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Standardization of Formats and Presentation of Fire Data—the FDMS

Vytenis Babrauskas, Richard D. Peacock, Marc Janssens
Building and Fire Research Laboratory, National Institute of Standards and Technology, Gaithersburg, MD 20899, USA

and
Nigel E. Batho
Dark Star Research Ltd, Penley, Clwyd, UK

Effective exchange of fire test data, even within a single laboratory, has been difficult due to the multiple, and often incompatible, data formats and hardware. This issue has been addressed by a careful study of user needs, leading to the development of a series of standard formats whereby fire test data could easily be exchanged among users. These formats have been made practical by the development of a computer program—the Fire Data Management System (FDMS)—and pertinent hardware standards. The system includes the most commonly used of modern-day fire test methods, but also has provisions for future extension to other tests of interest.

INTRODUCTION

The goal of the work to be described in this paper was to evolve data exchange standards for fire test data, and then to make these standards useful by developing a software package which makes direct and straightforward use of them. The name Fire Data Management System (FDMS) has been given to this set of standards and the accompanying computer program.

Fire test data are essential for fire-prediction computer models. Fire tests are also used directly for assessing the expected performance of a product. In recent years some very advanced fire test methods have been developed which are capable of producing data that give an extensive characterization of a product. Making optimum use of such tests has been thwarted, however, due to inability to exchange test data among testing laboratories and professional users.

The data from the modern test methods are invariably generated as computer-stored information. It would seem simple to exchange the data among testing laboratories, researchers, and users of fire models, but this has not happened. The critical restraint has been the unavailability of standard formats for storing and exchanging the data and for entering the data into models. The formats used have varied among the laboratories and even within one laboratory as computer systems were upgraded and replaced.

In addition, within any given laboratory, there has typically not been any software available for managing the existing test data as a database. The data have typically been stored on tapes, floppy disks, etc., with no logical retrieval system available. Certainly, numerous commercial database packages exist which allow storing of a user's data. With the exception of very complex and difficult-to-use packages, however, none have been available which are geared toward the storage and manipulation of *vector* data. Older fire test generally reported simple results, such as a certain 'index = 90'. Such single-number results are termed *scalar* data, and are easy to manage with most database programs. Modern fire test methods, however, typically produce readings of instruments as a function of time. These are an example of vector data.

The FDMS concepts and the associated standards were evolved by consultation with large numbers of testing laboratories, product manufacturers, standards committees and others whose input was felt to be valuable into the process. The resulting data exchange and presentation formats adopted were then chosen to satisfy as many as possible of the needs of the users. In addition to the users already consulted, we expect FDMS to find utility in building code applications, as modern test methods are progressively introduced into the codes. In this paper we will discuss the data-exchange standards developed in FDMS, itemize the type of data that are included, and, finally, describe very briefly the computer package itself.

THE STORAGE OF DATA

Each fire test normally includes both scalar and vector data, although some simple tests may have no vector data. Vector and scalar data must be stored and managed somewhat differently, since their usages differ. Since we will want to search for scalar data, it is appropriate to put the information into *database tables.* For example, we might wish to search for all the fire tests available to us where the specimen thickness was more than 25 mm and the peak heat release rate was less than 100 kW m^{-2}. Since we have required even in this simplest example that (*condition A must be true*) *and* (*condition B must be true*), Boolean algebra operations must be implemented. It will later be seen that since there may be much redundant information in such a database, a *relational* database is preferred.

By contrast, searching for specific entries in vector data is rarely needed. Thus, for instance, one would not normally wish to find all the times during a particular test when the heat release rate was equal to 171 kW m^{-2}. Instead, with vector data the normal operation is plotting

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(including overlaying of plots), averaging, and, possibly, ratioing pairs of curves. For these types of operations, the simplest way to store the data is in a simple ASCII file, one each per test.

