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Joss Kiely, *University of Michigan*

Architectural Aerialism: The Translation of Aviation in Late Modern Architecture, 1951-75

In the 1950s, coincident with the rise of commercial air travel, and later the jet age of aviation, there was a distinct shift in architectural expressionism that had a clear formal relationship to the aerodynamic lines of aircraft. This form of expressionism, I argue, led to the development of an architectural aerialism that was wholly distinct, but perhaps fuelled by, the aerial view and flight, which had captured the imagination of artists, architects, and political leaders in the late 1920s and 1930s.

Situated in the post-war period, this paper seeks to examine the relationship between society, aviation, and architecture through a translation of formal, technological, and social imperatives into distinctly architectural ones. To achieve these ends, the paper briefly examines the rise of an aerial imaginary in the early twentieth century, followed by an examination of the translation of the aerial view into built form through the work of Le Corbusier and his visual essay, *Aircraft* (1935). Then, this author seeks to add to the historical record by identifying and examining the rise of an architectural aerialism in built form through a focus on Minoru Yamasaki's St. Louis Air Terminal of 1956, and two later airport projects. In so doing, it will relate this project to a larger post-war context by considering Eero Saarinen's TWA Terminal at JFK (1961) and Felix Candela's Bacardi Rum Factory outside Mexico City (1956) as two projects engaging in related formal affinities and aesthetic terms.

The paper argues that translation occurring to produce an architectural aerialism is threefold. First, architects and designers translated the new technology, and the excitement surrounding it, into an aesthetic and technological driver. Secondly, concrete, otherwise unrelated to flight, had to be translated from a monolithic material into a thin shell structure, radically increasing its formal possibilities and application. And lastly, it is now the work of an historian to translate these works of architecture into a distinct historical and formal category.

In the 1950s, coincident with the rise of commercial air travel and the jet age of aviation, a manner of architectural expression developed that had a clear formal and structural relationship to aerodynamic forces and to aircraft design. This formal and symbolic expression reified an identifiable recurrent interest in aviation that appears distinct from, but perhaps fuelled by, the aerial or bird's eye view associated with early representations of Modernist architecture. Through an examination of four airport terminals and a factory, this paper seeks to define and explore an understanding of *architectural aerialism* as it developed in Late Modernism. In order to distinguish this late modern aerialism from other forms of aeriality that emerged in early Modernism, the discussion will be grounded in a brief exploration of the aerial imaginary that arose in the early 20th century. Secondly, the paper will examine how the aerial has directly appeared in the work of Le Corbusier in the 1930s by specifically considering his 1935 visual essay *Aircraft*, and the relationship of the images to later built projects. Thirdly, the main focus of this investigation will examine Minoru Yamasaki's airport terminals in Saint Louis (1956) and Boston Logan (1969) for their aerial qualities. In conclusion, I will attempt to unpack a broader application of an architectural aerialism in late modern architecture that extends beyond the airport terminal typology.

The aerial view, earlier known as the “god’s eye” or the “bird’s eye” view, is not new to architectural theory and representation, but it gained new significance in the early-to-mid twentieth century with the advent of powered flight. Still today, it continues to be a topic of contemporary fascination: there has been a recent resurgence of interest in the aerial view and architecture, as seen in the recent publication of Mark Dorrian and Frédéric Pousin's edited volume, *Seeing from Above: The Aerial View in Visual Culture* (2013), which offers readers a collection of essays on the aerial view's application to mapping and surveying over the course of two centuries.¹ In addition, Jeanne Haffner's *The View from Above: The Science of Social Space* (2013) considers the ways in which aerial photographs impacted the evolution of social space, and its effect on urban planning practices in mid-twentieth century France.² Both titles add to earlier discussions of the aerial view in Le Corbusier's visionary urbanism proposals of the 1930s, notably by M. Christine Boyer, Adnan Morshed, and Beatriz Colomina. This project, while undoubtedly influenced by the work of these and other historians, attempts to add to this scholarship through an examination of flight as *translated into built form*, focusing on the work of Minoru Yamasaki, culminating in a new formal category: architectural aerialism. The paper argues that architectural aerialism is both a formal ambition and a cultural phenomenon that arose in the early days of the jet age of air travel whereby aspects of flight and aviation are abstracted and appear in architectonic form.

