Evolution of "Experimental House": Mass Production of the House and SOM During the Second World War

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The firm of Skidmore, Owings and Merrill (SOM), established in 1936, has been known as a representative of American corporate architecture since the early 1950s. Few people know about the firm's early history, during which SOM grew from a small design firm to a large corporate architecture-engineering firm. This paper concentrates on SOM's activities from 1939 to 1945, dealing with its involvement with the John B. Pierce Foundation in housing research and construction.

When the United States officially joined the Second World War in December 1941, the battle was not only waged in distant battle fields but also at home. Even more active than the war abroad, the domestic front took complex forms, transforming the country into a highly effective supply base for materiel and basic resources. Architectural journals understood the demanding war-time conditions and experimental efforts to anticipate post-war production, especially in terms of responding to the inevitable shortage in civilian housing. A systematic mass production of buildings was considered key to war-time and post-war construction, and standardization of building components seemed the best way to meet housing demands of the periods.

The September 1942 issue of *Architectural Forum*, "The New House 194X," exemplified this thinking. The journal invited thirty three architectural firms to present their ideas on standardization and systemization of a housing production, one of which was by SOM, ironically entitled "Flexible Space." While most of the other proposals were practical and useful, SOM focused on a fairly abstract idea of space. The goal was to construct a formula of spatial organization in which a building was conceived as a collection of disassembled parts and dividable functions. "Flexible Space" prefigured the idea of mass customization. The firm stated that "every family is different" and "every family changes," arguing that the formulas could meet diverse demands of various families.[1] <Fig.1> It was devised to justify and facilitate mass (re)production of a building.

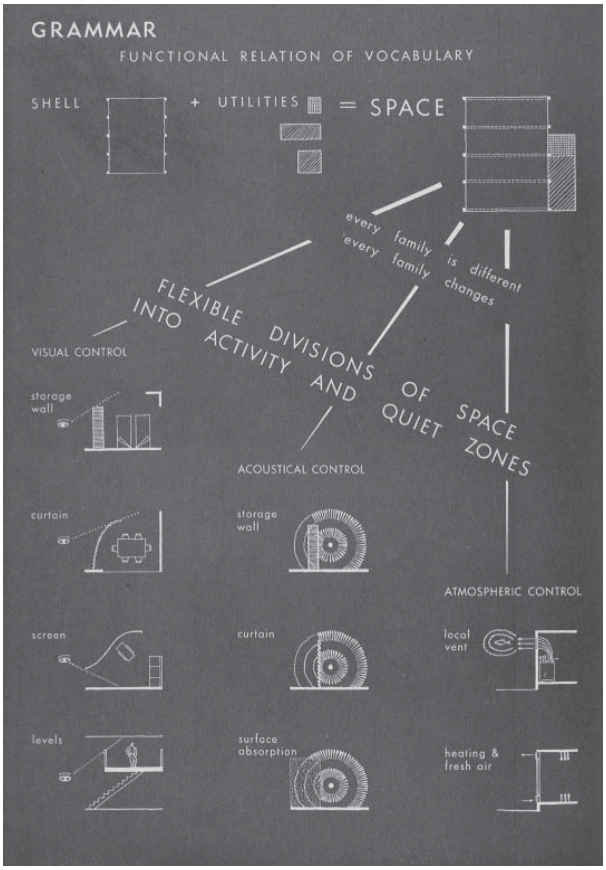

Fig. 1. SOM, Part of "Flexible Space," *Architecture Forum*, September 1942

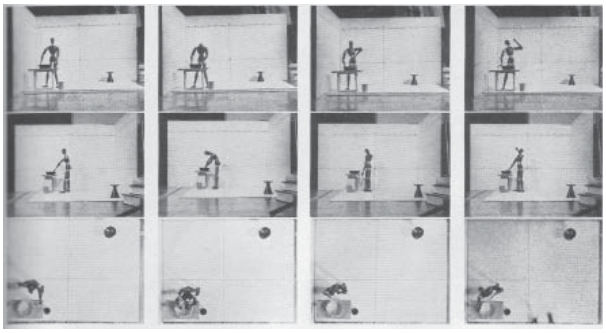

Fig. 2. John B. Pierce Foundation, "Testing the New Photographic Method in Small Scale," *Measuring Space and Motion*, 1943

This idea of flexible space came from SOM's earlier experience. From 1939, SOM was entirely devoted to research on the prefabrication of houses and related issues, working with one of the most well-known prefabrication research institutions, the John B. Pierce Foundation. The Foundation was established in 1924 by John B. Pierce, then Vice President of the American Radiator & Standard Sanitary Corporation. Its Housing Research Division was set up in 1931. In 1933, the foundation established another division, a Laboratory of Hygiene, in New Haven, Conn. This division specialized in physiological problems. The research into prefabricated housing, the use of space in the domestic environment, and physiological and psychological research were intended to complement each other. For the foundation, prefabrication was the result of a scientific understanding of individual and family life and the industrialization of a building. <Fig. 2> However, prefabrication did not necessarily mean standardization. On the contrary, it was understood as a precondition of flexibility.