For each *type of fire test* currently encompassed by the FDMS the majority of the scalar data are stored in what we call a 'main' table. The tables are stored within a computer in an internal data table format; this enables the needed search operations to be performed efficiently. The details of these formats will not be discussed here, since they are used only by the computer program itself. For data exchanges (described below), however, all the data are converted to plain ASCII formats. The 'main' tables that have, thus far, been established, and the corresponding tests covered are:

(1) CONE for the Cone Calorimeter, ISO DIS 5660[1]
(2) LIFT for the LIFT apparatus, ISO Draft Proposal DP 5658[2]
(3) FURN for the Furniture Calorimeter, NORDTEST NT FIRE 032[3]
(4) ROOM for the Room/corner test, ISO DP 9705[4]
(5) BS476-7 for the British Standard 476 Part 7 Surface Spread of Flame test[5]
(6) SCHACHT for the German Brandschacht test, DIN 4102 Part 1[6]
(7) EPIRAD for the French Épiradiateur test, NF P 92.501.[7]

Each test's data comprise one *record* in the pertinent main table. Most of the fields in these tables include actual data. Some contain integer variables which are *related* to records in secondary tables. Secondary tables are those which contain not the results of a particular fire test but, rather, some form of information that is pertinent to a large number of tests, or even to different test methods. The secondary tables are:

(1) ORGANISE for organizations sponsoring tests, performing tests, or producing products
(2) PERSONEL for individuals, such as test operator, test officer, etc.
(3) PRODUCT for products tested
(4) INSTRUM for instrument identifications, and
(5) CALIB for instrument calibrations
(6) INDEX, which keeps track of what Main tables have been installed.

It can readily be seen that an entry in each of these secondary tables can be used by (i.e. related to) many different individual fire tests.

For a simple test which produces no vector output the scalar information recorded in the data tables described above constitute all the test information. Many fire tests, however, do produce extensive vector data outputs. For instance, one of the primary outputs of the Cone calorimeter is heat release rate readings, taken typically one every 5 s. Such vector data are stored as simple ASCII files, one each per test. Two types of files are, in general, present: *raw data* (example data: oxygen concentration measurements) and *reduced data* (example data: heat release rate values) files. The raw data files are used only for generating reduced data and are normally not interchanged with other organizations. The reduced data files contain information which can be interchanged. A file-naming convention is established such that raw and reduced data files are clearly differentiated. The format of the vector data file is:

```
Header1
XX.XXX
-X.XXX
XX.XXX
-.XXXX
.
.
.
Header2
X.XXXX
.XXXXX
.XXXXX
.XXXX
.
.
.
HeaderX
.
.
.
```

Each block, beginning with 'Header. . . ', represents the information, from either one *channel* of raw data or one *column* of reduced data. (We use the term 'channel' to denote the *vector*, or series of readings, corresponding to one physical instrument output; similarly, 'column' is used to refer to a data vector in a somewhat more general context, when reference to hardware channels may not be appropriate). HeaderX is a multi-line header, which is slightly different for raw and for reduced data; the header contents are explained below. Each line after the header simply consists of numerical data, one reading per line. Each line is terminated by the ⟨CR⟩⟨LF⟩ combination. The length of the file is not fixed; the operating system keeps track of the actual length.

Raw data

The order of storing the data blocks is not important, but will usually be in the order of increasing channel numbers. Raw data channels which were not assigned in a particular test are not stored for that test. One raw data channel (and the corresponding reduced data variable) must be allocated to the time readings.

The header consists of five lines which provide a definition, name, and calibration data for the instrument:

```
CHANNEL xx
SERIAL NAME
SHORT LABEL
LONG LABEL
CALIBRATION DATA
```

As an example, the following is a header pertinent to a pressure transducer:

```
CHANNEL 02
Pressure Transducer, MKS 223AH-A-10, SN 23128-1
PRES
Pressure drop across exhaust orifice plate
Volts Pa 0. 10. P1 0. 133.333
```

All the data after the header correspond to instrument readings. Each line represents a single instrument reading. The system can accommodate up to four significant figures, in either fixed-point or scientific notation. As many lines as necessary are included in the data file.

Reduced data

Again, the order for storing the columns is not significant. The header consists of four lines:

SERIAL NAME
SHORT LABEL
LONG LABEL
UNITS

SERIAL NAME and LONG LABEL are generally identical as for the raw data. The SHORT LABEL and UNITS are used in plotting and tabular presentations as heading or labels pertinent to this particular channel of vector data.

