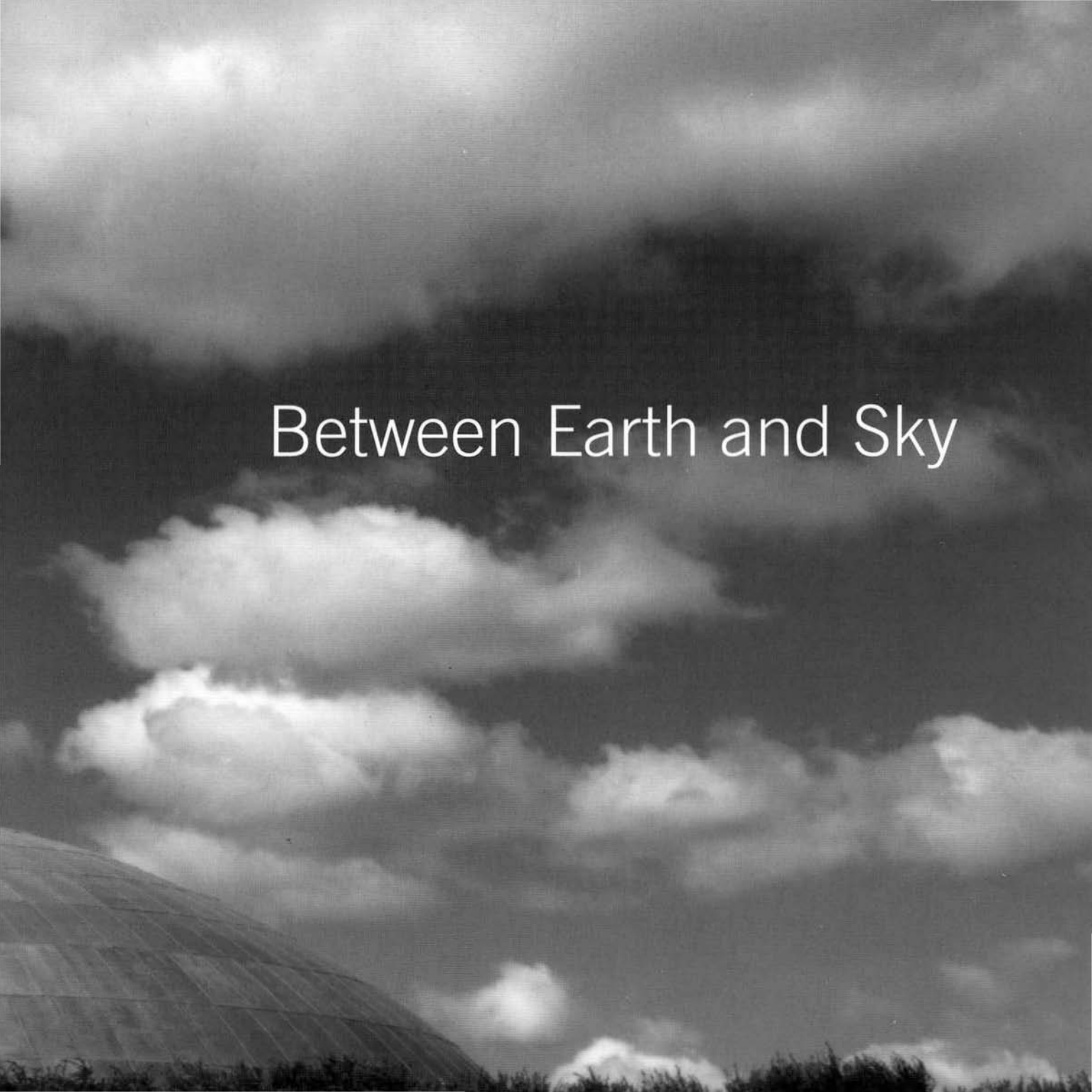

Between Earth and Sky

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THE WORK & WAY OF WORKING OF EERO SAARINEN