At this moment, it is worth noting how the foundation's research was formulated around 1940. One of the key members of the foundation, John Hancock Callender, who later wrote *Time-Saver Standards* (1966), argued that "housing design should be based on family needs. The problem was how to obtain the data on which to base a design for housing not one, but several thousand, families." [2] As seen in SOM's Flexible Space, Callender believed that thorough research on family life would help achieve flexibility as well as prefabrication.

The Pierce Foundation's early research program on family life was highly influenced by a Swedish sociologist, Svend Riemer, who worked with the Swedish Cooperative Building Society. One of Dr. Riemer's research methods, generally called the Stockholm Study, was a continuous record of the activities of each member of a family. More than 200 families were researched through interviews and on-site sketches and then statistically classified. But, how did Dr. Riemer see the issue of design? He answered the question, presenting a paper at the Milbank Fund annual conference in New York City in 1939.

> All too often the designer views the home in its static aspect only. He considers it as comprising so much space with so much furniture, neglecting the fact that it is the setting for many diversified activities of the family and its individuals, occurring in continuous flow and often conflicting… in space and time… Design is a problem of conflicts in space and time.[3]

Like Dr. Riemer, the Pierce Foundation understood the issue of design as "a problem of conflicts in space and time." Obviously design was not an issue of style or aesthetic. In order to focus on the conflicts in family living, the Foundation suggested understanding it in terms of three categories: space, equipment, and environment. While space was measured by the physical occupation of a person and equipment around specific items in the domestic space; the environment was subdivided into physiological and psychological measurements. While the physiological environment included control of moisture, heat, ventilation, light, sound, and sanitation; psychological environment incorporated control of privacy and consideration of the general appearance and impression of the space and equipment. Aesthetic preferences and social standards were also considered part of the psychological factors. A design of a house might be "fairly conventional – possibly even Cape Cod Colonial," when taking into account aesthetic preferences and social standards. In terms of design, this is what SOM explored when it worked with the foundation. <Fig. 3>

SOM's opportunity to work with the Foundation came unexpectedly while working for the New York World's Fair of 1939. The Westinghouse was one among many of SOM's exhibition buildings. Joseph F. O'Brien, who worked for the corporation as the organizer of the exhibition, later joined

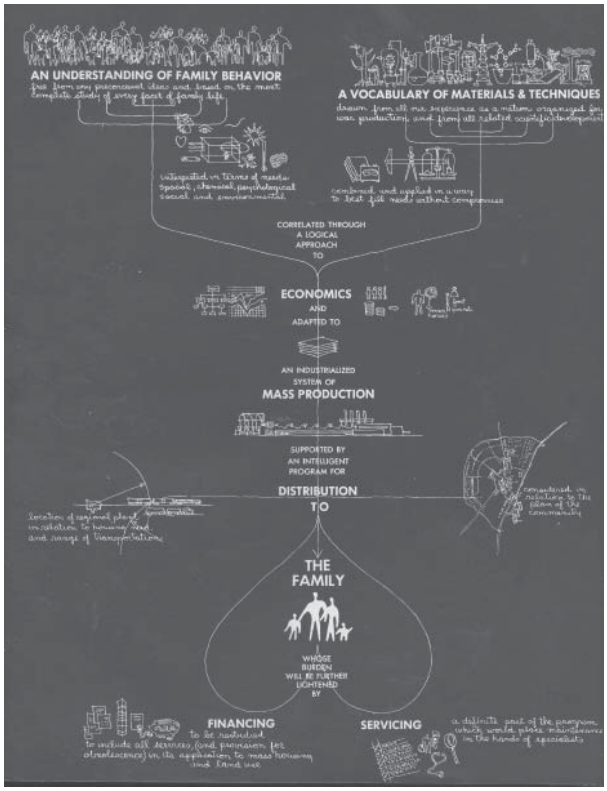

Fig. 3. Charles Eames, "Chart," Special Issue on Prefabrication, *Arts & Architecture*, July 1944

the Pierce Foundation as Director of Electrical Research.[4] Through him, SOM became Consulting-Architects to the Foundation, which enabled it to accumulate expertise related to prefabrication technology, the scientific understanding of human activities, and the systemization of its architectural language. The plywood 'Experimental House' of 1939, built on the O'Brien's farm in Lebanon, NJ, was the first result of their collaboration.[5] SOM designed and built the Experimental House and its numerous variations based on the research of the Foundation.