EXAMPLES OF DATA TABLES

As an example of the kinds of data included in a typical 'main' table record, we present the data table structure of 'CONE' along with a brief description of the fields. 'Related File' gives information about the relations among the tables. 'R.F. Field #' identified the field number in one of the secondary tables. The explanations for the fields are given below, except for 'relational' data types. For those, the actual information is linked from the secondary tables, outlined above.

Field	Name	Type	Related File	R.F. Field #	Choice
0	DELETED	Logical			YN
1	LABID	Relational	ORGANISE	1	
2	FILE	String$			
3	TESTDATE	Date			
4	PRIVATE	Mult. Ch.			
5	ADMIN	String$			
6	REPDATE	Date			
7	OPERATOR	Relational	PERSONEL	3	
8	OPERID	Relational	PERSONEL	1	
9	OFFICER	Relational	PERSONEL	3	
10	OFFID	Relational	PERSONEL	1	
11	SPONSOR	Relational	ORGANISE	3	
12	SPONID	Relational	ORGANISE	1	
13	SPONCONT	Relational	PERSONEL	3	
14	SPCONTID	Relational	PERSONEL	1	
15	PRODUCT1	Relational	PRODUCT	3	
16	PRODID1	Relational	PRODUCT	1	
17	PRODUCT2	Relational	PRODUCT	3	
18	PRODID2	Relational	PRODUCT	1	
19	INSTRUM	Relational	INSTRUM	1	
20	FLUX	Single!			
21	ORIENT	Logical			HV
22	PILOT	Logical			YN
23	AREA	Single!			
24	THICK	Single!			
25	C	Single!			
26	E	Single!			
27	GRID	Logical			YN
28	FRAME	Logical			YN
29	ASCARITE	Logical			YN
30	OXYGEN	Single!			
31	RHCOND	Single!			
32	TEMPCOND	Single!			
33	RHTEST	Single!			
34	TEMPTEST	Single!			
35	SCANS	Integer%			
36	INTERVAL	Integer%			
37	COMMENT1	String$			
38	COMMENT2	String$			
39	COMMENT3	String$			
40	COMMENT4	String$			

Field	Name	Type	Related File	R.F. Field #	Choice
41	COMMENT5	String$			
42	MASSI	Single!			
43	MASSF	Single!			
44	TIGN	Integer%			
45	FLAMEOUT	Integer%			
46	MAXTIME	Integer%			
47	MAXQDOT	Single!			
48	MAXMDOT	Single!			
49	MAXSIGMA	Single!			
50	AVGQDOT	Single!			
51	AVGMDOT	Single!			
52	AVGHC	Single!			
53	AVGSIGMA	Single!			
54	AVGCO2	Single!			
55	AVGCO	Single!			
56	AVGH2O	Single!			
57	QDOT60	Single!			
58	MDOT60	Single!			
59	HC60	Single!			
60	SIGMA60	Single!			
61	CO260	Single!			
62	CO60	Single!			
63	H2O60	Single!			
64	QDOT180	Single!			
65	MDOT180	Single!			
66	HC180	Single!			
67	SIGMA180	Single!			
68	CO2180	Single!			
69	CO180	Single!			
70	H2O180	Single!			
71	QDOT300	Single!			
72	MDOT300	Single!			
73	HC300	Single!			
74	SIGMA300	Single!			
75	CO2300	Single!			
76	CO300	Single!			
77	H2O300	Single!			
78	SOOT	Single!			
79	HCL	Single!			
80	HCN	Single!			
81	HBR	Single!			
82	HF	Single!			
83	USER1	String$			
84	USER2	String$			
85	USER3	String$			
86	USER4	Single!			
87	USER5	Single!			
88	USER6	Single!			
89	ZNUMBER	LongInteger			
90	VERSION	Integer%			
91	TEST	Integer%			

The explanations of the fields are as follows:

DELETED This field is used by the database system for record-deletion purposes.

LABID Is an integer number referring to the first field in the secondary table ORGANISE. This field is intended to hold the ID number of the laboratory where the test was done.