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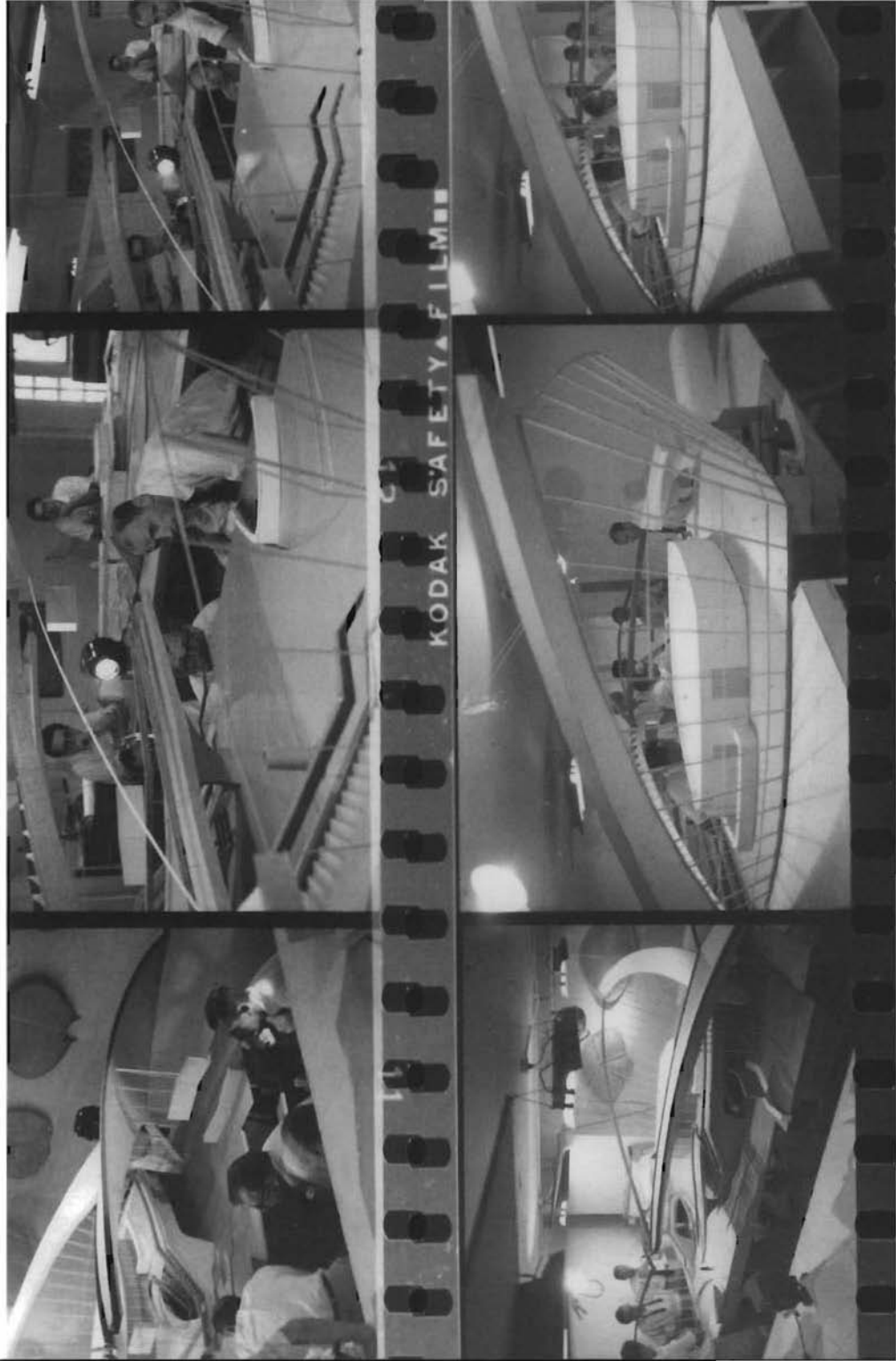
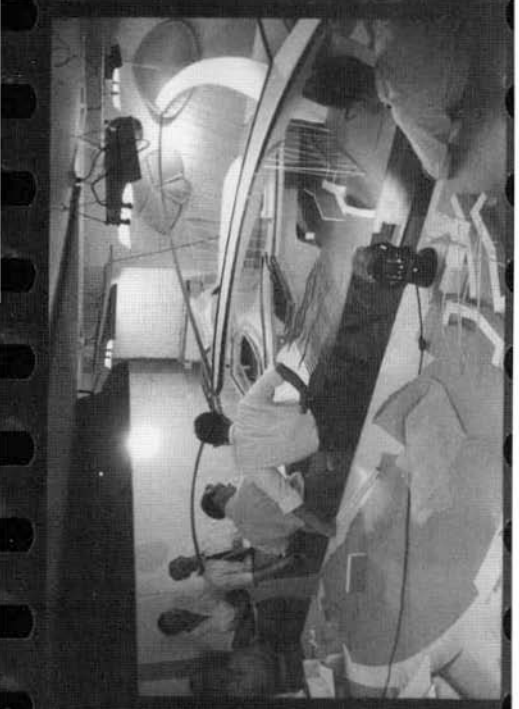
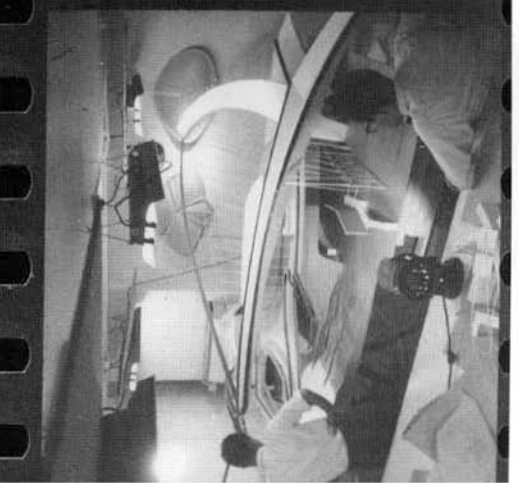






Foreword

The Finnish-American architect Eero Saarinen, first studied sculpture at the Academie de la Grande Chaumière in Paris before graduating with a degree in architecture from Yale University in 1934. He was to go on to win two first prizes in the 1940 MoMA furniture design competition with Charles Eames and a few years later be successful in a national competition to design the monumental Gateway Arch for a site on the banks of the Mississippi in St. Louis. However, it was his proposals for the General Motors Technical Center at Warren in Michigan, prepared between 1945 and 1956, that were to establish Eero Saarinen as an architect of international significance. This project was to provide the basis for both a radical consideration of sculptural form and the innovative use of material in the design of buildings. It also prompted both architect and client to develop new forms of collaborative work that connected design and technology, research and fabrication, idea and substance.

This enthusiastic cooperation with corporate America was a significant factor in securing other major commissions. The TWA Terminal at Kennedy Airport in New York, Dulles Airport and the headquarters for the John Deere Corporation in Moline followed in quick succession along with requests to design new

educational buildings at MIT, Yale and the University of Michigan, and embassies for the United States in Oslo and London.

Eero Saarinen had strong connections with Michigan. Not only had his father, the architect Eliel Saarinen, taught at the University of Michigan when he first came to America, but subsequently he and his family moved to Cranbrook where he designed the buildings for the new Academy of Art of which he was also the first Director. After teaching and working for several years with his father, Eero established his own practice in a modest studio nearby in Bloomfield Hills. Only thirteen years later, he died suddenly at the age of 51 in Ann Arbor.

This book celebrates Eero Saarinen's work and documents his contributions to architecture. It is based on Brian Carter's studies and research of this notable architect and the buildings that he designed. Professor Carter's work has resulted in a number of published articles and two exhibitions. The exhibition 'Between Earth and Sky', first shown at the University of Michigan in 1999 and subsequently across America and Canada, was made possible through an enthusiastic collaboration between Brian Carter and the renowned architectural photographer Balthazar Korab. The success of that venture resulted in a second exhibition in 2001. Curated by Brian Carter, and including working drawings alongside photographs by Balthazar Korab, it focused specifically on the design of the General Motors Technical Center. Subsequently shown at the University of Texas in Austin, this exhibition opened at the Graham Foundation in January 2003 and is scheduled to go to other venues in America and Europe. I would like to thank Professor Carter for embarking on these studies of Eero Saarinen and his accomplishments. He has done this in such a way that it conveys how the designs of this outstanding Finnish-American architect create a connection between sculpture and architecture, how ideas and materials flow together, and how everything from the smallest element to the largest structure can be integrated to create an inspired whole. I hope that you will enjoy this book and that you will find it, and the outstanding buildings that it documents, to be an inspiration too.

