way to communicate design given the impossibility of a complete vision because of the time it takes to execute landscape work. For more details see Corner, James. "Eidetic Operations and New Landscapes" in *Recovering Landscape*. Edited Corner, James. (New York: Princeton Architectural Press 1999). Pages 153-169.
6. I'd like to thank Judith De Jong for sharing with me her knowledge of Pittsburgh airport.