Following from Peter Galison and Alex Roland's assertion that flight is a *defining technology* of the twentieth century, this project seeks to understand an expanded role of aviation and flight in late

1 Mark, Dorrian and Frédéric Pousin, eds., *Seeing from Above: The Aerial View in Visual Culture* (London: Tauris, 2013).

2 Jeanne Haffner, *The View from Above: The Science of Social Space* (Cambridge, Mass.: MIT Press, 2013).

modern architectural praxis.³ The idea of a “defining technology” originated in Jay David Bolter’s *Turing’s Man*, where he describes it as a technology that “resembles a magnifying glass, which collects and focuses seemingly disparate ideas in a culture into one bright, sometimes piercing ray.”⁴ This claim is particularly significant for a project focusing on the twentieth century’s recurrent obsession with aviation and the aerial view. To this end, we might consider the history of aviation as both a history of technology and a history of our cultural capacity to absorb the technological and social imperatives of the aerial view and air travel. Particularly in the late 19th and early 20th century, air took on new significance as a material, a commodity, and a liability. Manipulating air through precise geometries and speed was a central component of powered flight, and aviation also played a central role as an aesthetic driver for the avant-gardes of the teens and twenties through the post-war era. This was notable in early Italian Futurist aeropaintings, performances, and manifestos, and particularly emphasized in Filippo Marinetti, Angiolo Mazzoni, and Mino Somenzi’s 1934 “Futurist Manifesto of Aerial Architecture”, which envisioned new, linear cities that were to be admired from above, along with a complex system of ‘aero highways’ that paralleled the landforms below, the descriptions of which also call to mind the writings and visionary urban proposals of Le Corbusier.⁵ By considering the ‘aerial lineage’ from Marinetti to Le Corbusier, there appears to be a growing interest in what aviation might offer architecture – a new view from an aerial vantage that was both inspiring and revealing. These developments, in turn, set the stage for an architectural aerialism in late modernism by foregrounding a newly dynamic relationship between earth and sky that architects began to embrace in the 1940s and -50s. The early architectural application of these outcomes is perhaps best first understood through Le Corbusier’s 1935 visual essay *Aircraft*.

Thanks to the work of other scholars, we are well acquainted with Le Corbusier’s visionary urban proposals for Europe, South America, and North Africa, but perhaps less familiar with *Aircraft*, a work that emerged from Le Corbusier’s interest in technology and the machine. In addition to the manifesto-like written portion of the essay, this publication compiles a collection of 124 photographs, sketches, and maps that together exalt flight’s promise for society, its potential power and domination over humankind. The work is a veritable catalogue of aerial “parts” which he relates to both technological advancement of aircraft and to the structural systems of architecture itself. In one spread, Le Corbusier shows a structural detail of a Bréguet “Bizerte” aircraft, a construction detail of a Bernard 82, and the shell structure of a Hydroplane Blériot 5190, the latter of which regularly plied the skies on the mail route between France and South America.⁶ Accompanying these images, Le Corbusier adds the following text, “Poet, ponder a moment on the truth of these objects!”

3 Peter Galison and Alex Roland, *Atmospheric Flight in the Twentieth Century* (Dordrecht, Boston, and London: Kluwer Academic Publishers, 2000), vii.

4 Jay David Bolter, *Turing’s Man: Western Culture in the Computer Age* (Chapel Hill: University of North Carolina Press, 1984), 11, quoted in Galison and Roland, *Atmospheric Flight in the Twentieth Century*, vii.

5 Filippo Tomaso Marinetti, Angiolo Mazzoni, and Mino Somenzi, “Manifesto Futurista dell’architettura aerea,” *Sant’Elia*, no. 3 (1 February 1934).