Dr. Gary R. Waissi
Honorary Consul of Finland in Detroit

Between Earth and Sky

Eero Saarinen suggested that 'Architecture' consists largely of placing something "between earth and sky." It is an observation that focuses attention on the 'between.'

In looking at his work, and at the General Motors Technical Center in particular, it is possible to identify a series of preoccupations that developed out of that interest in the space created when architecture is lifted from its earthbound ties and offered up to the airy expanse of the sky.

Firstly, there seems in this work, to be a preoccupation with lightness. The word 'light' occurs several times in the Concise Oxford Dictionary. In English, unlike French or German, this one word refers not only to a condition of weight but also to that of illumination. Saarinen's work revels in that ambiguity and rigorously responds to both qualities.

In his book *Six Memos for the Next Millennium,* Italo Calvino also focused on light and lightness. "For me," he wrote, "lightness goes with precision

and determination, not vagueness and the haphazard." Calvino went on to say how he looked "to science to nourish my visions in which all heaviness disappears."

In seeking out lightness Saarinen, like Calvino, embraced precision and science, and in doing so often spoke of the significance of material in architecture. For him, this pursuit certainly included close examination of the tectonic qualities of materials, and he repeatedly sought to explore how those materials would span farther, enclose space more effectively and help to create increasingly efficient and performative skins. However, he also embraced the poetic qualities of material.

This enthusiasm to explore both the tectonic and poetic defines a third preoccupation in Saarinen's work – that of collaboration. Throughout his professional life, Eero Saarinen chose to work actively with others. From the first moments of the design to the handover of a completed building he forged collaborations that resulted in productive work with clients, consultants, artists, fabricators, and contractors. It was a way of working that led to extraordinary technical innovation and inspiring acts of patronage.

Eero was born in 1910 into a setting where design, fabrication, and collaborative work were central. His mother, Loja, was a sculptor who later also became a weaver, while his father Eliel was arguably Finland's most accomplished architect at the beginning of the twentieth century. After opening an office in Helsinki in 1897, when still a student, Eliel Saarinen worked with Gesellius and Lindgren. Together they won several prestigious national competitions, saw the construction of several projects and in 1899 were invited to design the Finnish Pavilion for the 1900 Paris Exposition – a project that established them as one of the leading practices in Scandinavia.

At this time, they decided to move out of the city and designed a large house overlooking a lake where the three families could live and work together. Speaking of life at Hvitträsk, Eliel Saarinen noted that "because we lived there, my associates and I were able to enter into a deeper contemplation of the basic nature of our work."

Eero grew up in that setting and for much of that time was in his father's studio. "I practically grew up under his drafting table," he said, "and then when I was old enough…I was drawing on the other end of it."

A year after Eero's father won second place in the 1922 Chicago Tribune Competition, the family moved to America and Eliel joined the faculty at the University of Michigan. It was while he was teaching there that he met George Booth – a wealthy Canadian, owner of the Detroit Free Press Newspapers and the father of one of his students.

Eliel Saarinen's deep roots in the arts and crafts movement and Booth's interest in the creation of an environment where those ideas could be cultivated in America led to Saarinen being commissioned by Booth to design the new Cranbrook Academy of Art. On its completion Eliel Saarinen was appointed Director of the Academy. The design program he initiated there was one where "all work done by the student must be based upon reality, and therefore be a part of life itself, and not upon artificial conditions about which the student can only theorize...there is no assembling of stylistic forms for the solution of a problem, but a dependence upon common sense." As a result, Eero was to spend his adolescent years in a setting which in many ways recreated Hvitträsk in America.

He left Cranbrook in 1929 to study sculpture in Paris, returning to America a year later to study architecture. After graduating from Yale in 1934 and working for Norman Bel Geddes in New York he went back to Cranbrook to teach and to work in practice with his father.

These were extraordinary times at Cranbrook. There was an extremely lively group of students and faculty there that included Charles Eames and Ray Kaiser, Florence Knoll, Harry Bertoia, Ralph Rapson, Edmund Bacon and many others. Eero and Charles Eames became close friends and worked on numerous schemes together. In 1940, with Ray Kaiser's help, they won two first prizes in a national furniture design competition organized by MoMA.

However, it was a request from the Directors of General Motors that was to transform the career of Eero Saarinen. The company had first approached his father, Eliel, in 1945, when they asked him to design a new Technical Research Center. Eero worked with him to prepare a scheme. However, due to changing economic circumstances after World War II, the project was put on hold. When the client returned in 1948, Eliel Saarinen was seventy-five, and it was Eero who was commissioned to design the new General Motors Technical Center.

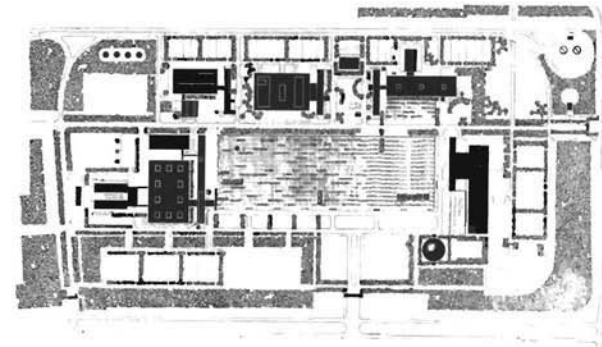
"When the General Motors people first came to my father for the General Motors Technical Center" Eero said, "they probably thought and imagined in their mind that they would get something like Cranbrook. But the problem was a different one. The whole spirit of what they stood for was a different one. The time was a different one."

When he received what was arguably the largest and most complex architectural commission in America at that time, Eero was thirty-seven and had an office with just a few people. The plan that he developed for this vast new industrial research complex on a 320-acre site outside Detroit [1] was clearly influenced by his father's earlier proposal. However it was also substantially different.

