# A Dry Passage to the Afterlife

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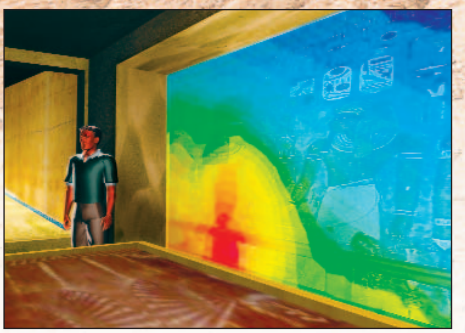
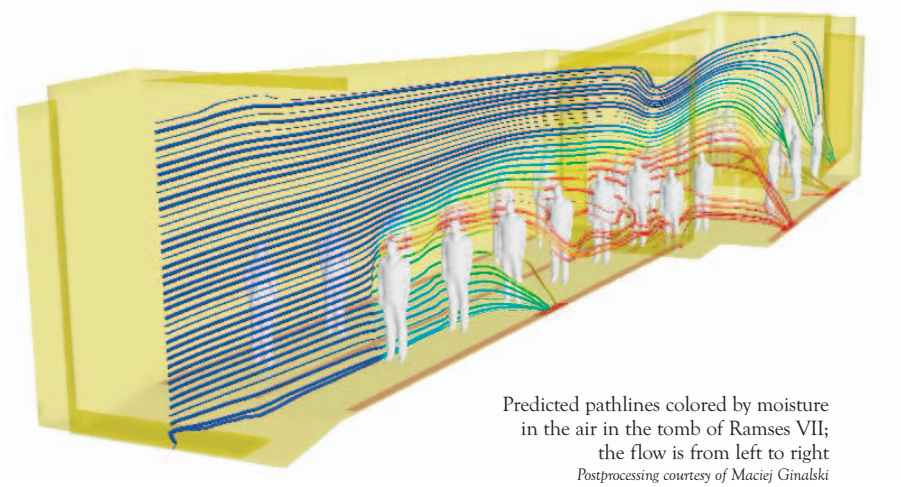
EGYPT WAS ONCE HOME to the Pharaohs, one of the oldest and most sophisticated civilizations in the ancient world. Many Egyptian artifacts, treasures, and buildings are a priceless part of our world heritage. The Valley of the Kings at Luxor is a unique and world famous site where thousands of years ago, many Egyptian monarchs had elaborate tombs built to ensure their safe passage into the afterlife. Many of these tombs were robbed after being discovered, but others have survived and their greatest remaining treasures are the beautiful, vivid, yet fragile wall paintings and decorations that lie within. Each year, tourists flock to Egypt to see these awe-inspiring tombs, but their visits cause a major problem for curators. The heat and humidity given off by visitors in the enclosed chambers and passageways cause damage to the plasterwork and paintings. Hence, the ventilation system and resultant air flow patterns in a tomb are critical to the preservation of the exhibits so that they may be kept open to tourists for many years to come.

The Egyptian government and the Supreme Council of Antiquities approached ventilation experts at Cairo University for help in solving this problem for the archeaological tombs in the Valley of the Kings. The engineers were asked to devise a climate control system for these tombs; a pilot study was conducted on the tomb of Ramses VII. Using GAMBIT, a model of approximately one million cells was created that yielded good geometric representation of the tomb passageway with the sarcophagus in the main room and a large number of visitors. They then used custom models in FLUENT to simulate human breathing and heat generation, and considered a worst case scenario when 20 adult visitors are in the tomb at the same time. Parametric CFD simulations were performed to predict what the relative humidity, a key variable, would be like near the wall paintings for a given air extraction system design and tomb vent locations. Their modeling work was used to determine the optimized air flow pattern for the tomb. Based on their findings, the installation of raised flow exhausts that were unobtrusive to visitors was recommended. The tomb now has minimal adverse flow and humidity gradients within the chamber, thereby helping to preserve this priceless piece of history for future generations of visitors. ■



Predicted local humidity levels on a plane near the main wall paintings of the tomb of Ramses VII with a representative adult male tourist figure; the sarcophogus is in the foreground
*Postprocessing courtesy of Maciej Ginalski*



Predicted pathlines colored by moisture in the air in the tomb of Ramses VII; the flow is from left to right
*Postprocessing courtesy of Maciej Ginalski*

# Convective

*By Daniele Melideo, Davide Mazzini, Enrico*

A NUMBER OF BENEFITS have resulted from recent reductions in weight and improvements to the efficiency of aeronautical gearboxes. Reduced heat generation inside the gearbox means that less oil is needed to maintain a certain transmission operating temperature. In addition, reductions in surge system losses allow the lubrication system components, such as tanks, high pressure tubes, filters, and pumps to be smaller in size.

In the framework of thesis work carried out in the Department of Mechanics, Nuclear and Production Engineering (DIMNP) of the University of Pisa, the convective motion of the air inside a gearbox induced by the rotation of the gear drive components has been investigated. FLUENT was used for the numerical modeling component of the project, which focused on a single gear pair. The reference equipment is located at the Research Center on