NISTIR 6030

THIRTEENTH MEETING OF THE UJNR PANEL ON FIRE RESEARCH AND SAFETY, MARCH 13-20, 1996

VOLUME 2

Kellie Ann Beall, Editor

June 1997
Building and Fire Research Laboratory
National Institute of Standards and Technology
Gaithersburg, MD 20899

U.S. Department of Commerce
William M. Daley, *Secretary*
Technology Administration
Gary R. Buchula, *Acting Under Secretary for Technology*
National Institute of Standards and Technology
Robert E. Hebner, *Acting Director*

A PROTOTYPE FDMS DATABASE FOR MODEL VERIFICATION

Rebecca W. Portier, Richard D. Peacock, and Walter W. Jones
Building and Fire Research Laboratory, NIST, Gaithersburg, MD 20899, USA

ABSTRACT

Fire Data Management System, FDMS, is a system designed to store and retrieve fire test results obtained from bench-scale and real-scale tests as well as fire simulation programs. By storing available fire test values in a common format, this data is readily available to computer models, plotting programs, and report generators. An implementation of the FDMS for data ranging from bench-scale test results to real-scale fire tests is discussed.

INTRODUCTION

A unified method of accessing data is desirable for both experimental and modeling efforts in the development of the science of fire. For experimentalists, easy to use data organization and retrieval tools facilitates analysis of the data. For modelers, access to experimental data is important for both model input and evaluation of the predictive capability of the models. FDMS, the Fire Data Management System, provides a system for organizing and presenting fire data obtained from bench-scale and real-scale tests as well as fire simulation programs. Implementation of databases in the FDMS format are intended to be used in individual laboratories to store, edit, and retrieve their own test results, as well as a central repository for contributed data. By storing available fire test values in a common format, this data is readily available to computer models, plotting programs, and report generators.

The goal for FDMS is to provide uniform access to test values generated from a variety of sources within the fire community. An initial version of a database implementing the FDMS was developed under the direction of the Fire Research Station according to the design proposed by Babrauskas, Janssens, Peacock, and Batho[1]. The resulting software, FDMS 1.0, provides for storage and retrieval of Cone Calorimeter and Furniture Calorimeter test data[2]. Further development at the Building and Fire Research Laboratory has extended this database to provide an open file design that will easily accommodate future test apparatus formats.

After completion of the analysis of the initial implementation of FDMS, it was determined that a redesign of the physical file formats was necessary to accommodate additional test methods. Technical documentation providing details for proposed database file formats was generated as the first step in this second stage of development[3,4]. The second stage of development also involved the generation of a centralized database using data contributed from individual FDMS 1.0 databases along with numerous real-scale tests which could not be accommodated by the FDMS 1.0 software with modifications resulting from user feedback on both the design of the database as well as to the completeness of the test data available in the centralized database.. A text-oriented interface, entitled FIREDATA, is being developed to provide quick, simplistic query access to the centralized database over the Internet. Development of a

stand-alone software program which will allow individual laboratories to store, edit, and retrieve their own test results is in progress. Additionally, a CD-ROM database is being considered as an additional means of distribution for the database.

ACCESSING THE FIREDATA DATABASE

At present, the centralized database can be accessed only through the Internet. Querying functionality is provided to allow selection of tests in order to generate various export file formats containing the selected data. Generated export files can then be transferred to the user site and accessed by other software applications such as spreadsheets for further evaluation. It is not intended that large-scale transfers of the data take place since the database currently occupies more than 100 megabytes of disk storage.