A new lake framed by distinct clusters of buildings still formed the focus of the plan, but now that lake was increased to almost three times the size of the one in the earlier scheme. Its mirror-like surface seemed to capture the sky and bring it down to the ground. And while the earlier proposal had separated cars and people on different levels, this scheme abandoned that and was developed to give greater importance to the car. Distances between buildings were increased and the expanse of the landscape was exaggerated by an ambitious planting program that created long avenues of trees. The center was registered by the scale of the road and, as one critic suggested, "just as the acropolis was built to be contemplated by a man standing still, Venice to be enjoyed from a drifting gondola, the GM Tech Center should best flash by a Buick window at 35 miles per hour."

The buildings were planned in five groups and many were lifted off the ground into that space between. A tall, thin office building to be built on a constructed island in the lake was to signal the main entrance off Mound Road. And although this office building in the lake was later omitted, it was replaced by an extravagant array of water jets and fountains designed by Alexander Calder.

The overall organization of the plan at first recalls Mies van der Rohe's proposals for the new IIT campus in Chicago that he had started in 1939. The two projects certainly had similarities -- both were planned to establish new centers for research focusing on technology, had large sites and involved the design of a family of new buildings. However, unlike the urban setting, pedestrian orientation and limited budget of the IIT project, the General Motors Technical Center was planned for a vast site on the outskirts of the city, assumed widespread use of the car and was developed for one of America's most significant industrial corporations, a client deeply involved in the research, design and manufacture of what was arguably the ultimate machine, the car. It was a plan that also created a distinctly new landscape, one that more closely resembled Broadacre City than the IIT campus of Mies or the forms associated with traditional urbanity.



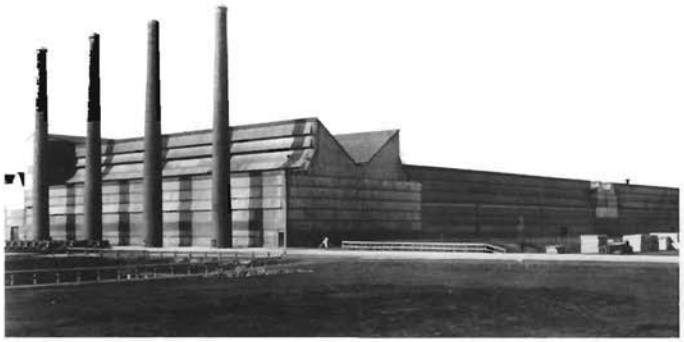
[1]

In developing designs for the buildings on this site that celebrated the machine, Eero Saarinen observed that "General Motors is a metal-working industry; it is a precision industry; it is a mass-production industry. All these things should, in a sense, be expressed in the architecture of its Technical Center. Thus, the design is based on steel – the metal of the automobile. Like the automobile itself, the buildings are essentially put together, as on an assembly line, out of mass produced units. And, down to the smallest detail, we tried to give the architecture the precise, well-made look which is a proud characteristic of industrial America."

Presented with a project that connected architecture and industry in a way that architects including Le Corbusier, Gropius and Mies van der Rohe had only fantasized about, Saarinen worked with General Motors to design more than twenty-five buildings between 1948 and 1956. Highly organized, rigorously planned on a 5 foot grid that integrated structure and environmental systems, and designed to create open and flexible workspaces with good day-lighting, heating and cooling, these buildings sought to provide the best working conditions for staff and encourage efficiency in production.

"The architecture," Saarinen said, "attempts to find its eloquence out of a consistent and logical development of its industrial character. It has been said that in these buildings I was very much influenced by Mies. But this architecture really carries forward the tradition of the American factory buildings which had its roots in the Middle West in the early automobile factories of Albert Kahn." Certainly the scale of building, the rigorous grid, and the stark simplicity of forms of the General Motors Technical Center recall Kahn's designs for Highland Park and River Rouge.[2]

By working together, General Motors and Saarinen made these buildings the basis for research, industrial production and technical invention. Perhaps one of the most significant examples of this was Saarinen's development of the curtain wall. Using metal forming techniques developed by the car industry, he was able to design and fabricate extremely thin and elegant curtain wall systems at a time when few were readily available on the market. In addition, while neoprene gasket glazing was already commonplace in the car



[2]

industry for fixing windscreens in vehicles, it had rarely been used in the construction of buildings at that time. Combining these areas of expertise, he designed cladding systems that were efficient, quick to build and both actually and apparently light. The architect and his client perfected these designs through the construction of full-scale prototypes, the testing of mock-ups, and studies of performance. Such testing sequences were everyday routines for car makers, yet were virtually non-existent in the construction industry. Enthusiastically adopted by Saarinen, they resulted in the creation of new materials and systems of fabrication and assembly which were immediately put to use in the construction of the new offices and workshops at the Technical Center.

In addition, elements within buildings were designed as light structures. So, for example, staircases in buildings were suspended on fine steel rods. Each was different yet all sought to connect ideas of lightness and performance.

Another collaborative development made it possible to manufacture a range of colored glazed bricks. Within his overall plan Saarinen was keen to create a series of large scale "cards of color" to sign the new buildings. This was to provide guidance for visitors to the campus and be obvious to the drivers of fast-moving cars, and also introduce color on a scale commensurate with the vastness of the landscape. Using techniques advanced in close collaboration with scientists from General Motors who were developing the manufacture of ceramic spark plugs and, working together with local brick makers, the architects were able to create a range of richly colored glazed bricks. Long walls constructed of these bricks form distinctive markers on the site that contrast with the transparency and lightness of the glassy curtain walls.

Eero Saarinen's use of metal at the General Motors Technical Center is perhaps most obvious and advanced in his designs for the water tower and the Styling Dome. The tall, free-standing water tower, sited within the vast lake, was to become an iconic sign of the Center. Built by pressure vessel fabricators, its sculptural stainless steel forms emphasized both materiality and lightness.

Like the water tower, the Styling Dome had appeared in the very first designs for the Technical Center that were developed by Eliel and Eero Saarinen in 1945. However, in sharp contrast to those earlier proposals where it was integrated with other buildings, in Eero's final design the Dome was transformed into an emphatic free-standing element. Sited within a courtyard, close to the main entrance and surrounded by an enclosing wall of trees, it reads as the ultimate machine in a garden – a smooth, silver metallic curving form

that reflects the sky and suggests an imagery of speed, sleekness, economy and a vision of a future shaped by technology.

