

**Report on**

**United States Fire Administration's**

**Fire Research Agenda**

**Submitted to**

**Committee on Commerce, Science, and Transportation  
United States Senate**

**Committee on Science  
United States House of Representatives**

Prepared by

United States Fire Administration  
Federal Emergency Management Agency  
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## **Report to Congress**

### **A Research Agenda for the United States Fire Administration**

#### **Purpose**

The Federal Emergency Management Agency's (FEMA) United States Fire Administration (USFA) submits this report to the Committee on Science of the House of Representatives and the Committee on Commerce, Science, and Transportation of the Senate prepared in accord with the requirement found in P. L. 106-503 of the USFA Reauthorization Act for Fiscal Years 2001-2003 Appropriations Bill. This requirement states:

#### **SEC.4. RESEARCH AGENDA.**

- (a) **REQUIREMENT** – Not later than 120 days after the date of the enactment of this Act, the Administrator of the United States Fire Administration, in consultation with the Director of the Federal Emergency Management Agency, the Director of the National Institute for Standards and Technology, representatives of trade organizations, State and local firefighting services, and other appropriate entities, shall prepare and transmit to the Committee on Science of the House of Representatives and the Committee on Commerce, Science, and Transportation of the Senate a report describing the United States Fire Administration's research agenda and including a plan for implementing that agenda.
  
- (b) **CONTENTS OF REPORT** – The report required by subsection (a) shall –
  - (1) Identify research priorities;
  - (2) Describe how the proposed research agenda will be coordinated and integrated with the programs and capabilities of the National Institute of Standards and Technology, the Department of Defense, and other Federal agencies;
  - (3) Identify potential roles of academic, and other research institutions in achieving the research agenda;
  - (4) Provide cost estimates, anticipated personnel needs, and a schedule for completing the various elements of the research agenda;
  - (5) Describe ways to leverage resources through partnerships, cooperative agreements, and other means; and

(6) Discuss how the proposed research agenda will enhance training, improve state and local firefighting services, impact standards and codes, increase firefighter and public safety, and advance firefighting techniques.

(c) USE IN PREPARING STRATEGIC PLAN – The research agenda prepared under this section shall be used in the preparation of the strategic plan required by section 3.

### **Background**

Historically, USFA’s research agenda has been developed with inputs from several sources including staff contacts with constituency at symposia, trade meetings, conventions, and similar venues. Students attending the USFA’s National Fire Academy, representing fire departments from across the country, provide input informally in the classroom as well as in structured focus groups. USFA staff meets with representatives of Federal agencies which have research capabilities or which may have similar research needs. Input is obtained through the submission of unsolicited proposals from fire service organizations and research organizations in the academic and private sectors. USFA also manages special research initiatives as directed by the Congress.

USFA research is often based upon the needs identified by the committees of national consensus standards-making organizations. These committees develop standards that are referred to by a broad range of organizations that may adopt or require the adoption of standards that apply to the built environment and emergency responders. Often the committees will require research results in order to develop a new standard or improve an existing one. This research might be conducted in cooperation other Federal agencies, Federal laboratories, private sector research organizations, and academic institutions. Other research documentation may involve the development of technical reports and guidance documents for constituency use.

USFA’s research and technology program is continually reviewed for its effectiveness and impact on fire safety in the United States. A national research agenda, based upon constituent input, is incorporated into USFA’s planning and budget process and integrated with its strategic plan. Input from staff, representatives of the fire and emergency services community, non-fire service constituency organizations, and other Federal agencies that conduct fire research, are used in the development of the national fire research agenda.

USFA places a high priority on meeting constituent research needs as those needs are made known to the USFA. Research is prioritized on an outcome basis, that is, how will the research product impact the fire problem in the United States and life safety of civilians and emergency responders.

On September 28, 2000, the USFA was reorganized to strengthen its ability to provide leadership, advocacy and coordination on behalf of the Nation's fire service and better meet the needs of the public. Concurrent with reorganization, USFA has identified operational objectives that will drive program initiatives. Research and applied technology are an important part of this effort.

The research agenda will focus closely on USFA's objectives and strategies that were set by the USFA's Chief Operating Officer and senior management in September 2000. These objectives and strategies are directly related to FEMA's Strategic Goal Number One: Protect lives and prevent the loss of property from natural and technological hazards.

