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Technology News

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MFIRE 3.0 - NIOSH Brings MFIRE into 21st Century

Objective

Improve the U.S. Bureau of Mines MFIRE mine fire simulator program by modernizing the programming language and incorporating improvements in fire and contaminant spread modeling made since its original development.

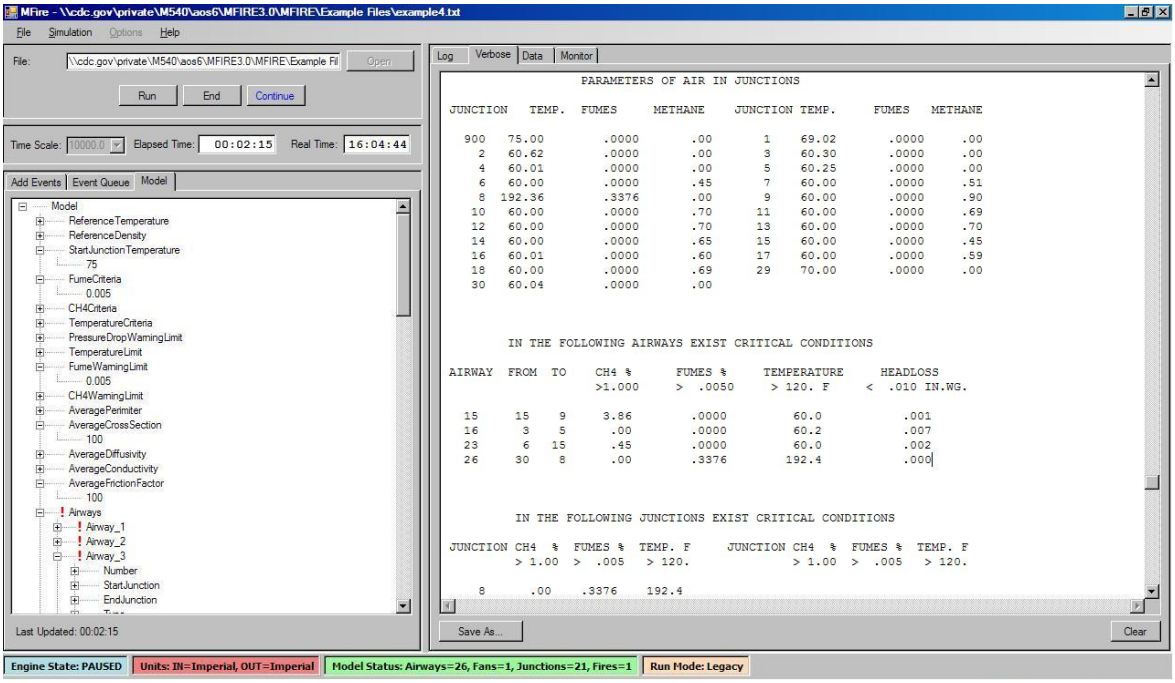
Background

The use of computer codes for assessing and predicting, in real-time, the impact of fire on the mine ventilation system and the spread of fire contaminants in coal and metal/nonmetal mines offers significant potential for improved safety and chance of success during evacuation and control. The MFIRE program, developed in the 1970's by the U.S. Bureau of Mines and Michigan Technological University, has been a mainstay in the modeling of ventilation and fire contaminant spread. It is used by U.S. and international companies to simulate fires for planning and response purposes. It is a dynamic, transient-state, mine ventilation network simulation program that performs normal planning calculations. It can also be used to analyze ventilation networks under thermal and mechanical influence such as changes in ventilation parameters, external influences such as changes in temperature, and internal influences such as a fire. The program output can be used to analyze the effects of these influences on the ventilation system. However, the program language and architecture are considered antiquated by current computer standards. Advances in personal computing operating systems have limited the use of the original program. In addition, the original program is not compatible with other Graphical User Interface (GUI) simulation tools. There is a clear need to modernize and improve the program to bring the program into the 21st century.

A conveyor belt fire in the NIOSH Fire Suppression Facility.

Summary of Improvements

The original MFIRE is a stand-alone program that runs to completion without pause, based on the input parameters. Because of this, it is difficult to use its ventilation and fire modeling capabilities within larger simulation projects as it is not possible to collect and process intermediate results. To overcome this limitation, NIOSH completed a major redesign and restructuring of



MFIRE Graphical User Interface screenshot.

MFIRE. The program was split into a front-end with a simple graphical-user-interface (GUI), and the MFIRE "engine" back-end. MFIRE 3.0 was rewritten as a discrete event simulation library so it can be used to simulate the progress of mine fires over time, under the control of user inputs through the GUI. MFIRE's outdated programming language was replaced with an object-oriented C++ approach for ease of future maintenance. A key aspect of the redesign was that third party developers can obtain ventilation network data from the common memory rather than the default MFIRE data output files. This allows developers to use their GUI's to display the progression of changes to the mine ventilation network. Finally, other improvements to MFIRE were made to increase the size of mine ventilation networks that can be modeled, improve capture and processing of runtime errors, add the ability to report results in both imperial and metric measurement units, and to utilize more user-friendly names for data structures.

Resulting Product

MFIRE is now modernized with an updated programming language and many new features to improve its usability and functionality. It can be used as a stand-alone tool for mine ventilation professionals and can also be integrated into other ventilation simulation tools. MFIRE 3.0 is available on the NIOSH Web site at http://www.cdc.gov/niosh/mining/products/product204.htm.

With its new design, a future step may be to interface MFIRE 3 with warning and communication systems, interactive graphics displays, and real-time atmospheric monitoring input, to provide a comprehensive solution for fire detection, alarm, and response.

For More Information

For more information on MFIRE 3.0, contact Alex C. Smith (ASmith@cdc.gov) or the Health Communications Coordinator (OMSHR@cdc.gov), NIOSH Office of Mine Safety and Health Research, P.O. Box 18070, Pittsburgh, PA 15236-0070.

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