Konrad Wachsmann’s Shift from Product to Process:

Location Orientation Manipulator

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Historical Cotext

Between 1940 and 1960, architect Konrad Wachsmann explored the theoretical concept of an architectural universal through the joint building system and fabrication methods. By 1971 his explorations of mechanical building assembly were ahead of his time. This building machine called the Location Orientation Manipulator (L.O.M.) was developed by Wachsmann and his doctoral students John Bollinger and Xavier Mendoza between 1969 and 1971 at the University of Southern California. This machine was unique from other robotic manipulators at the time because it was developed by architects to study the kinematics of architectural building assembly. At the time, the L.O.M. was built from the most technologically advanced robotic components borrowed from the aerospace and automotive industries. It could move with 7 degrees of freedom and was used to manipulate and rotate points, lines, planes, and assemble building components.

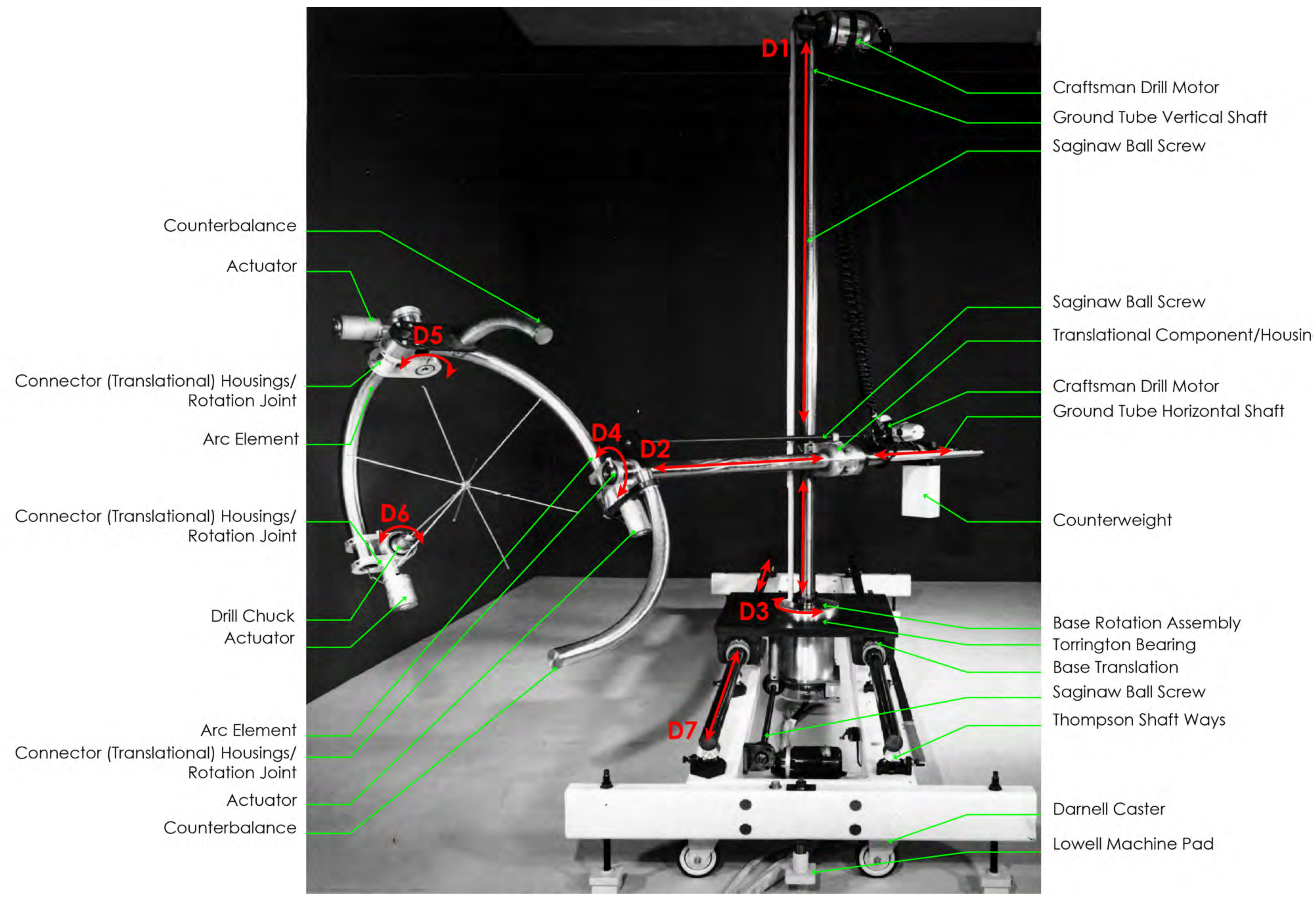


IMAGE CREDIT: ELIZABETH ANDRZEJEWSKI

L.O.M. Parts, Components, 7 Degrees of Freedom

Methods

Though the L.O.M. was lost shortly after its construction, the team was able to virtually reconstruct the machine from the dissertation of Bollinger and Mendoza, images, and video. Through the digital reconstruction, the team observed the tooling, machinery, and processes utilized to produce the individual components of the L.O.M. in 1971. This analysis is best exemplified in the virtual reconstruction of the translational component.

