RESEARCH OPEN HOUSE 2021

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PROBING THE UNIVERSAL WITH MACHINES:

EXPLORING THE POTENTIAL OF A CNC PLASMA CUTTER TO MANUFACTURE PARTS-BASED INDUSTRIAL HOUSING

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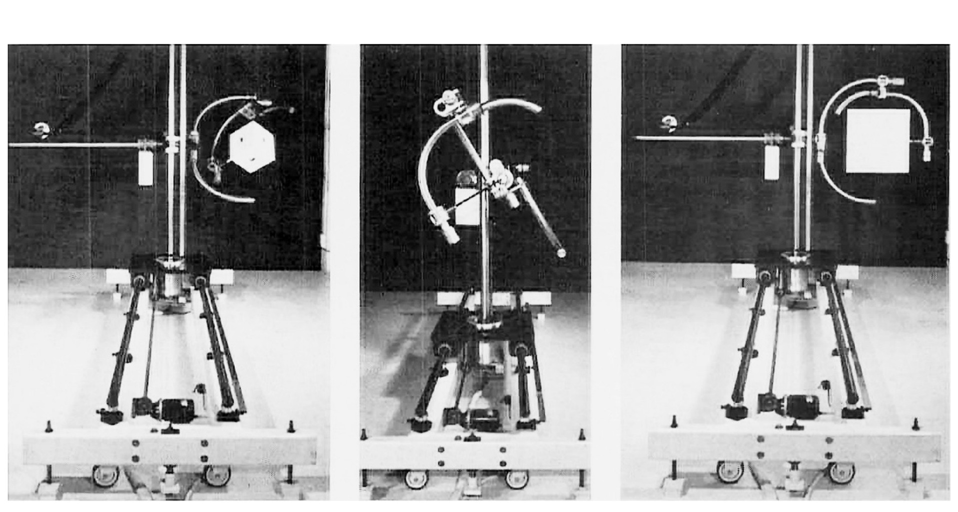
CONTEXT:

In his seminal writing on Industrial Architecture, *The Turning Point of Building: Structure and Design* (1959, Eng. trans 1961), German architect and educator Konrad Wachsmann described the distinction between special machines and universal machines specific to the manufacture of buildings. He lists "band saws, planning machines, turning lathes and so on" as universal machines — or machinery capable of operating on a variety of materials and capable of performing a variety of operations, cut-outs, forming, shaping, etc. Universal machines, which appeared on the manufacturing scene in the 1800s, distinguished themselves through a capacity for "duplication of a great variety of shapes" while special machines, according to Wachsmann, perform a singular, specific operation (punching, stamping, forming), often using specialized tooling, such as dies, attached to the machine. These definitions are distinguished by the universal machine's various nature and the singular focus of the special machine. In the same writing, Wachsmann lists the machine's potential contributions to industrial building manufacture: subtractive operations (cutting, drilling), additive operations (welding, joining, fastening), and through tool making (the fabrication of dies, jigs, etc.).

Wachsmann's design efforts in the realm of machinery include his layout work for the General Panel Corporation Factory in Burbank, California (1947), and in his development of the Location Orientation Manipulator (L.O.M.), with John Bollinger and Xavier Mendoza at the University of Southern California (1969-71). While his factory planning included the layout of many state-of-the-art machines that were to be used to create panel and node-based housing, the L.O.M. was developed as a single, universal "assembler" with 7 degrees of movement, "a physical tool for the control, measurement, and display of the kinematics of (building) design, production, and assembly" specific to industrial building systems. While the L.O.M. anticipated computer-controlled machinery and architectural robotics, Wachsmann did not anticipate the ubiquitous nature of CNC machinery today, nor that such machines would be scaled to industry (XL) and the DIY-er/maker (SM) and be made highly transportable in relation to the building site.

Informed by Konrad Wachsmann's observations on architectural machinery developed for and employed in the manufacture of industrial buildings — and as part of a larger research project to develop a contemporary Universal Building Macine (U.B.M.) — the authors determined to test a CNC-based machine capable of subtractive operations, additive operations, and tool making to make parts-based housing. The choice of the CNC plasma cutter — a multi-axis gantry-based machine that can process various metal sheets and stock shapes — was determined in anticipation of a U.B.M. that will cut, weld, press, manipulate parts, and assemble. The experimental objects shown here are attempts to make common industrial house parts — brackets, trusses, columns, etc. — to inform the U.B.M. under development (see Elizabeth Andrzejewski's *Konrad Wachsmann's Shift from Product to Process: Prefiguring Automated Industrialized Building in Architecture through Developments in "Universal" Building Machines*).