CONTRIBUTING DATA TO THE FIREDATA DATABASE

Clearly, the integrity of data in any database is of paramount importance to the utility of the database. In this initial test implementation of FDMS 2.0, we have provided a collection of available fire test data from NIST and elsewhere to provide a basis for evaluating the utility of the database and the effort involved in implementing future, more inclusive databases. In general, we have adapted the ASTM guide for database quality indicators for use in FDMS. Data supplied to NIST for inclusion into the FIREDATA database must include an assessment by the testing organization of each of these quality indicators. The following is considered the minimum values of indicators for data the is acceptable for inclusion into the database:

- *Source of data* – at least a report must be available describing the test
- *Statistical basis of data* – replicate tests are desirable but not required for standard bench-scale test methods. Single tests are acceptable for larger than bench-scale tests.
- *Material development or production status* – any category (from the ASTM guide) is acceptable
- *Evaluation status* – any category (from the ASTM guide) is acceptable
- *Certification status* – any category (from the ASTM guide) is acceptable
- *Completeness of material(s) information* – at least partial information on material. See section on *Product Description*, below, for details.
- *Completeness of test procedure description* – any category (from the ASTM guide) is acceptable

INFORMATION IN FDMS FORMAT

To make data in the FDMS format as complete as possible, this section provides guidelines for the information which can be included for a test to be imported into an FDMS format database.

Test Description: Each test is identified by the test conducted, persons responsible for the test, the test conditions, product or products tested, and comments or observations about the test. These are each related to fields in physical database files. Applicable documents related to the test method or test documentation can also be identified in the description.

Test Conditions: Test conditions describe setup aspects for each test and thus allow the user to more completely specify the testing conditions. The information which should be included depends upon the specific test method to which the data set applies. For the Cone Calorimeter, for example, the orientation, incident flux, pilot ignition, or mounting frame specification could be included.

Product Description: At least one product must be included. For the initial data included in the Internet version of the FIREDATA database, this information is the least complete and perhaps most important to the future utility of the database. A completely identified product (for FDMS product descriptions) includes: Product name (a text description of the product), Product ID, Manufacturer, Catalog number, Main use of the product (from a controlled choice list within FDMS), Density, Length, Height, Thickness, Mass, Thermal Conductivity, Specific Heat, and Emissivity. For layered products, each individual sub-product is described as above with an additional field to indicate the structure in the final product.

Personnel and Organizations: Description of personnel and organizations related to test data within the database provide contact points for additional information about the test or product details which may have been omitted in the database: Full name, Organization name, Address, and Phone, fax, telex, e-mail.

Organizations are described by: Organization type (from a controlled choice list within FDMS), Organization name, Division, Address, and Phone, fax, telex, e-mail

Fire Test Measurements: Vector and scalar data imported into the Internet version of the FIREDATA database must be specified in SI. The NIST "Guide for the Use of the International System of Units (SI)" provides complete details of SI. Within FDMS, the following base units are used:

temperature	Kelvin
absolute temperature	Kelvin
pressure	Pascal
length	meter
energy	Joule
energy release rate	Watt
energy absorbtion rate	Watt
mass	kilogram
time	Second

CONCLUSIONS

The availability of a wide range of quality experimental data is important to ongoing efforts in fire model evaluation. The FDMS format provides a consistent system for the exchange of

such data from both bench-scale and real-scale fire experiments. By establishing a protocol for storing and maintaining fire data and by providing an extensible database, the fire community will be encouraged to contribute results of experiments. This should result in improvement of both modeling and experimental techniques and facilitate further comparison of model predictions and experimental measurements.

REFERENCES

1. Babrauskas, V., Peacock, R. D., Janssens, M., and Batho, N. E., Standardizing the Exchange of Fire Data – The FDMS, *Fire and Materials* **15**, 85-92 (1991).

2. Software distributed by the Fire Research Station, Borehamwood, England.

3. Portier, R. W.,Fire Data Management System, FDMS 2.0, Technical Documentation, Natl. Inst. Stand. Technol., Technical Note 1407 (1995). Also available through the anonymous ftp site candela.cfr.nist.gov in /pub/reports.

4. Portier, R. W., A Programmer's Reference Guide to FDMS File Formats, Natl. Inst. Stand. Technol., NISTIR 5162 (1993).