Designed to provide a large column-free and well-lit space where new models of the latest cars could be unveiled, the form of the dome was developed to provide uniform illumination from all sides. It consists of two thin shells. The outer shell, which is 188 feet in diameter and 65 feet high, is made up of 3/8-inch-thick structural steel plate reinforced by steel angle stiffeners. This is clad with insulation and covered by aluminum plates stamped from .081 inch-thick sheet. Detailed like giant shingles, these plates are supported on stainless steel studs welded to the steel structure. The inner shell, which is non-structural, consists of 12 and 14 gauge perforated sheet metal which is suspended from the structural steel shell; it is shaped to function as a giant light reflector. In order to avoid acoustic problems associated with the focusing of echoes in a space of this configuration, the Dome has additional acoustic absorption provided by rings of absorbent material installed behind the perforated inner lining and within the cavity between the two layers of the structure.

Completed in 1954, the Dome is an outstanding example of the innovative use of metals. Eero frequently referred to it as a 'blister' – a term borrowed from the aircraft industry – while in its detailing it also utilizes techniques borrowed directly from the car industry. As such, this building is arguably Eero Saarinen's most successful attempt to integrate modern industrial technology and architecture.

These are just a few examples of the new materials and innovative methods of construction that were developed by Saarinen and his client in the design and construction of the Technical Center. Others included the development of new types of glass, integrated structure and servicing systems and elegant modular illuminated ceilings that created a sense of lightness within the buildings.

The Technical Center, constructed at a cost of $100,000,000 – equivalent to about half a billion dollars at today's costs – was dedicated on May 16, 1956. In his opening address, Charles F. Kettering of General Motors suggested that "We now have a place where we can make an indefinite number of practice shots; the only time we don't want to fail is the last time we try."

It was arguably that same process of design, one based on making an indefinite number of shots, which Saarinen developed with his client for this project and that was to influence his way of working for the rest of his career. During the course of designing his first major commission there were numerous experiments, industrial tests of performance, the construction of large-scale models and fabrication of full-size mock-ups.

Architecture was fused with the discipline and rigor learned from industry and specifically developed alongside the design and manufacture of the car.

Charles Eames identified this rigor as a major influence on Eero Saarinen. He observed that "industrial research vocabulary and procedures accorded in many ways with Eero's fondness for testing by models, both abstract and concrete; innovated building elements were tested at full-scale, in real conditions, over time. Energy and experience from each stage of construction were fed back to the successive ones, to upgrade the details and materials. Surface finishes were changed and changed again; aluminum glazing strips gave way to precisely detailed neoprene gaskets, as the same new techniques were incorporated in General Motors' assembly lines. From the beginning the modular principle so often taken only as an aesthetic guideline was applied with unprecedented operational thoroughness."

As his father had brought a lively and talented group of designers to Cranbrook, so the design of the Technical Center attracted an outstanding group of architects to Saarinen's office. It was a group that included Kevin Roche, John Dinkeloo, Robert Venturi, Cesar Pelli, Gunnar Birkerts, Chuck Bassett, Glen Paulsen, Tony Lumsden and Balthazar Korab, to name just a few. In addition, his enthusiastic embrace of corporate America attracted numerous other major clients. In the same year that the

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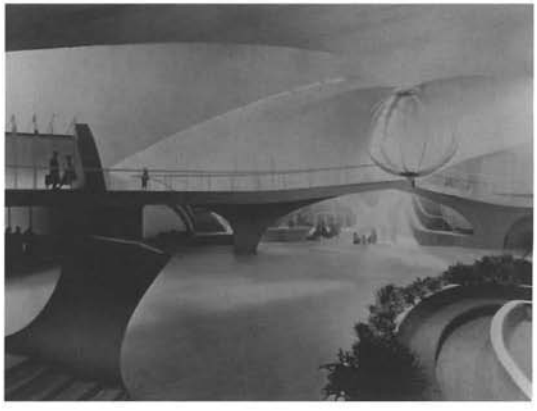

Technical Center opened, TWA commissioned Saarinen to design their new terminal in New York. Here he sought to design a building that captured the spirit of flight and chose to do this by exploiting the potential of material. He spoke of how he "would very much like to produce a real concrete building...and I think TWA will have the sort of total unity of the flowing cast material of concrete."

The design for TWA was also developed through the construction of physical models. The resolution of the complex three-dimensional forms that grew out of explorations of the potential of concrete was demanding. Numerous alternatives were investigated and details studied. The refinement of the design required the understanding of engineers, the collaborations of builders and the commitment of the client, and all benefited from the large-scale models prepared as an integral part of the design process.

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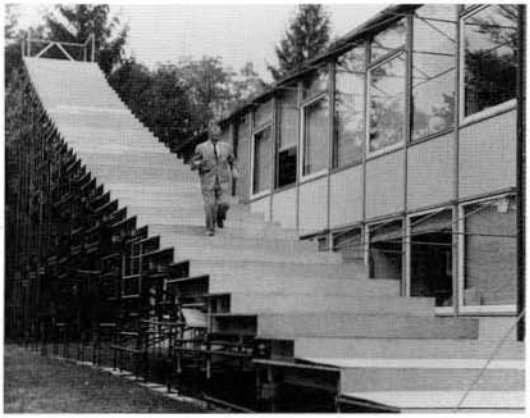

The significance of this way of working was highlighted by one commentator who observed that "To make certain that TWA would be totally resolved – one thing – Saarinen relied on model design to a degree probably unparalleled in the contemporary movement and he found the method so rewarding that it was elaborated steadily in later projects."

These elaborations involved the construction of models at increasingly larger scales. A full-size mock-up of a stair for the St. Louis Arch, which extended more than two stories in height, was constructed outside of Saarinen's office[4] to confirm the details of complex geometries, while other prototypes and full-size sections were constructed in collaboration with manufacturers for testing prior to the start of construction.

Studies like this were helpful for the clients who Saarinen frequently asked to underwrite technical innovation and the experimental use of new materials. For example, in designing the headquarters for the John Deere Corporation – a large complex of buildings planned for a manufacturer of farm machinery and set in a rural site – Saarinen recommended the use of Corten steel. He described it as "a real iron building. It is in the right kind of setting and for the right kind of a client for an iron building." Corten, however, was not a material that had been widely used for buildings at that time, and the construction of a two-story full-scale mock-up was invaluable to refine details and explain the project to both client and contractor.

