SFSA Cast in Steel 2025 - George Washington Sword Technical Report

The University of Alabama - Swordge Washington

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Foundry Partner: Southern Alloy

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Research and Inspiration

George Washington's collection of swords reflects both a diversity of style and the evolution of his status. Many of his swords were not chosen personally but were given as gifts, handed down through family, or presented as tokens of respect, leading to a range in design and functionality across his collection [1].

Washington's swords trace a timeline of his life and career. The earliest known sword in his possession, an onyx-handled cuttoe from the 1690s, was an ancestral piece. In 1753, upon his first appointment with the Virginia militia, he acquired a silver-hilted smallsword, which symbolized his initial steps into military service. Later, as his prominence grew, he acquired two high-quality swords from renowned cutlers in London.

During the Revolutionary War, Washington wielded two American-made cuttoes, one crafted by an unknown Philadelphia artisan and the other by John Bailey near Fishkill, New York. Among his European-made swords was one particularly special piece—a gift from the Marquis de Lafayette, symbolizing their deep friendship and shared commitment to the American cause.

Though known for his leadership, Washington seldom unsheathed his sword in combat. One of the rare moments he did was during Braddock's Defeat, where he defended himself against French and Native American forces. Washington's swords, therefore, serve as both symbols of his status and relics of pivotal moments in his life and in American history.

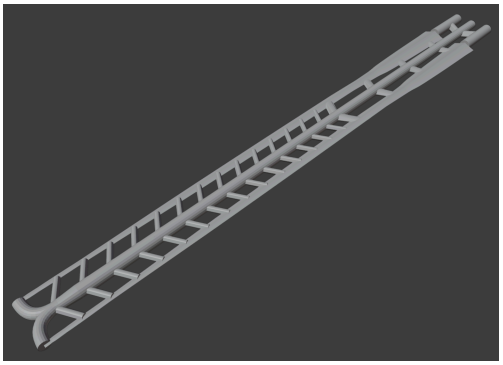
George Washington's steel-hilted small sword was both a weapon and a statement piece. Bought in 1770, it had a silver-mounted steel hilt and reflected his status as both a military leader and a gentleman. Washington wore it on formal occasions and during his time as Commander-in-Chief of the Continental Army. For officers of the era, a small sword wasn't just for defense—it was a symbol of rank and honor. Today, the sword is preserved as a powerful reminder of Washington's leadership and the early days of the United States.

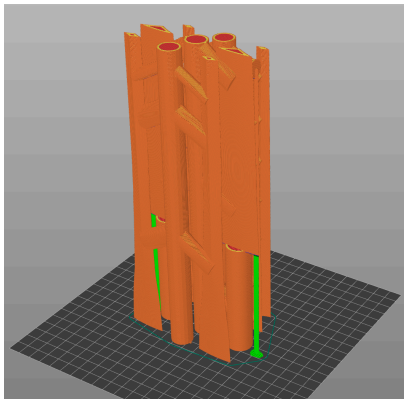
Alloy Selection

The biggest metallurgical decision that we made for this sword was alloy selection. We decided to use 1065 steel. This alloy was chosen because we thought it would strike a strong balance between hardenability and brittleness [2]. At ~0.65% carbon this alloy allows the sword to maintain a sharp edge once quenched without being as brittle as higher carbon alloys would be. Another benefit of this alloy is its relative composition simplicity which made acquiring material for the furnace charge very easy.

CAD Modeling and 3D Printing

The sword blade was modeled in Blender using reference images from Goldstein [3] to influence the shape. Risers and gates were added to optimize metal flow through the whole blade and to minimize defects such as porosity and shrinkage. The model was then divided into pieces and sliced with prusa slicer. The sword was printed in PLA in parts, then melted together with a soldering iron.





Sand Molding

The joined pattern was used to make a loose piece sand mold with cold-box silica sand. After the two sides of the sand mold were made, small adjustments were made by hand to ensure that there were no sharp corners or incredibly thin sections that would have the risk of not filling during the pour. After the mold was complete, a zircon wash was applied. Finally, the halves of the mold were glued together with mold glue, and the mold was stood upright and clamped together. After casting, the sword was broken out of the sand mold and visually inspected for hot defects such as hot tears, cracking, or areas that did not properly fill.

Post-Processing

After casting, the tip of the sword blade was forged flat, and the tip was cut off to fit length requirements. The tang was also drawn out for the purposes of increased mechanical properties resulting from converting the as-cast microstructure into a forged microstructure with directional grain flow. After forging, a hollow grind was ground into the length of the blade using the wheel of a belt grinder. After heat treatment, the blade was ground to its final shape and sharpened on one side with a bench grinder.

Heat Treatment

The sword was heated up past the austenization point in our forge. The forge was not big enough to accommodate the full length of the blade, so the back of the forge was opened and the blade slid back and forth through the forge until it was evenly heated. Once at temperature, the sword was quenched in oil. A file test showed that it was successfully hardened. A blowtorch was used to lightly temper the blade.

Handle Construction

Steel square stock was forged out and twisted to make the D-guard for the handle. A hole was drilled through a large block of wood to create a hidden tang handle and the initial handle shape was ground into the block. The tang and D-guard were slid onto the tang. The part of the tang that protruded out of the bottom and the D-guard were MiG welded together, and the excess material cut off the bottom before final shaping and surface finishing.

References

[1] Goldstein, Erik, et al. *The Swords of George Washington*. Mowbray Publishing, 2016.
[2] Shane. “SAE AISI 1065 Steel: Composition, Properties, and Uses - MFG Shop.” *MachineMFG*, 4 Dec. 2024
[3] “The Swords of George Washington: An Interview.” *George Washington’s Mount Vernon*