FILE This field is reserved for a laboratory-specific identification of the test series to which the test conducted belongs. This is typically the way to refer to the sponsorship of a test. In addition to 'File' some laboratories call this information 'Test Code', 'Job Number', 'Test Ref.', or a similar appellation.

TESTDATE This is the date that the original test was run.

PRIVATE The PRIVATE field allows a laboratory to define the allowed level of access to the test results to other organizations within the database. As a multiple-choice field, three options are available. (1) Freely allow the data to be exported without any changes in the data. (2) Purge the test of any information which would identify the manufacturer from the test before export. (3) Do not allow export of the data under any circumstances.

ADMIN This field is intended to hold a laboratory-specific code which might be used to store some internal admin information such as a Cost Centre code or invoice number.

REPDATE This is the date that the test was reported.

OPERATOR This field refers to the name field in the secondary table PERSONEL and it is used to store the name of the person who performed the test. The unique ID code of their record within PERSONEL is held in the following field, OPERID.

OFFICER This field also refers to the name field in the secondary table PERSONEL but here it is used to record the name of the laboratory officer responsible for the test. The unique ID code of their record within PERSONEL is held in the following field, OFFID.

SPONSOR This is the name of the test sponsor, which is actually held in the third field of the secondary table ORGANISE. This table holds information about organizations which includes all bodies, be they sponsors, producers or laboratories. The following field SPONID holds the sponsor's ID number.

SPONCONT This is the name of a person who is the contact at the sponsoring organization. This name is actually held in the secondary table PERSONEL. The following field SPCONTID holds the unique ID number of their record in the PERSONEL table.

PRODUCT1 Is a name cross-referenced to the first field in the secondary table PRODUCT. This is the main product of which the sample consists. For instance, for a particular foam/fabric combination of upholstered furniture this could be the foam. The following field PROD1ID holds the unique ID number of this product within the PRODUCT table.

PRODUCT2 Is a name cross-referenced to the first field in the secondary table PRODUCT. This is the secondary product of which the sample consists. For instance, for a particular foam/fabric combination of upholstered furniture this could be the fabric. The following field PROD2ID holds the unique ID number of this product within the PRODUCT table.

INSTRUM Laboratories may have more than one of a given type of fire test apparatus. This field is $=1$ for the first unit, $=2$ for the second, etc.

FLUX Flux ($kW\,m^{-2}$).

ORIENT Specimen orientation, horizontal or vertical.

PILOT Indicates whether ignition was piloted (spark) or not.

AREA Effective exposed specimen area (m^2).

THICK Specimen thickness (m).

C This is the orifice constant as determined from the CH_4 burner calibration.

E Oxygen consumption constant. A generic value for this is $13.1\ kJ\,g^{-1}\,O_2$. If the composition of the fuel is known (CH_4, PMMA, . . .) a more exact value can be used. At run time, the data-acquisition program lets the operator specify the value to use from a menu. For instance, for PMMA this value would be $12.98\ kJ\,g^{-1}\,O_2$ rather than $13.1\ kJ\,g^{-1}\,O_2$. The data-reduction program uses the value in this field by default, but the user can still change it when the data reduction is being carried out.

GRID Denotes if the wire grid was used during testing.

FRAME Denotes if the edge frame was used during testing (meaningful only for horizontal orientations).

ASCARITE This fields tells whether the CO_2 was removed (using Ascarite, or equivalent means) from the sample before O_2 was measured or not. This information is needed to determine the proper algorithms to use when the raw data were being reduced during test import.

OXYGEN This is the nominal value of the oxygen concentration in the enclosure around the heater and sample. Its purpose is to enable quick searching of the database. For tests run at non-ambient oxygen concentration the user may have installed a second oxygen meter to monitor the concentration of the inflow. Such data are then recorded in a vector data channel. For normal tests, the nominal value of 20.95% is specified.

RHCOND The relative humidity for specimen conditioning (%). This is important if, for example, the specimens were oven-dried at $RH=0$.

TEMPCOND The temperature (°C) for specimen conditioning.