Looking back, these approaches seem a logical development of Eero Saarinen's initiation into architecture at Hvitträsk, where he saw both his parents and their colleagues working together to design and build within the defining setting of the arts and crafts tradition. Later at Cranbrook he observed the advancement of these ideas in the context of industrial America. He chose to develop that way of working, and allowed it to shape his own practice in that place. The patronage of clients such as General Motors, TWA and the John Deere Corporation focused Eero Saarinen's work in a way that created outstanding monuments for the time. It was a commitment that, as Charles Eames suggested, was rooted in 'operational thoroughness' and that inspired a generation of architects. Yet, when seen in the context of much recent architecture in America, it now seems to be almost a myth. *B.C.*

GENERAL MOTORS TECHNICAL CENTER

1945-56 Warren, MI

INGALLS HOCKEY RINK

1956-59 New Haven, CT

TWA TERMINAL

1956-62 New York, NY

FURNITURE

1955-57 Tulip Chair

DULLES AIRPORT

1958-62 Chantilly, VA

JOHN DEERE HEADQUARTERS

1957-63 Moline, IL

GENERAL MOTORS TECHNICAL CENTER

"I met Eero Saarinen in 1952 when I went there to work in his office in Michigan...I was there for two and a half years...I think the most impressive thing was the method of working...Starting out and saying let's try north, east, south, west...I was very impressed then and still am by the thoroughness of the way of working...there was enormously thorough study in that office from massing to detailing."

— ROBERT VENTURI

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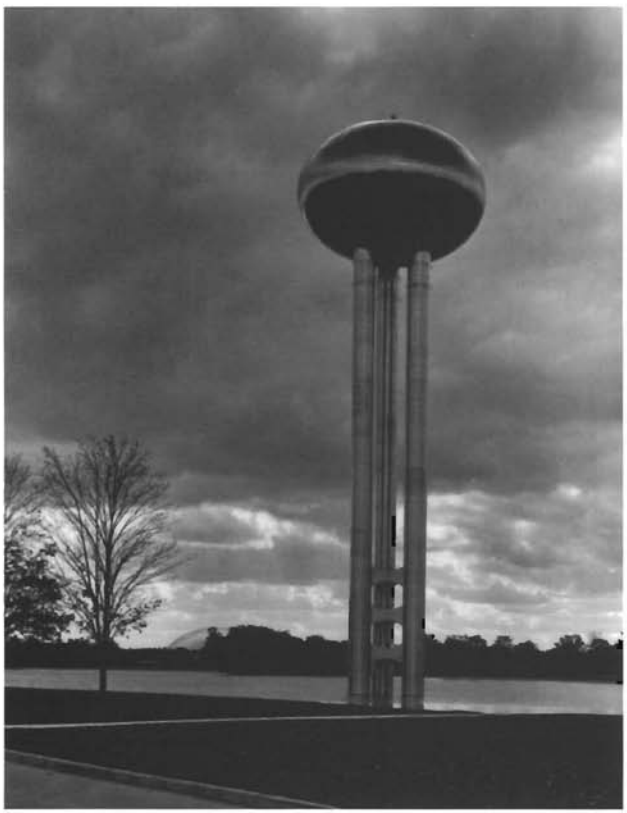
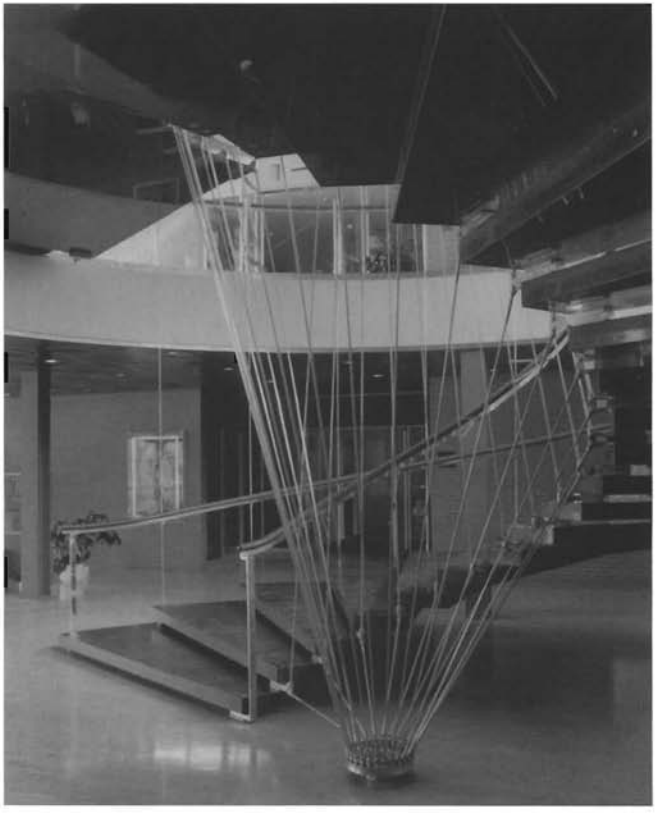


"Each of the staff organizations prides itself on its own individuality and its range of activities. Each wanted its own 'personality.' We tried to answer this desire architecturally in the main lobby of each of the five groups. These staircases are deliberately made into ornamental elements, like large-scale, technological sculptures."