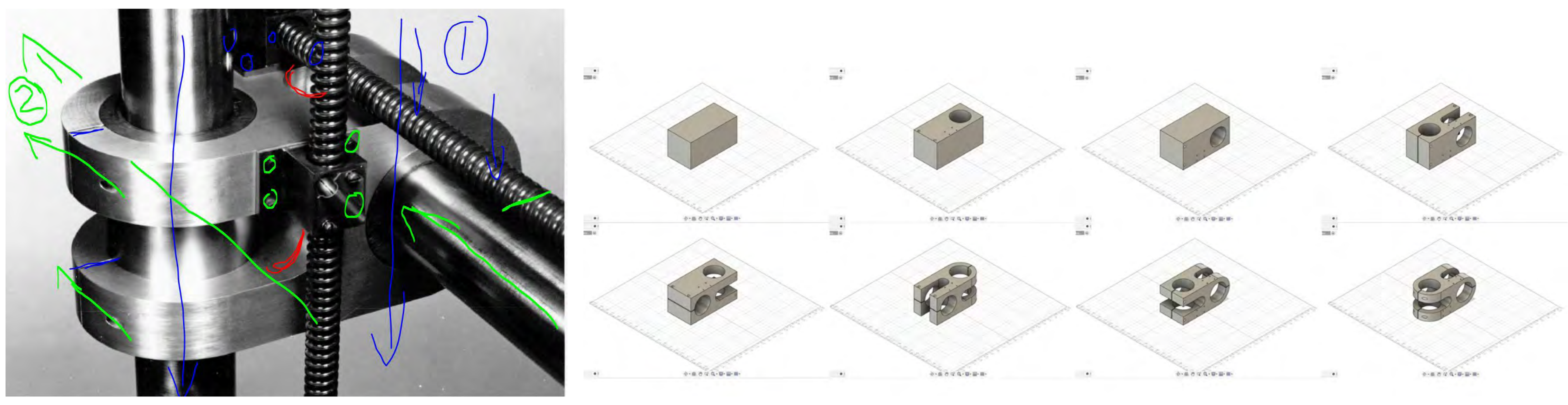
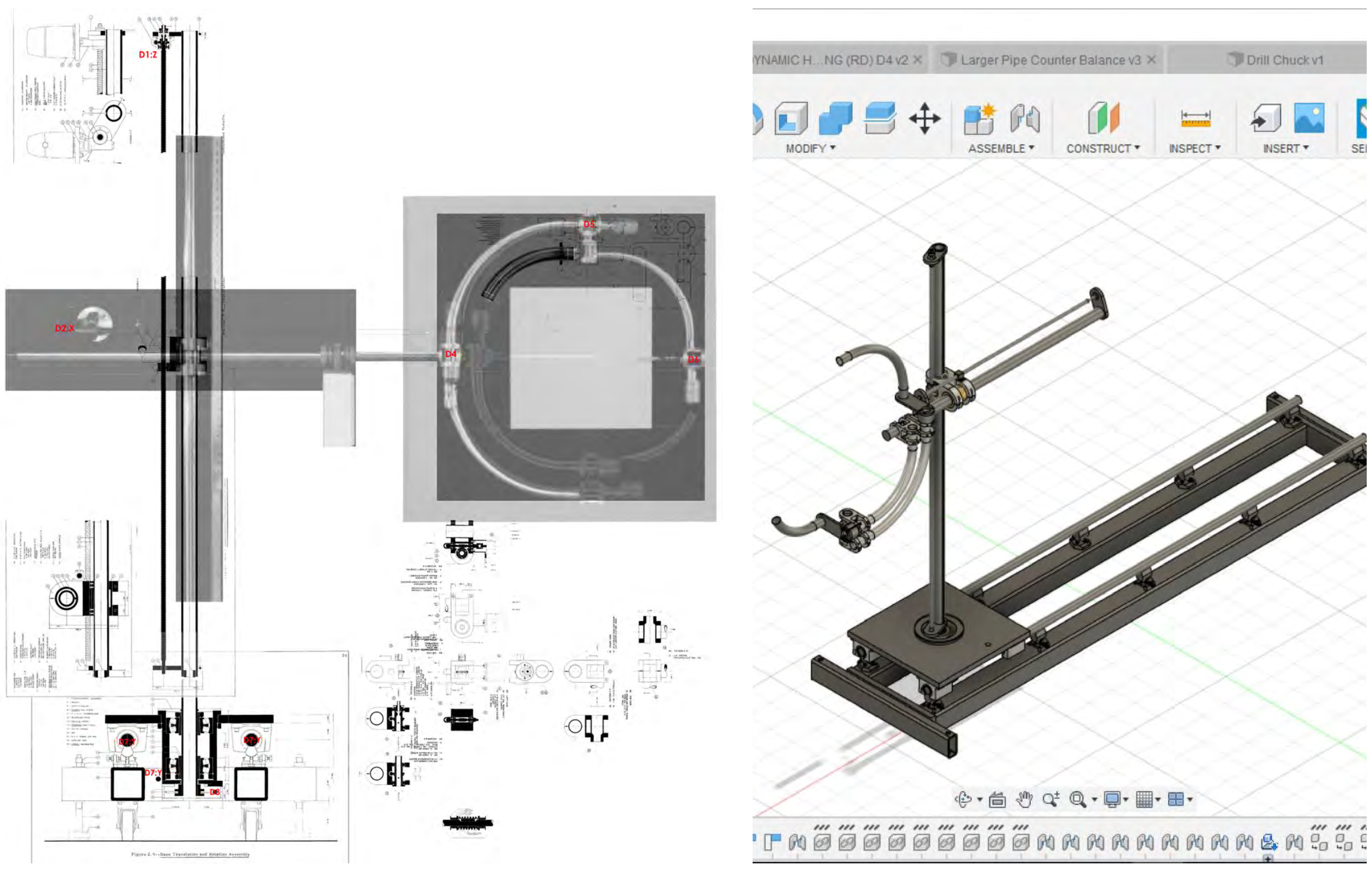


IMAGE CREDIT: ELIZABETH ANDRZEJEWSKI

Bollinger and Mendoza’s dissertation states that this part was milled out of a 4”x4”x8” block of aluminum. The team began with an image of this component and overlaid a diagram onto it to understand operations that would have been used to mill the part. Considering typical milling processes, or capabilities of a modern five-axis CNC mill, milling the translational component from an aluminum block would be processed in a very specific order, as the block had to be positioned and held in a very specific way. The rounded interior and exterior forms were not meant to be decorative but rather were formed by the rounded end mill used in a milling process.

Significant Results

Critically, the animated recreation of the missing L.O.M. in Fusion also allowed the team to rotate and manipulate different joints on axis, resulting in a better understanding of how the machine was designed to assemble buildings. Studies of tooling, machines, and processes are important to understand the L.O.M. as a product of technologies available in 1971, as well as the mechanical capabilities and limitations. This reconstruction of the L.O.M. has produced a dimensionally accurate digital model of the L.O.M. and its motion, which had previously been inaccessible.



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L.O.M. Collage and Virtual Reconstruction.

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