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# Use of Multiphysics Simulation to Model Environmental Conditions Associated with Bat Hibernacula Including Preliminary Indication of Impacts on Saltpeter Vats in Mammoth Cave

Aaron Bird

*CD-adapco, wvcaveman@gmail.com*

Rick Olson

*Science and Resources Management Division, Mammoth Cave National Park*

Rick Toomey

*Mammoth Cave International Center for Science and Learning, Mammoth Cave National Park, rick\_toomey@nps.gov*

Aaron Addison

*Scholarly Services, Washington University in St. Louis*

Rachel Bosch

*Cave Research Foundation*

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# Use of Multiphysics Simulation to Model Environmental Conditions Associated with Bat Hibernacula including Preliminary Indication of Impacts on Saltpeter Vats in Mammoth Cave

Aaron Bird<sup>1</sup>, Rick Olson<sup>2</sup>, Rick Toomey<sup>3</sup>, Aaron Addison<sup>4</sup>, and Rachel Bosch<sup>5</sup>

<sup>1</sup> CD-adapco

<sup>2</sup> Science and Resources Management Division, Mammoth Cave National Park

<sup>3</sup> Mammoth Cave International Center for Science and Learning, Mammoth Cave National Park

<sup>4</sup> Scholarly Services, Washington University in St. Louis

<sup>5</sup> Cave Research Foundation

## Abstract

As a historically and biologically significant feature, the Mammoth Cave System has seen many changes due to human activity that have resulted in known and unknown changes to environmental conditions present in the cave. While the historical and archaeological records reveal much about these changes, the actual environmental conditions present can be difficult to describe. In our work, multiphysics simulation is used to recreate environmental and physical conditions that may have existed before changes were made to the natural state of the cave system. In addition, simulation is used to predict what may happen if further changes are made to the system in the future. Using 3-dimensional laser-imaging detection and ranging data (LIDAR) as a geometric representation of the historic section of Mammoth Cave combined with computational fluid dynamics simulations, the current work serves to demonstrate the thermal and airflow conditions that would have been present in a former (now abandoned) bat-hibernation colony in the *Vespertilio* area near Audubon Avenue. The model is then extended as a preliminary indicator of the humidity and thermal impacts that maintenance of conditions conducive to bat hibernation may have on airflow patterns in and around historically significant saltpetre vats in the main section of the cave.