

A SEARCHABLE TRANSPORTATION FIRE SAFETY BIBLIOGRAPHY

Douglas E. LaDue III

Douglas W. Kononen

General Motors Global Research and Development Operations
United States

Paper Number 98-S6-W-46

ABSTRACT

Over 1,000 scientific and technical articles, specifically chosen for their relevance to transportation fires, were incorporated into a searchable bibliography. A searchable database was developed which incorporates the title, authors, source, publication year, associated keywords and, in many cases, an abstract for the citation. The database provides a mechanism to search the incorporated transportation fire safety literature for articles containing specific information. Transportation fire safety information that is reported in the scientific literature encompasses: the causes, propagation, severity and extinguishment of fires in passenger carriers, as well as, the flammability characteristics of the fuels and materials used in such vehicles. The advantage of this software package is that one can quickly locate scientific literature associated with a particular transportation fire topic (e.g., the radiant heat flux from a hydrocarbon pool fire or the critical heat flux required for the ignition of polypropylene). This is accomplished by searching the keywords that were selected for each citation. The software package is publicly available in a CD-ROM format for use on personal computers operating with Microsoft Windows® 3.1 or Windows® 95.

INTRODUCTION

Although fire safety bibliographic databases exist, to our knowledge none specifically address transportation. The Transportation Fire Safety Bibliography is a collection of scientific literature citations that is limited to articles relevant to transportation fire safety. The Transportation Fire Safety Bibliography cites over 1000 scientific articles published between 1911 and 1996. The bibliography is contained within a software package that enables users to both search and add citations. The software package is publicly available in a CD-ROM format for use on personal computers. This paper describes the development of this software package, conducted by the Fire Safety Research Group at General Motors Research and Development Center.

DISCUSSION

The Transportation Fire Safety Bibliography is designed to quickly and efficiently produce a list of publicly available scientific literature within a specified area of transportation fire safety. Developing the Transportation Fire Safety Bibliography required:

- (1) locating scientific literature related to transportation fire safety,
- (2) describing these works,
- (3) storing this information in an easily retrievable format, and
- (4) developing a PC-based stand alone software package with a user manual and help utility.

Locating Transportation Fire Safety Literature

Extensive literature searches were conducted to locate scientific literature relevant to transportation fire safety. This literature was reviewed and the appropriate citations were included in the bibliography. In general, transportation fire safety information within the scientific literature encompasses; the causes, propagation, severity, and extinguishment of fires in passenger carriers, as well as, the flammability characteristics of the fuels and materials used in such vehicles.

Both electronic and traditional resources were used to find scientific literature related to transportation fire safety. The electronic resources used include the following:

- (1) on-line card catalogs at General Motors and 15 universities (all the Big Ten Universities, Eastern Michigan University, Wayne State University, Illinois Institute of Technology and the University of Illinois-Chicago),
- (2) CD-ROM bibliographies (e.g., "BFRL Publications, 1994", developed by the Building and Fire Research Laboratory (BFRL)), and
- (3) both commercial and public on-line electronic databases (e.g., FIREDOC,¹ developed by BFRL and RAPRA: Rubber and Plastics, supported by DIALOG Information Services²).

The traditional resources used to locate relevant scientific articles are: selecting references from the literature that was already incorporated into the Transportation Fire Safety Bibliography and requesting reprints from authors established in the fire safety field.

Transportation fire safety literature had to be extracted from thousands of fire safety research papers (most of which are related to building fires).¹ Topics relevant to transportation fire safety were defined, by the original project statement, as the following:

- (1) flammability standards developed for transportation and related industries,
- (2) ignition of vapor plumes and stratified mixtures,
- (3) liquid pool fires and pool fire correlations,
- (4) fire spread and fire spread correlations,
- (5) large scale practical fires,
- (6) flammability of interior and exterior materials used in transportation,
- (7) flammability of fuels and other fluids used in transportation,
- (8) flammability hazards associated with alternatively fueled vehicles, and
- (9) the toxicological effects of off-gases produced by the combustion of vehicle materials.

The literature included in the Transportation Fire Safety Bibliography is limited to scientific articles addressing the above topics.

Describing the Scientific Literature

The selected literature is described by choosing a set of representative keywords for each scientific article and developing abstracts for the most important scientific papers.

Keywords were used to identify all the important concepts or data presented in an article. A complete set of keywords acts as a terse description of the article. The Transportation Fire Safety Bibliography incorporates keywords that are very specific to the study of transportation fire safety. These sharply defined keywords provide a mechanism to quickly locate information relating to specific transportation fire safety topics.

About 170 of the citations in the database include abstracts. This is due to the fact that abstracts developed by the original author are often subject to copyright protection. Abstracts subject to copyright protection are not included in this database. Therefore, the abstracts that

are included in the Transportation Fire Safety Bibliography must meet one of the following two criteria:

- (1) abstracts that are not subject to copyright protection, such as those provided by public institutions (i.e., NIST),³ and
- (2) abstracts that were written specifically for this project.