RHTEST The relative humidity of the supply air for conducting the test (%). In the case of special, controlled atmospheres this can be user selected.

TEMPTEST The temperature (°C) of the supply air for conducting the test.

SCANS This is the total number of scans made for this test. The value is not entered by the operator but by the computer program which is collecting the test data.

INTERVAL This is the interval in seconds between two consecutive scans.

COMMENT1 . . . COMMENT5 The test comments together occupy a maximum of 5 lines of 60 characters each. They can be entered by the operator at any time before, during, or after a test. In some cases (e.g. second ignition) the comment is directly inserted by the software, not by the operator.

MASSI Specimen mass before the start of the test (g).

MASSF Specimen mass at the end of the test (g).

TIGN Time to ignition, defined as sustained flaming (s). This is the time of first ignition, even if more than one ignition/flameout have occurred. The subsequent ignitions are recorded with the comments.

FLAMEOUT Time to flameout (s). This is the time of the last flameout, if more than one ignition/flameout have occurred. The subsequent flameouts are recorded with the comments.

MAXTIME Time in seconds to the peak heat release rate (see MAXQDOT field).

MAXQDOT Peak heat release rate $\dot{q}''$ ($kW\,m^{-2}$). For some materials (e.g. charring ones) heat release rate curves have more than one peak. This field contains the peak which is the highest value for the whole test; it is an actual value and is not smoothed.

MAXMDOT Peak mass loss rate $\dot{m}''$ ($g\,s^{-1}\cdot m^2$). The mass loss rate data is a numerically obtained multipoint estimate of the derivative of the mass loss. This value is smoothed, using the instructions provided in ISO DIS 5660.

MAXSIGMA Peak specific smoke extinction area σ_m ($m^2\,kg^{-1}$). As the raw σ_m records the actual turbulent fluctuations in the duct velocity, the instantaneous values of the extinction coefficient k have a considerable amount of fluctuation. The computed specific extinction area therefore makes use of a smoothing algorithm. Thus, this field contains not a turbulent instantaneous value but a smoothed representation.

Overall and interval average values (fields 50–77) for heat release rate $\dot{q}''$ (kW m^{-2}), mass loss rate $\dot{m}''$ (g $s^{-1} \cdot m^2$), effective heat of combustion Δh_c (kJ g^{-1}), specific smoke-extinction area σ_m ($m^2 kg^{-1}$), CO_2 yield (kg kg^{-1}), CO yield (kg kg^{-1}), and H_2O yield (kg kg^{-1}) are included in the database scalar record to facilitate searching of the database without searching tl ' entire vector data file for each test.

SOOT This is the soot yield, i.e. the mass of soot deposited on the soot filter during the test divided by the mass of specimen loss during the test.

HCL, HCN, HBR, HF The yield of HCl, HCN, HBr, and HF, as determined by batch analysis, typically by ion chromatography. These are similar types of measurement as the SOOT field. These dimensionless quantities are determined using the raw data (grams of species), the ratio of mass flow rate through the solution to the main duct flow, and the mass of specimen loss during the test.

USER1... USER3 These fields contain user-defined text data. This might, typically, be a variable name identifying a variable which would show up in the next group of (numeric) fields below. The data in these fields are site-specific and are not exported by the FDMS export module as they have no meaning in other implementations of the FDMS.

USER4.... USER6 These fields contain user-defined numeric data. For example, for a given test series the yield of NO_x may be one of the measurements. The user could attribute this field to the test-average NO_x yield. Again, the scalar data in these fields are site-specific and are not exported.

ZNUMBER Is a unique test number which functions, essentially, as the 'accession number' within a particular installation of FDMS. The Z-number is the mechanism by which the pertinent vector data DOS file is associated with the proper record in CONE. Simply, the name of the pertinent DOS file is ZNUMBER, plus the letter Z prefixed in front.

VERSION This contains the version number of FDMS, identifying the correct version of the data-reduction routines that have been used. (Note that these routines are an integral part of the FDMS.)

TEST This is the (serial) test number assigned by the program collecting the test data. It is specific to the laboratory and to the instrument.