6 Le Corbusier, *Aircraft: The New Vision* (London: The Studio, 1935), 24.

and further, “Eiffel Tower? Or giant bridge? The aluminium framework of an airplane—search for economy of material, for lightness, always the fundamental, the essential law of nature.”⁷ Here, Le Corbusier makes an analogy between the parts of the aircraft and built architectural works. Further, he suggests that one should not consider these to be details, rather: “Everything is an essential part of the whole. In nature, microcosm and macrocosm are one.”⁸ Indeed, flight is predicated on a certain level of mimesis; aircraft have to model their structure and their weight after their avian counterparts, and the control surfaces, while comprised of distinct parts, must operate as a choreographed whole. In a certain sense, Le Corbusier brings to the discipline, for the first time, a direct link between architecture and aviation through imagery and text, from which we might later understand more abstract versions of architectural aerialism emerge.

There are strong similarities to be found in the comparison of images that appear in *Aircraft* and the work of Le Corbusier himself. First, we might consider plate 35 – a wing “section” of an aircraft, a film still taken from “Aero Engine (1932)” – in relation to the roof structure of Le Corbusier’s Notre-Dame-du-Haut at Ronchamp. The architectural element appears as an inverted aerofoil and seems to mimic the aerodynamic lines of the aircraft’s wing. In spite of its massive size, perched atop a hill, the chapel seems poised as if ready to fly away. Secondly, we might compare Plate 48, a film still which depicts the “Tail Float of Flying Boat ‘Scipio’ Class” taken from Paul Rotha’s 1933 documentary, “Contact”, with a photograph of the pilotis-type-support of the roof structure, again at Ronchamp, for its striking formal similarity and technical ambition. The differences between the two objects are equally clear: whereas the pilotis-like-support tethers the wing-like roof structure to the ground, the strut attaches the pontoon to the wing, enabling the seaplane to leave the earth’s surface, smoothly transitioning from sea to sky. Following from the formal relationship between these images and built works of architecture, the possibilities of a post-war architectural aerialism are to be examined, that continued the translation of aerodynamics into built form, perhaps first seen in a handful of airport terminal designs. Until the 1950s, airports were often little more than grass (later paved) strips with a covered waiting area and a collection of hangars. Only when the size of the traveling public increased, thereby increasing demands for terminal space, did architects truly get involved in the design of airport terminals. Leading up to this moment, in the mid-1940s, Le Corbusier offered his opinion on the architecture of the airport terminal, asserting:

“Once on the ground, only one kind of architecture seems tolerable and perfectly admissible: that of the magnificent airplanes which have brought you or will take you away, and which in front of you occupy the visible space. Their biology is such, their form such an expression of harmony, that no architecture seems reasonable beside them ... An airport then seems to have to be naked, entirely open to the sky, full in the center of the field, with the concrete runways.”⁹

7 Le Corbusier, *Aircraft*, 24.

8 Le Corbusier, *Aircraft*, 24.

9 Le Corbusier, quoted in Anthony Vidler, *Warped Space* (Cambridge, Mass.: MIT Press, 2001), 179.

Just over a decade later, it seems Minoru Yamasaki and his partners attempted to find a harmonious solution to Le Corbusier's call, bridging the wide gap between the sleek "architecture" of the aircraft, and the necessary architecture of the terminal.

The 1956 Saint Louis Air Terminal project, designed by Minoru Yamasaki, with George Hellmuth, and Joseph Leinweber, was the first major public work for the firm, and the architects took on the task of creating not only an airport terminal, but one that, in the architect's own words, "should convey a sense of gateway to the traveller, a building that should reinforce the drama and importance of the trip, reflecting both the excitement of a departure and the comfort of a safe arrival."¹⁰ During the design development phase, the team travelled to airport terminals around the United States, but were largely disappointed in what they found. The architect turned to the great transportation icon of the 19th century for inspiration, the railroad station: "My memories of the great space at Grand Central Station in New York offered a much better example of the appropriate spirit than did any of the existing terminals we had visited."¹¹ For Yamasaki, Grand Central offered a spatially compelling experience, owing to its vast interior, that was not yet found in the airports of the era.