This first exposure to prefabrication research helped the firm win a commission to standardize the many different types of prefabricated houses that existed in the market. For the October 1940 issue, the *Architectural Forum* commissioned SOM to study all prefabricated housing and to create "a basic house design" that supposedly included all the merits and excluded all the weaknesses of individual variations. The general intention of the project was not only to present an economical house, but also to examine prefabricated houses

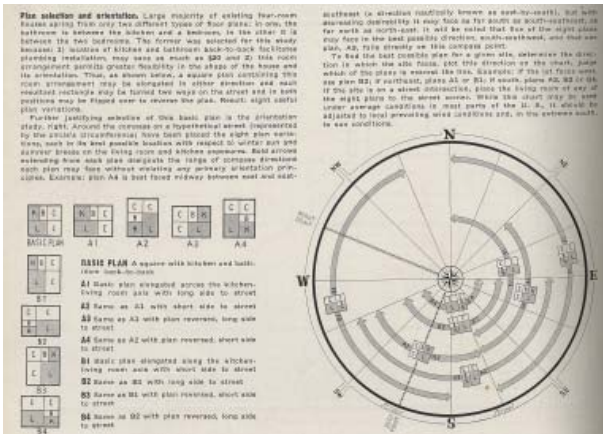

Fig. 4. SOM, Plan Selection and Orientation Diagram, "The Architectural Forum Defense House by Skidmore, Owings & Merrill, Architects." *Architectural Forum*, November 1940

available on the market and provide the manufacturers with a standard model of the low cost dwelling unit. For the journal, SOM presented a prefabricated house and developed a feasible manual for large-scale housing development. SOM explained its design with a 'Plan Selection and Orientation' diagram. The firm chose one basic plan. Based on the plan, eight variations were produced. <Fig. 4> These variations could be installed in any location according to the orientation diagram. This simple diagram was believed to be employed in almost all parts of the country.[6] A few months later, SOM had an opportunity to apply it.

On October 7, 1941, a group of businessmen, government officials and reporters gathered in Baltimore, Maryland in order to celebrate the completion of a housing project for the employees of the Glenn L. Martin Aircraft Company. <Fig. 5> The event was followed by a tour to Middle River, Maryland, where a 600 unit housing project was built. SOM was the main architect for the project, creating general plans and specific technical drawings as well as construction supervision. The Experimental House was used as a prototype.[7] A set of detailed drawings was repeated 600 times to create 600 identical houses. It took a compact four and one-half room rectangular shape, type A3 in the 'Plan Selection and Orientation' diagram.

The main building material was 'Cemesto' board, a product of the Celotex Corporation. Cemesto board consisted of a cane-fiber insulation board

core, sealed with a special compound between two layers of a combination of asbestos and cement. These boards did not need painting. All panels, ceiling boards, and structural members were delivered cut to specified sizes by the manufacturer. Assembly work was done mainly in a field shop. Workers of each team knew only their own specific task, much as a worker on an assembly line repeats a series of work.

The successful completion of the Glenn Martin project helped SOM participate in the Manhattan Project. The United States began development of the atomic bomb around 1942, when the U.S. Army Corps of Engineers created the Manhattan Engineer District (hereafter, MED) under the directorship of Leslie R. Groves. There were three major locations for the project, Oak Ridge (TN), Hanford (WA), and Los Alamos (NM). Among the three, Oak Ridge was the first and most complex. It was the city SOM designed.

The site of the future Oak Ridge did not appear on the map until fall of 1942. MED used compulsory acquisition to purchase a rectangular area of 59,000 acres at $2,600,000. The reservation area had been carefully selected: it was safe from air attack; the Tennessee Valley Authority supplied large quantities of dependable electric power; an adequate water supply from the Clinch River shirted the site; natural barriers defined flat building areas; and the land was cheap.[8]

JOHN B. PIERCE FOUNDATION, Robert L. Davison, Director of Housing Research

SKIDMORE, OWINGS & MERRILL, Consultant Architects

Most recent of the experimental, low-cost houses developed by the John B. Pierce Foundation is this "skeleton frame and curtain wall" house built by the Stanebury Corporation near Baltimore, Md. Two elements are of special news interest: 1. The structural system. 2. A rationalized construction procedure which assigns items to the shop or the field according to where they are most economically handled; yet which does not conflict with existing craft organizations. Such operations as sizing, notching, etc., are handled in the shop or mill; actual assembly of elements is made a field operation.

