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Building the Medieval Trebuchet: Assembling a Half-Scale Historical Machine

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In the Middle Ages, armies built trebuchets to destroy enemy castles. The trebuchet is a type of catapult that uses a falling counterweight to throw projectiles.

Many trebuchets were huge machines over 60 feet tall and their construction was complex. The methods used to erect a trebuchet in history are not widely known.

My Research Question:
How were trebuchets designed and assembled in the Middle Ages?

Through experimental history, I used primary sources to design a trebuchet. This machine is half-scale: 30 feet tall.

I built this trebuchet with medieval techniques, assembled it with an ancient type of crane hoist, and tested it with up to 1,500lb of counterweight.

**Building Methods**
- Trebuchets were designed with ratios.
- Components rotated on wooden axles.
- Parts were connected with wood joints and made to fit together without nails.

**The machine is assembled in stages:**
1. Piece together the ground frame.
2. Assemble the sides on the ground.
3. Tilt up the sides like raising a barn.
4. Lift the throwing arm into the blocks.
5. Attach the counterweight box.

**Results of Testing**
- Assembly methods worked well. A full-scale trebuchet could be made by generally using these same methods.
- Wooden axles performed better than expected. The main axle held 1,500lbs.
- The historical windlass loading system allowed two people to lift this weight.
- Historically-based wood joints are sturdy.
- The machine threw a 16lb ball 300 yards.

**Figures 1 – 4: From primary sources to the siege.**

**Far Left:** A ground plan of a trebuchet from the notebook of Villard de Honnecourt, 13th century.
**Left:** One of the side frames, or “bents.” It has just been tilted up into position by hand with three people.
**Right:** Climbing the machine ladder to grease the axle with olive oil, used around the Mediterranean.
**Far Right:** A frame capture from a launch. The sling slips open and the bowling ball heads downrange.

**Conclusions**
- When made properly, wooden axles can hold as much weight as metal ones.
- Trebuchets can operate outside longbow range. A typical bow distance is 240 yards.
- A loading system, such as a medieval windlass, is needed at large-scale.
- This project helps us to understand that medieval technology and engineering was complex, elegant, and sophisticated.

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