In plan, the St. Louis Terminal was a straightforward rectilinear volume. Departing passengers entered through the eastern entrance, whereupon one would continue to the right to check in at the airline ticket counters. After dropping off the bags, one could wait in the central area, before descending to the piers or "fingers" from which the loading of the aircraft would eventually take place. In reverse, passengers would disembark, collect their luggage, and exit from the western entrance/exit onto the roadway. Owing to the smaller scale of air travel at the time, both the arrivals and departures could be handled from the same roadway on the same level. Although the designers and engineers were aware of the idea the two could be kept separate, which might reduce congestion, it was deemed architecturally inefficient, and would reduce the rentable space of the terminal, which comprised of over half the square footage,¹² and something that became a central component of the airport's economic viability.

The design of the terminal proffers many aerial associations. The spacious central area, dubbed "the great room", was the architect's answer to the technical requirement of a 120-foot wide clear span, and yet it also offered the ability to be repeated consecutively in a manner reminiscent of an organic form, giving it a "rhythmical sequence".¹³ The resulting design aimed to be both dramatic and necessarily pragmatic: in addition to being a space that attempted to reflect the exciting possibilities flight newly afforded, the terminal also needed to be designed with a future in mind. Yamasaki elaborates further: "We also knew that air travel was the fastest growing form of public transportation and realized that the terminal would have to deal with problems of future

10 Minoru Yamasaki, *A Life in Architecture* (New York and Tokyo: John Weatherhill, 1979), 39.

11 Yamasaki, *A Life in Architecture*, 39.

12 Buford L. Pickens, "Proud Architecture and the Spirit of St. Louis," *Architectural Record* 119, no. 4 (April 1956): 202.

13 Pickens, "Proud Architecture," 198.

expansion.”¹⁴ Although the terminal appears as a composed object, it could actually be easily expanded by building additional barrel vaults attached to the initial structure.

The concrete shells were themselves graceful, and owing to the addition of diagonal rib vaults, the shell thickness at the crown was a mere 4 inches.¹⁵ At the centre, the vaults reached a height of 32-feet, and according to press at the time, the designers found the terminal avoided any “association with heavy locomotives or bus depots”¹⁶ likely due to its thin, undulating form and emphasis on views of the ramp and the sky. The interior space indeed privileged a more direct relationship between land and sky, between interior and exterior: “... the new arches had a combination of lightness and tension which, when supported on the square base, seemed to float like bulbous clouds or to suggest symbolically the graceful cross-section of an airplane wing from which the ‘lift’ is actually derived.”¹⁷ The interior space was, as much as possible, kept free of clutter in an effort to preserve the views and maintain the ease of traffic flowing through the terminal. Most of the terminal’s furniture, as well as the sculptural screen that defined the dining area of the restaurant, was designed by Harry Bertioia, supported Yamasaki’s goal of a visually unified space. According to the architectural press of the era, the resultant feeling of occupying the space is said to be one of suspension over the airfield below, which we might now read as a kind of ‘pre-departure flight’, a vantage from which “the largest planes, airborne, pass by almost close enough to touch.”¹⁸ The glazed archways added to this sensation, through which a waiting passenger could “follow the planes throughout 360 degrees as they circled the field.”¹⁹ The experience was not over once one’s aircraft took to the sky. For the departing passenger, once airborne, the terminals appeared as though they were “great open parachutes or strange tripartite bras with their diagonal stiffening ribs.”²⁰

The result, if conservative by today’s standards, was intended as a monument to flight and a new landmark for St. Louis, aviator Charles Lindbergh’s hometown. Despite its modern form, the design also made historical references, a move typical of Yamasaki’s firm, and one that in later projects attracted much discussion, including strongly worded criticisms from Charles Jencks. The structural form was comprised of three intersecting groin vaults, which *Architectural Forum* likened to the structural system employed at the Roman Baths of Caracalla. However, unlike the structure of the baths, whose vaults were perched atop walls with engaged columns, the terminal’s vaults sprung from the ground, providing an arc we might read as reminiscent of flight. In year the of its opening, Buford L. Pickens, Dean of the School of Architecture at Washington University in Saint Louis, wrote a lengthy review of the project for *Architectural Record*, during which he, too, ascribed to the work