As in previous houses researched by the Pierce Foundation (AR 1/34; 8/35; 10/36 and 9/39), plan elements, materials and construction methods were determined only after exhaustive pre-analysis and test, with no interest in or bias in favor of any particular material, equipment or system per se.

Detailing of the house for large-scale production required the development of an entire new type of drawing, combining architectural, structural and shop drawings, specifications and erection manual (see next page).

Fig. 5. The Glenn Martin Project by SOM and the Pierce Foundation, *Architectural Record*, May 1941

During the construction of houses, no one knew the final size of the town, which got larger and larger until it turned out to be "the biggest job of quick town building ever attempted in the U.S.A."[9] When the war ended, what had been empty land in 1942 was filled with a population of 75,000, with all necessary facilities for a normal town. How could a small, barely known firm of some 25 employees take the nation's most confidential and largest war-time project and complete that mission successfully?

In late June of 1942, the earliest stage of the town development, the Stone & Webster Corporation (S&W) took the responsibilities of constructing the whole site including nuclear facilities and the town. Later, MED concluded that the corporation did not have the ability to complete the housing and town planning mission. MED quickly began to search for another team. On January 28, 1943, MED officials met with O'Brien of the Pierce Foundation and Louis Skidmore of SOM. At the meeting, O'Brien and Skidmore promised that, within two weeks, they could present "complete plans and specifications, a site layout including stores, dormitories, recreational facilities, and hospital, and cost estimates based on any size town."[10]

On February 16, 1943, a Harvard-trained landscape architect and former partner of Olmsted Brothers, Leon H. Zach, chief of the Engineering Branch Construction Division, was called in and asked to compare the S&W's and the Pierce Foundation's plans. Zach concluded that the new plans by SOM showed "far more thought and ability" than S&W's plans.[11] With the meeting, the Pierce Foundation and SOM now became an official part of the Manhattan Project.

On February 25, 1943, John O. Merrill and five other SOM employees left for Knoxville, Tennessee. SOM's initial site plan had been based on an aerial contour map and some photographs, so it

could not be used for construction. Since there was no time to develop a site plan drawing from the context, it was inevitable for SOM architects to inspect all the road locations on foot in order to avoid topographical obstacles, and to check all potential locations for houses.[12] Once the position of roads was indicated, construction was almost automatic. Immediately after construction orders were issued, a full construction crew and equipment followed the SOM survey team. As in the Glenn Martin project, each construction team completed a set number of tasks. By doing so, 30 to 40 houses a day were ready for occupancy.[13]

SOM's initial contract included site planning for road design and house locations, three thousand dwelling units of six types, two shopping centers, a town administration building, a hospital, a nurses home, an elementary school, two apartment buildings, a gas station, a recreation hall, and a grouping of neighborhood stores. At this stage, the estimated population was 22,000 residents. Seven months later, that number grew to 44,000, which soon grew to 66,000. In order to measure its scale of production, it might be helpful to mention the number of housing units in the city. By the end of the war, the total housing reached nearly 10,000 family units, 13,000 dormitory units, more than 5,000 trailers, and 16,000 huts and barracks.

The original houses built by SOM in 1943 played an important role in determining the general character of Oak Ridge. Those houses were variations of the original Experimental House developed by the Pierce Foundation and SOM. Joseph T. Ware, who served in the city during the war, recalled that there was "no requirement for stylistic design."[14] Nevertheless, there existed a certain homogeneity in the designs of the houses and other facilities. The design was neither modern nor traditional. It was something in-between: a hybrid. There were two reasons for this; first, SOM used the houses developed by the firm and the Pierce Foundation as generic prototypes and MED was fully satisfied with them. In addition, the Experimental House was designed to be built anywhere with minor modifications. Second, MED had not preferred a specific style. It suggested that the cultural connotations over a specific style should be suppressed because new settlers would come from all of the country. Instead, vague symbols of country houses were thought much better than a particular model.[15] Obviously there was no time and resources for considering aesthetic preferences and social standards of each settler.

