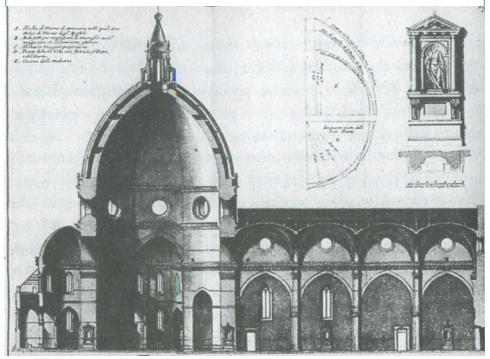
DOME COMPETITION

A competition was held by the directors of the Opera del Duomo upon which the two main architects vying for the Dome were Brunelleschi and Lorenzo Ghiberti. This time Brunelleschi was found victorious, but not for long. The council believed that Ghiberti should continue to help oversee and collaborate with Brunelleschi's work. Even in this minor role, Ghiberti would be paid an equal salary to Brunelleschi which made him furious. Brunelleschi consulted his friends Donatello and Luca della Robbia whom advised him to feign ill. When he was "ill" the work was placed onto Ghiberti who claimed the task was too daunting for him. A victory for the great Brunelleschi!

TIMELINE OF CONSTRUCTION

1296: *Cathedral begun by Arnolfo di Cambio*
1355-57: *Francesco Talenti enlarges the east end of the Duomo, including the dome base*
1418-19: *Arte della Lana competition*
1420: *Brunelleschi's solution accepted*
1436: *Brunelleschi completes construction on the dome*
1439-45: *construction of exedrae, or outside bench*
1446-61: *construction of dome and lantern*



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Brunelleschi's Dome

An Engineered Masterpiece

Study 03: COA 3116
George Doyle
Tyler Wolf

Historical Background

Filippo Brunelleschi, a man of stubborn patience and intangible potential of the time, was the creator and inventor of the infamous double-shelled dome of Santa Maria del Fiore in Florence, Italy.

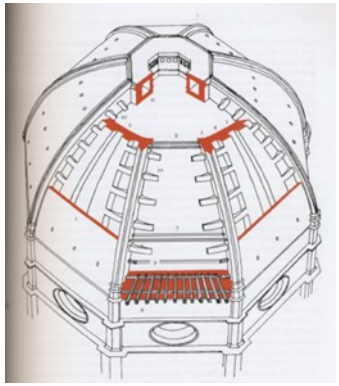
He became inspired by his research in Rome, Italy from Hadrian's Pantheon and archeological digs in the Roman Forum. From this, the impossible engineering fleet at the time of construction was made possible.

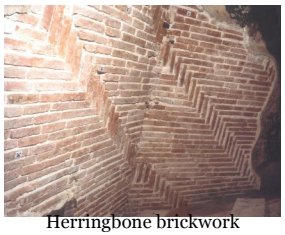
The Renaissance genius bent men, materials, and the very forces of nature to construct such an architectural masterpiece we still see today.

Denounced at first as a madman, Brunelleschi was celebrated at the end of the achievement as a genius by his Florentine people. Within thirty years he engineered the perfect placement of brick and stone, and built ingenious hoists and cranes to carry millions of pounds of material hundreds of feet into the air, defying those who said the dome would surely collapse.

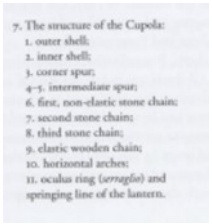
STRUCTURAL FEATURES OF THE DOME

In 1418, a dome commission for the church was supported by the wool workers guild. The challenge was to develop a structure that would be self-supporting during each and every step of construction, a triumphal total distance of 82 meters from the cathedral floor to the highest point of Brunelleschi's dome. The initial phase of construction included an octagonal base for the domed structure. Work began on the dome in 1420 and was completed in 1436. Beginning at a height of 54 meters above the ground, bigger stone was laid to an additional 7.8 meters. Herringbone masonry composed the upper portion of the dome. The dome itself comprised of four chains total, three of stone and one of wood. Base Chain of non-elastic interlocked sandstone. An elastic wooden chain was next. Finally, the second and third were stone chain. The space between the third stone chain and the oculus was a series of arches, relieving stresses between the oculus and the last chain. The dome itself is 24.5 meters tall, and 4.65 meters thick and approximately 39,000 metric tons.





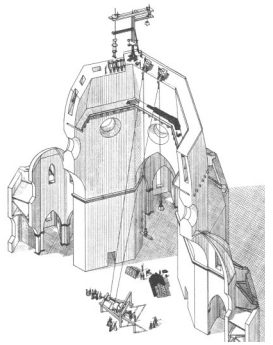
Herringbone brickwork



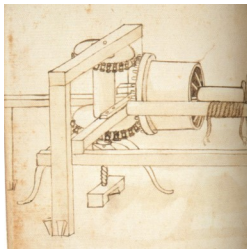
Stress displacements and deformation in the dome by its dead weight and the Dome's corresponding reaction

IMPLEMENTED TECHNIQUES

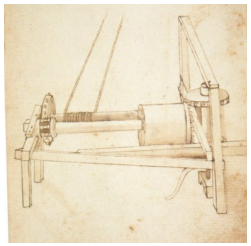
- The Egg Incident
- The Catenary curve
- Inauguration of construction
- Ancient practices
- Departure from Gothic Architecture
- Double-Shell method
- Solutions to limited scaffolding
- Herringbone method
- Use of mortar
- Galileo's observations



Reconstruction of the loaded platform in place with the great hoist and crane in operation



Reversible operations of the 'great hoist'



Brunelleschi's 'great hoist'