14 Pickens, “Proud Architecture,” 198.

15 NN, “Grand Central of the Air,” *Architectural Forum* 104, no. 5 (May 1956): 113.

16 Pickens, “Proud Architecture,” 199.

17 Pickens, “Proud Architecture,” 199.

18 Pickens, “Proud Architecture,” 199.

19 Pickens, “Proud Architecture,” 199.

20 Pickens, “Proud Architecture,” 199.

an understanding of the past with but with future-oriented goals, observing that “the terminal is worthy of study for it is architecture whose bid for greatness does not come from novelty, nor from a technical tour de force,” but rather from “the dedication by its architects to a bold and imaginative concept which, once stated, was carried through despite conflicting pressures to compromise.”²¹ Perhaps refuting Le Corbusier’s damning proclamation that airport terminals could hardly stand up to the streamlined nature of the craft they serviced, Dean Pickens argued further: “Here, perhaps for the first time, an airport looks, feels and even acts as though it belongs amid aircraft—whether you view it from the inside, outside, or circling the field above.”²² This point is key, not for its praise, but for its understanding of spirit of the times: Pickens saw the terminal as *sharing* a visual language with the aircraft it serviced, rather than being a foreign entity necessary for air travel. In that sense, the project aimed to provide a more seamless transition from land to sky and back. Formalism aside, Pickens also suggests that this terminal is readily understandable by the general public; that is, the layperson can read and appreciate its inherent appropriateness without explanation or citation of its impressive costs. Indeed, its formal affinities, borne of a translation of flight and aerodynamic form into built architecture, seem to have helped imbue it with both a sense of place for the arriving passenger and a sense of anticipation for those departing. Indeed, the aerialism inherent in the project might be understood as apparent from every angle - in a similar fashion to how one experiences the aircraft itself: above it while awaiting a departing flight, next to it while emplaning and deplaning, inside of it during flight, and below as it criss-crosses the sky above.

In addition to the praise, the terminal also received critical attention from two of Yamasaki’s contemporaries, Félix Candela and Eero Saarinen. Both architects were familiar with the project during the design phases of their own projects in Mexico City and New York. Indeed, the design of Félix Candela’s Bacardi Rum Factory of 1956 was inspired by Yamasaki’s Saint Louis airport terminal, but the Spanish architect claimed he could achieve more impressive structural form.²³ The formal affinities between the two projects are indeed readily apparent - the two buildings share a similar overall form - even though the structural system and the programmatic functions of the projects are completely different. Whereas Yamasaki’s terminal is comprised of intersecting cylindrical barrel vaults, Candela’s factory is made up of intersecting hyperbolic paraboloids, lending the latter an even more undulating roof structure. Furthermore, we might also consider Eero Saarinen’s 1962 Trans World Airlines Flight Center in New York, which while visually quite different from either project, employs sweeping curves reminiscent of flight itself. In the January 1958 issue of *Architectural Forum*, one writer suggested the terminal “blends the drama of flight with a concrete shell structure and an efficient plan.”²⁴ According to historian Allan Temko, Saarinen was familiar

21 Pickens, “Proud Architecture,” 197.

22 Pickens, “Proud Architecture,” 197.

23 Based on an interview with the architect, quoted in Maria E. Moyrera Garlock and David P. Billington, *Félix Candela: Engineer, Builder, Structural Artist* (New Haven, CT and London: Yale University Press, 2008), 154.

24 NN, “TWA’s graceful new terminal,” *Architectural Forum*, (January 1958): 78.

with Yamasaki's Saint Louis project and thought it "left something to be desired as a flight terminal", primarily because its dome structures did not encourage passengers to move forward, but rather incited people to stay beneath them.²⁵ Over the years, historians and critics have likened the TWA Terminal to a bird or even an aeroplane, and Charles Jencks has also suggested that "the concrete shells are clearly recognisable as a metaphor of flight."²⁶ Through shared formal and spatial ambitions, all three projects begin to build on a growing trajectory of architectural aerialism built form, and they seem to do so as if in dialogue with one another.