The physical shape of Oak Ridge was a narrow strip approximately one mile wide and over six miles long. SOM planners laid streets to follow the contours of the landscape, a procedure which minimized grade operations and construction costs, and allowed easy expansion. This helped the city look quite natural on the map. This shape however was a result of the army's requirement that the percentage of grade on the roads could not exceed eight percent.

At the end of 1944, SOM hired almost 650 employees at Oak Ridge and was transformed into an entirely different firm in terms of its organization, operation, and capability. The organizational change of the office began in August 1943, when the major labor force of the firm moved to the fenced town of Oak Ridge from the New York office, along with the move of the MED headquarters to the town. From then on, the scope of SOM's responsibility suddenly became quite inclusive. Anything remotely connected with planning, building, furnishing or equipping of the town was the firm's responsibility.

This change was conditioned by SOM's second contract with MED. As Captain Samuel Baxter of MED reported, SOM was "required to maintain his complete staff, and conduct all his operations at Oak Ridge."[16] The requirement drove the firm to invent a new organizational structure. In order to complete a commission expeditiously, Skidmore and Owings introduced an innovative solution: bringing in competent professionals from entirely different fields while radically restructuring and expanding its own personnel and operational methods. At Owings's request, the L. S. Ayers Department Store in Indianapolis dispatched its key merchandizing manager, and Skidmore asked Robert Moses to send the chief engineer of the Tri-borough New York - New Jersey Bridge Authority to head the traffic and highway department. SOM hired a complete construction company from Grand Rapids, Michigan to form the construction division of the firm. Jan Porel, under whom SOM worked at the Glenn Martin project, joined the operation.[17] Ironically, when MED evaluated and

praised the firm, not a single comment on 'quality of design' was mentioned. It only discussed its organizational capacities, which later proved to be the key to SOM's triumph in the post-war years. However, it should not be forgotten that the organization could be built only because of its new concept of design based on prefabrication and flexibility.

With the detonation of the atomic bomb, SOM completed its brief, transformative journey, one that had begun with the small Experimental House in New Jersey. The journey was well rewarded with a formidable organization, which combined mass production and flexible space. It was now poised to become the best known firm in modern architecture in the post-war world.

ENDNOTES

1. "The New House of 194X," *Architectural Forum*, September 1942, p.100-03

2. John H. Callender, *Introduction to Studies of Family Living*, John B. Pierce Foundation, December, 1943, p.5

3. Svend H. Riemer, quote in John H. Callender, ibid., p.8. Riemer's paper was later published. Svend H. Riemer, American Public Health Association, Committee on the Hygiene of Housing, "Family Life as the Basis for Home Planning," *Housing for Health*, Lancaster: Pennsylvania, 1941

4. *New York Times*, November 12, 1938, p.26

5. "The Architectural Forum Defense House by Skidmore, Owings & Merrill, Architects," *Architectural Forum*, November 1940, pp.444-49

6. Ibid.

7. *A Vital Contribution*, Chicago, IL.: The Celotex Corporation, 1941

8. Charles O. Jackson and Charles W. Johnson, "The Urban Frontier: The Army and the Community of Oak Ridge, Tennessee, 1942-1947," *Military Affairs*, February 1977, p.9

9. "Atom City," *Architectural Forum*, October 1945, p.103

10. "Conference with J. B. Pierce Foundation with Reference to Town Planning and Housing Development," January 29, 1943, File MD-337, J. B. Pierce Foundation, Box 29, RG 4nn-326-85005, The National Archives and Records Administration (NARA)

11. "Conference-Housing," February 17, 1943, File MD-337, Meetings and Conferences, District Office, Box 28, RG 4nn-326-85005, NARA

12. Stephane Groueff, *Manhattan Project: The Untold Story of the Making of the Atomic Bomb*, Boston: Little Brown and Company, 1967, pp.164-65

13. Walter G. Metschke, *Memoir of Walter G. Metschke*, The Art Institute of Chicago, 1998, pp.38-39

14. Joseph T. Ware, A Letter Sent to Nathaniel A. Owings, October 7, 1970, Box 49, The Papers of Nathaniel A. Owings, The Library of Congress

15. Nathaniel A. Owings, *The Spaces in Between: An Architect's Journey*, Boston: Houghton Mifflin Company, 1973, p.90

16. Captain Samuel S. Baxter, "Completion Report of Skidmore, Owings and Merrill, Contract No. W-7401-eng.69." October 9, 1944, File MD-600.914, Skidmore, Owings & Merrill, Completion Report, Box 51, RG 4nn-326-85005, NARA

17. Owings, Op. Cit., pp.87-8