The USFA operational objective is to reduce the loss of life from fire-related hazards by 15 percent over five years. The USFA has identified five strategies to help meet that objective. They are:

1. The USFA will undertake programs that will help reduce the loss of life in the 14 years and younger age group by 25 percent over 5 years.
2. The USFA will undertake programs focused on reducing the loss of life to those 65 years and older. The 5 year strategy is to reduce the loss of life from fire related deaths by 25 percent.
3. The USFA will focus on reducing the number of firefighter deaths by 25 percent over 5 years.
4. The USFA will identify 2,500 communities in which the fire department is a partner in a Community Multi-Hazard Risk Reduction Plan.
5. The USFA will respond to emergent issues.

The USFA has chosen to focus programmatic efforts on those populations most at risk for injury and death due to fire. By targeting high-risk populations, we believe we can have the greatest impact on the overall fire problem. These goals and strategies will be at the center of USFA research priorities for the next 5 years.

### **Agenda Development**

The USFA, in cooperation with the Building and Fire Research Laboratory (BFRL), at the National Institute of Standards and Technology (NIST), conducted two workshops to obtain input from the fire community and trade organizations. The first meeting, which focused on the identification of fire service needs, was held October 13-15, 1999, in San Antonio, Texas. At that workshop, members of the fire service representing national fire service organizations and a wide range of fire departments in both size and location were

asked to identify research issues. General recommendations were made in which the following needs were identified: make emerging technologies, new programs and support services available to as broad a section of the fire service as possible; make fire safe behaviors and prevention a fire service cultural priority; coordinate research with training entities for better implementation of technology/programs; improve transfer of technology to fire departments and individual firefighters. Recommendations were made regarding specific subject areas of search and rescue, salvage and overhaul, suppression, ventilation, operations, fire prevention, public education, firefighter safety, personal protective equipment, firefighter health, special fires, mutual aid, communications, dispatch, incident command, and record keeping. (Attachment 1)

On October 20, 1999, at the National Emergency Training Center, Emmitsburg, Maryland, USFA and NIST hosted a meeting of representatives of non-fire service organizations and allied professions in order to obtain insight on their fire research needs. (Attachment 2)

On October 21-22, 1999, the Society of Fire Protection Engineers hosted a workshop to develop a research agenda for the fire protection engineering profession. The participants came from around the world and from all segments of fire protection engineering practice: consulting, insurance, education, research, manufacturing, enforcement and facilities management. The workshop attendees identified research priorities in four areas: increased use of risk concepts; increased understanding of fire phenomena; human behavior; and data. (Attachment 3)

On December 10, 1999, the Building and Fire Research Laboratory, NIST, hosted the 15<sup>th</sup> meeting of Agencies that Fund Fire Research, in Gaithersburg, Maryland. The purpose of this meeting was to provide a forum for agencies to discuss their current fire research programs and offer an opportunity for agencies to share ideas and information. Researchers representing 10 Federal agencies presented overviews of their fire research programs. This sharing of information allowed for coordination of similar research efforts and the avoidance of potential duplication of efforts. In addition to USFA and NIST, other Federal agencies represented were the Department of Defense, the Consumer Product Safety Commission, the United States Coast Guard, the United States Department of Agriculture, the Forest Service, the National Aeronautics and Space Administration, and the National Institute for Safety and Health.

#### 1. Identify Research Priorities

In Fiscal Year 2000, USFA funded \$2,000,000 in research related projects, the majority of which are being conducted over a 12 to 18 month period. The initial selection of projects was based on staff evaluation of input from sources described in the Background of this report with attention given to existing commitments. The series of research workshops held in the first quarter of the fiscal year provided additional input for consideration. This research is focused on the FEMA/USFA goal of reducing the impact of fire in the United States including death, injury, and property loss. Fiscal Year 2000 and Fiscal Year 2001 are transition years leading to projects being focused on the specific USFA strategy of reducing the loss of life among those 14 and younger, 65 and older, and

firefighters, by 25 percent over 5 years. Each project undertaken in Fiscal Years 2000 and 2001 relates to one or more of the recommendations that came out of the fall 1999 research workshops although they did not specifically or solely result from those proceedings.