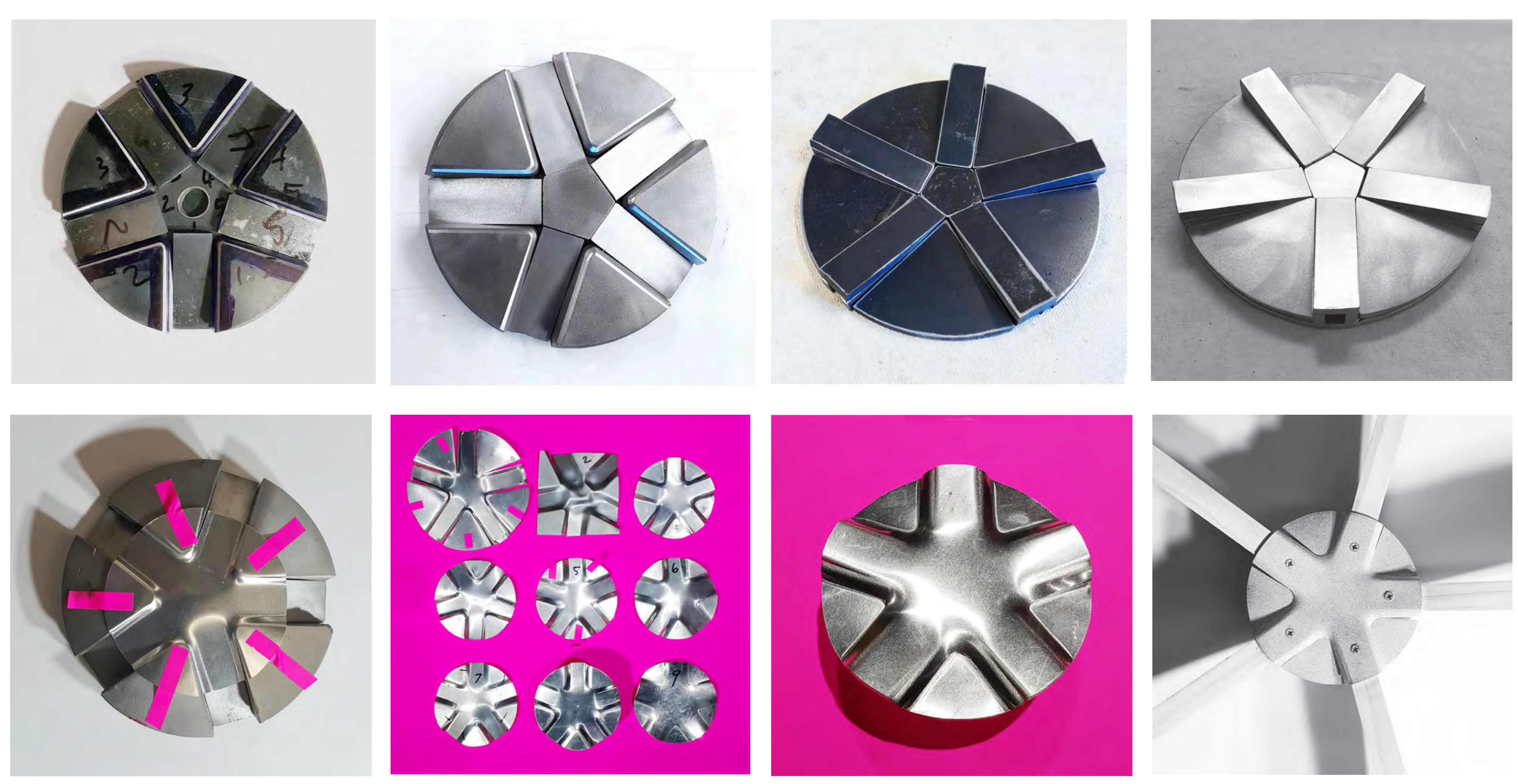


Wachsmann, Bollinger & Mendoza's L.O.M., A Universal Machine developed to test the automated assembly of industrial buildings.

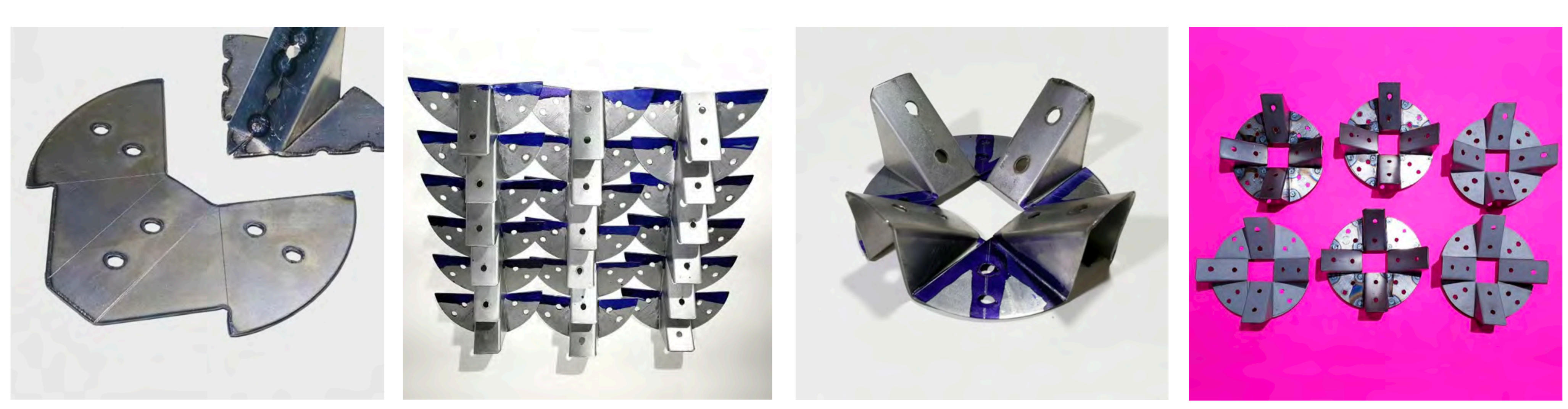
RESEARCH QUESTIONS: IN THE CONTEXT OF AUTOMATING HOUSING CONSTRUCTION, CAN A CNC PLASMA CUTTER — A SUBTRACTIVE, ADDITIVE, OOLMAKING MACHINE — BE USED TO MANUFACTURE PARTS-BASED INDUSTRIAL HOUSING?

Plasma Cut Truss / Study 01

Plasma Cut Truss Study / 02



Plasma Cut M/F Press Plates and Resultant Aluminum Node for Geodesic Construction



Plasma Cut 45-degree Space Frame Bracket / Study 01

Plasma Cut 45-degree Space Frame Bracket / Study 02 (Triangular Section)

IMAGE CREDIT: MARCUS SHAFFER

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