STANDARD FORMAT FOR DATA EXPORT AND IMPORT

Tests are exported and imported 'one-by-one'. That is, a single export file will consist of one record from a main (CONE, LIFT, etc.) table, more than one record from the secondary tables (ORGANISE, PERSONEL), and the complete set of vector data pertinent to that test.

Parts of an example file of the standard format used to export and import reduced data are given below. In essence, the exported (or imported) file is simply an ASCII representation of the database record and its associated secondary and vector data files. Each keyword (shown in bold here; their meaning and use are described in detail in the technical documentation to FDMS) is followed by the appropriate value for that keyword as a field in the primary table, secondary table, or vector data file. Thus, for the main table entry, note the correspondence to the CONE table described above.

TABLE
CONE
FILE
34A-FG
SPONID
U1234567
SPONCONT
U2345678
LABID
U3456789
TESTDATE
12/14/87
.
. *Complete specification of the main table database*
. *record for this test*
TABLE
ORGANISE
ORGID
U123456
ORGAN
Sponsoring Company
.
. *Complete specification of the secondary table en-*
. *tries referenced directly or indirectly (through*
. *other secondary tables) in the database record for*
this test.
VECTOR DATA
VARIABLE
Time
TIME
Time from sample insertion
Sec
0.0
5.0
.
.
.
VARIABLE
Load Cell, ATC 6005C06E1XX, SN 2851
MASS
Specimen mass
Grams
169.85
169.50
.
. *Complete set of vector data for this test (for*
. *reduced data files, this includes calculated results).*
.

THE FDMS COMPUTER PROGRAM

An effective system for managing fire test data must, in general, provide several types of functions. These include:

(1) Accept raw data from a given test, convert to reduced data, and store the reduced data.
(2) Print out a standard test report on any test in the database.
(3) Delete a test from the database.
(4) Make a copy of the entire database (or a specified portion) to transmit to another installation.
(5) Perform searches, including Boolean functions, on the scalar variables stored in the database.
(6) Correct erroneous data in the database.
(7) Make interactive, overlaid screen plots and hard-copy graphs of the vector data.
(8) Provide for various specific-application-oriented query-and-report modules.

Excluded from the Database System is the function of storing raw data. The main function of the System is to permit easy interchange of data by various users. It is not contemplated that raw data (which have no meaning by themselves) would need to be interchanged. Thus, the archiving of raw data from individual tests will be done purely as a local site operation.

A computer program to implement the functions described above has been developed by the Fire Research Station and is available from them.[8] The program has been designed to be user-friendly and intuitive in its operation. The operation of the FDMS is accomplished though a series of pulldown menus that provide easy access to all the available functions of the system. At any time, if an operation is unavailable it will be removed from the list of available operations. Thus, throughout the program the user simply uses the cursor keys or a mouse to select the desired operation and be presented with another list of choices or a fill-in-the-blank menu to continue. At any point an extensive online help system is available by simply pressing the Help key or clicking on the help icon with a mouse button. The help is context sensitive so that the help text which appears on the screen is keyed to the current operation.

FDMS has been developed to run on only one family of computers—the IBM 80286/80386/80486 machines, and others which are fully compatible with these.[a] Standards have also been adopted for video boards (VGA) and graphical output devices (Hewlett-Packard LaserJets). In addition, physical standards were established for data exchange media: a $3\frac{1}{2}$ in floppy disk, for up to 1.44 MByte storage, and a 150 MByte cartridge tape for larger data exchanges. In all cases, only a single standard is prescribed, since it was realized that hardware prices are so low in comparison to programming costs that economics alone makes that decision for us.

In the design of the FDMS it has been recognized that since it is expected to be used worldwide, the capability to operate in other languages is desirable. The program has been written so that the user may do two different operations related to language selection: (1) configure the screen messages for the language of his choice; (2) configure the language choice for the test report. These two options are not identical, of course, since an English-speaking user may desire to prepare a report for a French-speaking client. Language choices, as with most other selections, are implemented in a pulldown menu.