If the 1950s saw the beginning of this development, we might recognise that the momentum continued well into the 1960s and 1970s. Yamasaki and Associates continued to pursue airport terminals in the years that followed the Saint Louis commission, and an examination of office records shows projects at a range of scales - from simple toilet renovations at Detroit's Willow Run airport in 1955, a hangar for American Airlines, along with three airport terminals in the 1960s and -70s. One such project was Eastern Airlines' Terminal A at Boston Logan, which opened 7 November 1969. Similar to the St. Louis project, this terminal also employs a spacious interior with a ceiling height of 73 feet, supported by exterior columns complete with arches that hold the roof structure in place.²⁷ Although the Boston terminal does not embrace as distinct an aerial aesthetic as the Saint Louis project, it employs an efficiency that might be understood as related to aircraft design, which is known for maximizing performance with a minimum amount of material and space. Instead of spreading out the many necessary components of an airport terminal, as had been the standard practice, Yamasaki and his team stacked the program vertically - including the parking - effectively housing all elements in one building. The design for the terminal was such a departure from the norm, that Eastern Airlines took out full-page advertisements in the *Boston Globe* to explain to passengers how to use the new facilities so that they would not "feel like a tourist" the first time. Passengers being dropped off entered the terminal underneath a covered roadway, checked their luggage with the skycap, and entered into the lobby, where spacious and "softly-lit ceilings ...appear to reach to the sky."²⁸ Passengers parking their own vehicles first entered the multi-level, 1,000-space car park located above the terminal's lobby, before taking an elevator down to the check-in area below.

In addition to spatial efficiency, the incorporation of parking was motivated by the large number of passengers who commuted to New York²⁹ via the new, reservation-free Eastern Airlines Shuttle that departed from the terminal's East Satellite. The West Satellite of the terminal was utilized for the more standard reservation flights that operated to destinations such as Miami, San Juan, and St. Louis, among many others. Eastern further claimed to have one of the most luxurious first class

25 Allan Temko, *Eero Saarinen* (New York: George Braziller, 1962), 46.

26 Charles Jencks, *The Language of Post-Modern Architecture* (New York: Rizzoli, 1977), 47.

27 "Eastern Airlines Moves Into Drive-In Terminal at Boston Airport," *New York Times*, 9 November 1969.

28 Eastern Airlines Advertisement, *Boston Globe*, 6 November 1969.

29 The *New York Times* estimates that nearly three million passengers were traveling between New York and Boston in 1969, accounting for 37 percent of all traffic at Boston Logan.

lounges in the country, the Ionosphere Lounge, and from the Portico Lounge and Gallery Restaurant, open to all passengers, one could “sip a drink a watch the lights glitter on jets taking off.”³⁰ Given the compact nature of the design, a passenger could now transition from his or her private automobile to a commercial airplane, whilst never stepping outside, even to board the flight. It is clear that the airline was very proud of the project, and even publicly thanked the architect in the advertisement, claiming that without Yamasaki’s help, the new terminal “might still be a dream”.³¹

If the Saint Louis terminal, along with aspects of Yamasaki’s later airports, was one of the earliest post-war projects to deploy formal affinities to an architectural aerialism, it was certainly not the last. Over the next quarter century, a number of architects seemed to embrace a similar aesthetic, both in terminal buildings, as well as in churches, sporting halls, and other architectural spaces requiring large interior volumes and lengthy clear spans. Although many before me have considered a number of these projects as “expressionist”, it appears as though we might find a more specific and more articulate term to describe this unique moment in late modern architecture. If we consider Yamasaki’s terminals, along with Candela’s Bacardi Rum Factory and Saarinen’s TWA Flight Center, as depicting an *architectural aerialism*, we might eventually be able to move beyond a discussion of the formal similarities and understand the projects as *inherently espousing the era of flight in built form*. This, in turn, might open up new avenues for examining a broader range of architectural projects and building typologies that may be newly considered in stronger terms than simply ‘architectural expressionism’. In so doing, we might finally give the projects of the aerial age a title worth their due.

30 Eastern Airlines Advertisement.

31 Eastern Airlines Advertisement.