— EERO SAARINEN

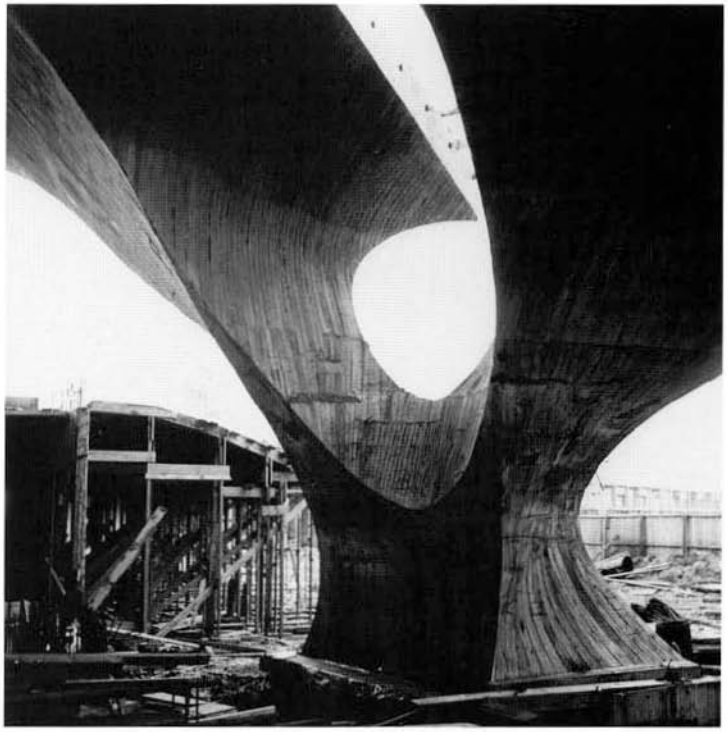


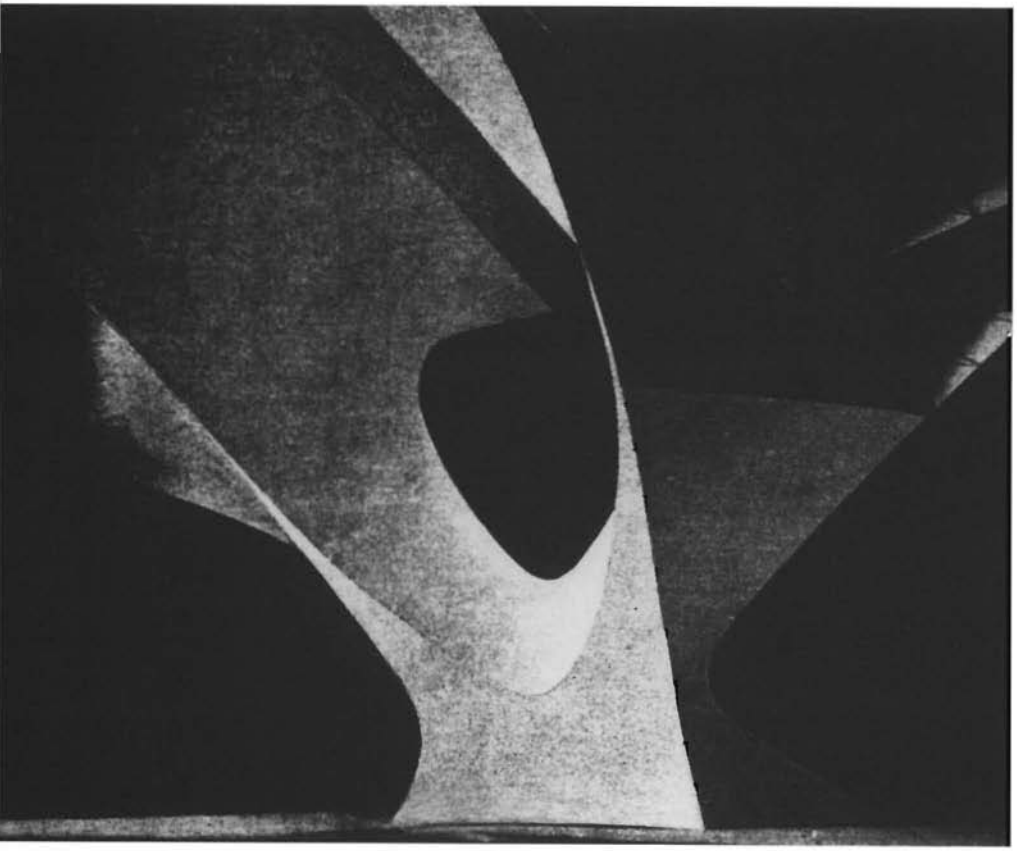
INGALLS HOCKEY RINK

TWA TERMINAL

"I was the designer in charge of that project...in some ways it's a building that freed itself, that liberated itself from what was at the time a restricted ideology. TWA expressed that freedom, it also is a beautiful building. It has another important quality which is also very Saarinen, that it was experimental. Eero was best when he was experimenting freely."