Data reduction is the process of performing needed computations to convert raw voltage readings into useful output variables, expressed in engineering units. Within the FDMS this is accomplished in the simplest way—the data-reduction algorithms are incorporated as part of the routines for importing raw data. This means that any additional, intermediate programs for reducing data are not required; data reduction is just one of the logical steps to be followed in converting raw data into suitable entries in the database tables and files.

It will often happen that a given experiment, while conducted in a standard test apparatus, incorporated additional measurements for some exploratory purpose. These will generally consist of additional vector data channels. In other cases, no additional raw data will be gathered, but a special data-reduction algorithm will need to be used. Traditionally, such tasks are handled by the user patching his version of the pertinent software. In terms of modern software design this is undesirable. A user using patched software has no easy way of being updated when a new software release is issued. Thus, for FDMS a concept of user stub routines has been implemented. These allow users who do need to engage in such computer programming themselves to be presented with a clean and simple interface for doing so, without there being a need for their understanding the operation of the program in its totality.

FDMS comes already equipped with menu selections for issuing a standard printed report for each of the test types which are handled by FDMS. It is recognized, however, that often the user may wish to generate repetitive, but non-standard, reports. Such may be, for example, summary reports which analyze more than one type of test result per product, or combine results for more than one product in a single report. Unavoidably, the user will need to do some programming to accomplish this. To help him in this task, standard calling sequences have been set up for these operations. By adhering to these calling sequences the user will be able to install these customized report formats into the appropriate FDMS menu.

It must be emphasized that the FDMS formats and software are only intended to facilitate and standardize the exchange of data among users—this is *not* a mechanism for certifying or approving of data. It is, of course, essential that the quality of fire test data be sufficient for the intended task and that quality control procedures be present and be effective. FDMS, however, has not been designed as the tool for enforcing such data quality, but merely automating its storage and exchange. For the same reasons, the list of fire tests presented above are not intended to represent an 'approved' list, merely a list of those for which user demand has already been high.

FUTURE DEVELOPMENTS

While version 1.0 of FDMS does come with the capability to handle a number of different types of fire tests, many of the less common tests which a user may wish have not been provided for. Thus, users will wish to develop capabilities to handle additional test types. Once users identify such a need and prepare the appropriate tables and formats for these tests they will then be incorporated into future versions of the software. Thus, later versions of FDMS will include an even larger variety of test methods.

A very important aspect of the FDMS is that it is being developed as a tool for managing the fire test data inputs needed by various computer fire models. The integration of the FDMS with the fire models will be accomplished in several stages. In the first stage, input routines will be included in appropriate fire models to accept FDMS data in standard format. In a following stage, a tighter integration will be achieved, whereby the FDMS and the fire models will interact directly.

The graphics within the initial implementation of FDMS provides for screen displays and plots only of the vector data from the tests. Additional graphics objects are sometimes of interest in connection with fire tests. For example, fire-endurance test reports are customarily accompanied by drawings illustrating the construction details of the test object. It is envisioned that FDMS would eventually incorporate computer-generated construction drawings and similar graphics objects.

NOTES

[a] Certain commercial products and materials are identified in this paper in order to adequately specify the experimental procedures. Such identification does not imply recommendation by the National Institute of Standards and Technology, nor does it imply that these products or materials identified are necessarily the best available for the purpose.

REFERENCES

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4. Room Fire Test in Full Scale for Surface Products, ISO DIS 9705, International Organization for Standardization (1989).
5. Fire Tests on Building Materials: Reaction to Fire: Wall and Ceiling Linings, Part 3, Method of Measuring the Surface Spread of Flame, CEN/TC 127 (to be issued).
6. Fire Tests on Building Materials and Structures: Reaction to Fire: Wall and Ceiling Linings, Part 2, Method for Assessing the Ignitability and Fire Propagation of Building Materials when Subjected to Thermal Irradiance (Épiradiateur), CEN/TC127 (to be issued).
7. Fire Tests on Building Materials: Reaction to Fire: Wall and Ceiling Linings, Part 1, Method of Measuring Extent of Fire Damage (Brandschacht), CEN/TC127 (to be issued).
8. The Fire Data Management System Software, package available for purchase from: Fire Research Station, Attn: S.A. Ames, Borehamwood, Herts WD6 2BL, UK.