Abstracts could not be developed for all the citations in the Transportation Fire Safety bibliography, therefore, only those articles determined to be relevant to motor vehicle fires were abstracted. Literature selected as relevant to motor vehicle fire research examined the appropriate flammability properties of automotive materials or fluids. The flammability properties of interest are:

- (1) ignition temperatures or critical heat flux,
- (2) flame spread,
- (3) rate of heat release,
- (4) material or flame retardant chemistry and combustion or pyrolysis products, and
- (5) the toxicological effects of combustion or pyrolysis gases.

Relevant automotive materials are defined as ABS, nylon, polyethylene, polypropylene, polyvinyl chloride, thermoset polyesters and urethane. These seven materials represent more than 75% of the total mass of polymers used in motor vehicles.⁴ All automotive fluids are considered relevant, except gasoline. All of the abstracts developed for this project were written by students at Michigan State University.

Information Storage and Retrieval

Microsoft Access[®] was chosen as the software application to develop the Transportation Fire Safety Bibliography because it provides both efficient information storage and a mechanism to develop a specialized search engine.

The Microsoft Access[®] database incorporates the title, authors, source, publication year, associated keywords and, in some cases, an abstract from each scientific article. To avoid possible copyright conflicts information was not electronically manipulated from existing databases into the Transportation Fire Safety Bibliography. All the gathered and developed information was entered into the database by hand.

A search engine was developed to access the information stored in the database. The search engine searches most of the available data fields, including the: title, authors, source, publication year, associated keywords and abstract. The combination of the search engine and the sharply defined keywords provides a mechanism to search the database literature for articles containing very specific information.

Software Package Development

Microsoft Access[®] Developer's Toolkit enables software developers to produce a stand alone run-time software package of their Microsoft Access[®] database. All the necessary licenses are owned by GM and their contracting companies and the Microsoft License Agreement conditions have been fulfilled. The software package is distributed in a CD-ROM format. The files required to run the TFS Bibliography are installed from the CD-ROM to the user's hard disk.

The Transportation Fire Safety Bibliography is a dynamic database. In other words, the software includes the ability to add citations to the bibliography. Therefore, as the field of transportation fire safety grows, users can incorporate new publications. User-added citations are included in all searching and browsing operations. However, the user cannot edit any of the information (citations, authors, keywords, sources or abstracts) originally provided with the Transportation Fire Safety Bibliography.

Both a help utility and a manual are included with the Transportation Fire Safety bibliography. The help utility is an additional piece of software that is accessed when using the Transportation Fire Safety bibliography. The manual is a stand alone text document, included on the CD-ROM in Microsoft Word[®] versions 6.0 and 95. Note that the help file and the manual contain nearly identical text.

CONCLUSION

The Transportation Fire Safety Bibliography is a collection of scientific literature citations that is limited to articles relevant to transportation fire safety. The Transportation Fire Safety Bibliography operates as a stand alone, PC based software package. The advantage of this software package is that one can quickly locate scientific literature associated with a specific transportation fire research topic. Furthermore, a mechanism to add additional citations is included so that

users can keep the database up to date as the transportation fire safety field continues to grow.

Use and Distribution Agreement

The Transportation Fire Safety Bibliography was created to assist researchers in their search for information. GM makes no claims regarding the accuracy or completeness of the software or accompanying information. GM is not responsible for any use or misuse of the software or accompanying information.

The information contained on the accompanying disks should not be altered in any way. Attempts to change the files will adversely impact the integrity of the information and its usefulness.

Searchable Transportation Fire Safety Bibliography is a database which contains citations to and abstracts of scientific literature. The database was prepared by General Motors Corporation pursuant to an agreement with the U.S. Department of Transportation. General Motors Corporation claims no copyright in the citations or abstracts which may be freely reproduced and used by the public, without limitation.

Searchable Transportation Fire Safety Bibliography was created using Microsoft Access[®] Developer's Toolkit, a copyrighted work of the Microsoft Corporation. The permission conferred above to reproduce or use portions of the database does not extend to any portion of the Microsoft Access[®] Developer's Toolkit.

Microsoft Access[®] Developer's Toolkit, Advanced Tools For Custom Applications, Version 2.0 © 1984-94 Microsoft Corporation. All Rights Reserved.

Completion of this project partially fulfills the March 7, 1995, agreement between GM and the Department of Transportation.

REFERENCES

- ¹ Jason, N. H., "FIREDOC Users Manual", 3rd Edition, NISTIR 5305, December, 1993.
- ¹ "Knight-Ridder Information Sourcebook 1996/97", Knight-Ridder Information, Inc., Mountain View, CA, 1996.
- ¹ Zimmerman, D. E. and Muraski, M. L., "The Elements of Information Gathering", Oryx Press, Phoenix, AZ, 1995.
- ¹ Best, J. R., Ed. "Automotive Plastics Newsletter", Market Search Inc., Toledo, OH, February, 1996.