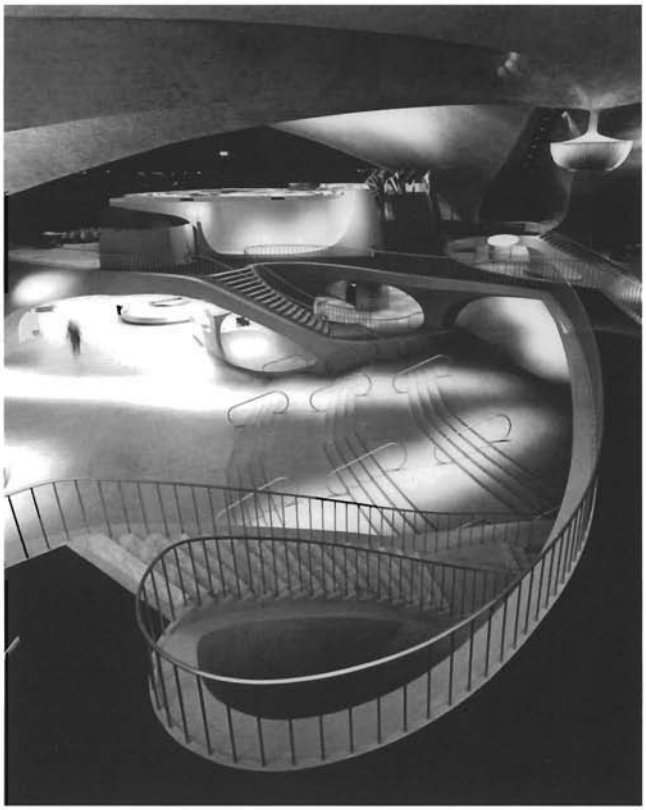
— CESAR PELLI



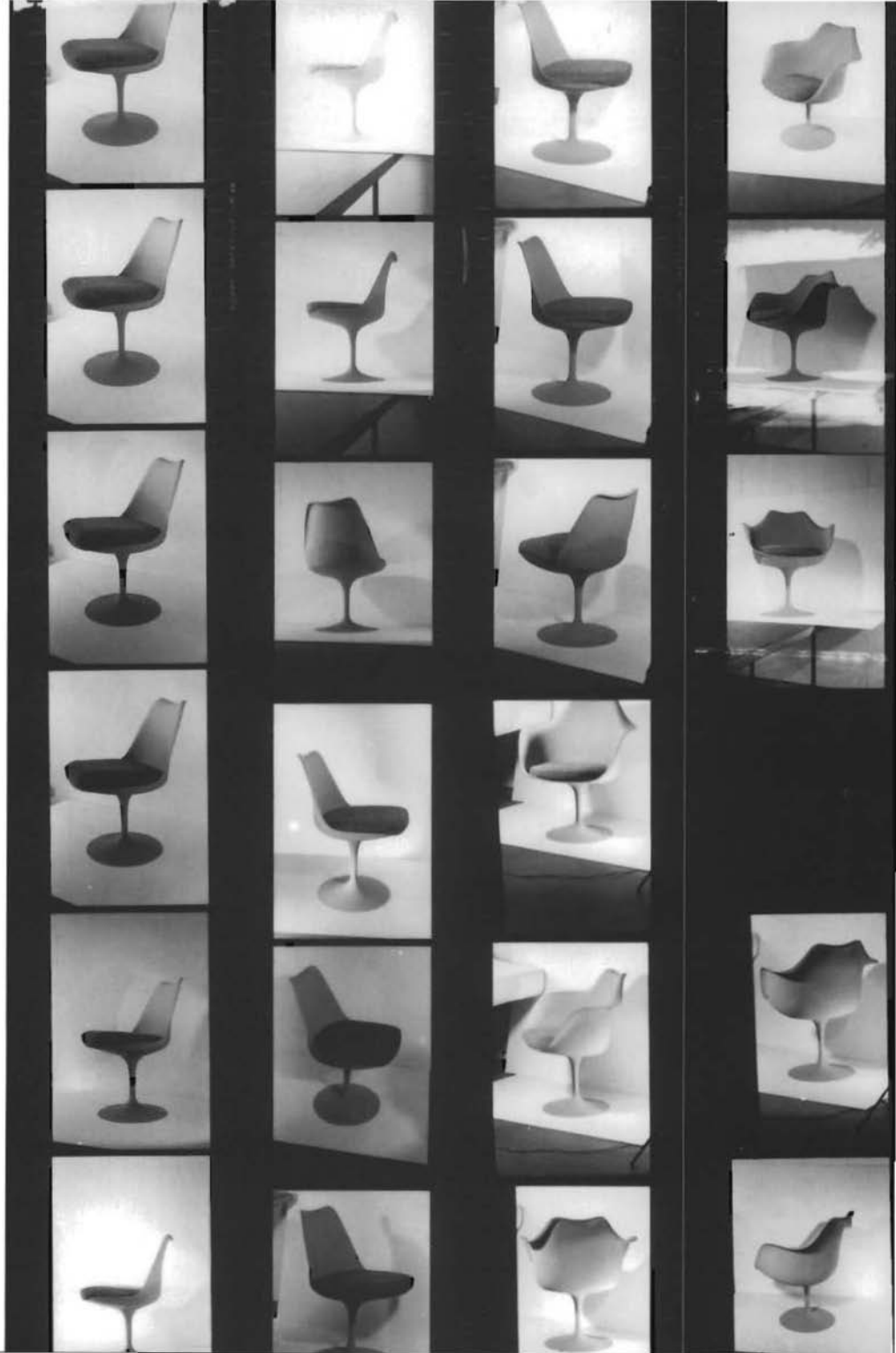


"I would very much like to produce a real concrete building...and I think TWA will have the sort of total unity of the flowing cast material of concrete."

— EERO SAARINEN




TO PLANES



"I was there when he said, "We have four-legged chairs, we have three-legged chairs, and I have seen two legged chairs, but I've never seen one-legged chairs. So we are going to build a one-legged chair, right?" So that's how this came about."

— GUNNAR BIRKERTS

DULLES AIRPORT

"...in the new international airport for Washington we're working together, as a team...a team of several firms, but we're working on the terminal and the function of the terminal. Just how should an airport terminal function? What is the best method? What really happens in a terminal? What do people really do? How do they move around and what takes time in a terminal? All these problems are fascinating and we're right in the middle of a real analysis of the problem."

— EERO SAARINEN


.RICAN
B.O.A.C.

"...a real iron building. It is in the right kind of setting and for the right kind of a client for an iron building."

— EERO SAARINEN

JOHN DEERE HEADQUARTERS

Brian Carter

Brian Carter is Dean of the School of Architecture and Planning at the State University of New York at Buffalo. Prior to coming to America he worked in practice with Arup Associates in London. Subsequently, as Professor of Architecture at the University of Michigan, he taught design, construction and criticism and was Chair of the Architecture Program from 1994-2001. During that time he curated exhibitions on the work of Charles & Ray Eames, Eero Saarinen and Albert Kahn. In 1995 he initiated the Michigan Architecture Papers, a series that received a 1998 AIA International Book Award. He was a 2002 Pietro Belluschi Distinguished Visiting Professor in Architectural Design at the University of Oregon. A graduate of the Nottingham School of Architecture and the University of Toronto, Brian Carter is a member of the Royal Institute of British Architects and a Fellow of the Royal Society of Arts.

Balthazar Korab

Balthazar Korab was born in Budapest, Hungary in 1926. A student of architecture when he left the city in 1949 to escape communism, Korab eventually completed his architectural studies at the École de Beaux Arts in Paris. He worked with Le Corbusier and then came to the USA to work with Eero Saarinen.

Korab has been uniquely successful in integrating photographic possibilities with architectural documentation. His photographs document Eero Saarinen's way of working using large scale models in the studio. They provided the inspiration for this exhibition and are an invaluable record. "To record architecture," Korab explains, "is to service the architect. To interpret architecture, one has to dig deeper to the essence of the idea and project it onto an image." There is a unique quality and depth in Korab's photographic documentation of the architecture of Mies van der Rohe, Gunnar Birkerts, Minoru Yamasaki, Frank Lloyd Wright and Eero Saarinen, among many other significant architects of the modern era. Balthazar Korab is an internationally known photographer and this publication is based on original material which he has generously made available from his personal archive.

Acknowledgments

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