In Fiscal Year 2001, the level of funding for research projects will be closer to \$2,400,000. These projects too are generally short term, that is, from 12 to 18 months in duration. Some are connected to initiatives begun in Fiscal Year 2000, building on initial findings or exploring new alternatives.

The following projects were initiated and funded in Fiscal Year 2000:

- A Review of Residential Automatic Sprinkler Technology
- Limited Area Fire Sprinkler Systems for Residential Applications
- Earth Alert – Personal Warning System
- Performance of Firefighter Protective Clothing
- Structural Collapse Prediction Tools
- Smoke Detector Research
- Electrical Wiring in Older Residences
- Range and Oven Fire Safety
- Sprinkler Head Research
- Enhancement of Personal Alert Safety Systems
- Fire Research Workshops
- Liquid Fuel Spill Burn Patterns
- Revision of Emergency Service Infection Control Manual
- Psychological Impact of Residential Fires
- Effectiveness of Public Education Methodologies
- Operation Life Safety – Residential Fire Safety Institute
- Fire Service Hazardous Materials Preparedness and Response

Fiscal Year 2001 planned projects include:

- Dormitory Fire Scenario Tests
- Beam and Vaulted Ceiling Fire Tests
- Safer Vehicle Operations of Fire Tankers
- Evaluation of Structural Ventilation Techniques
- Evaluation of Thermal Imaging Systems Technology
- Heat Transfer Model for Firefighter Protective Clothing
- Evaluation of Structural Collapse Prediction Tools
- Smoke Alarms for Residential Properties
- Electrical Wiring in Older Residences
- “Smart” Stove Technology
- Sprinkler Head Research
- Fire Suppression Effectiveness of Hose Streams
- Motor Vehicle Fires
- Investigating the Capability of Recreating Fire Patterns with Computer Simulators
- Smoking Fires

- Multi-year Firefighter Fatality Study
- Integration of Research Results in Training
- Evacuation of Disabled Persons
- Operation Life Safety – Residential Fire Safety Institute
- Fire Service Hazardous Materials Preparedness and Response

2. Describe how the proposed research agenda will be coordinated with the National Institute of Standards and Technology (NIST), the Department of Defense, and other Federal Agencies.

Almost half of USFA's research projects initiated with Fiscal Years 2000 and 2001 funds are being accomplished in partnership with NIST's Building and Fire Research Laboratory (BFRL). The efforts of USFA and NIST to work cooperatively fully comport with a Memorandum of Understanding signed by both parties in November 1998. USFA and BFRL staff meet regularly to discuss programs of mutual interest that will have a positive impact on fire in America. As an example, the USFA has cooperated with NIST by sponsoring research focusing on residential fire protection technology. This has resulted in the development and enhancement of national consensus standards for sprinkler applications for residential occupancies—where most of our fire deaths occur.

In 2000, a satellite office was established at USFA's Emmitsburg location, the National Emergency Training Center (NETC), for NIST staff assigned to the USFA on a rotating basis. This allows NIST personnel to become more knowledgeable about USFA programs and the needs of its constituency and it fosters greater cooperative efforts between the two agencies. In addition, the Bureau of Alcohol, Tobacco and Firearms (ATF) has established a satellite office at NETC to share and analyze arson data with USFA. This partnering fosters increased interagency activities intended to meet the needs of shared constituencies.

USFA maintains a long standing relationship with the Consumer Product Safety Commission (CPSC) by which both agencies work together on projects related to fire alarm/detection systems and product-related fire hazards.

Federal and private sector meetings focusing on national fire issues and related agenda allow USFA to become aware of opportunities for cooperative efforts with these organizations. Examples are the Annual Meeting of Federal agencies that Fund Fire Research. This meeting, hosted by NIST, allows the Department of Defense (DoD) and other Federal agencies to come together and describe current projects and capabilities. At the most recent meeting, several DoD research projects were described by researchers from various Federal agencies. One of these referred to USFA sponsored research on water suppression systems in cooperation with the Naval Research Laboratory to develop documentation in support of the National Fire Protection Association Technical Committee on residential sprinklers.

The Fiscal Year 2000 and Fiscal Year 2001 USFA research projects involve partnerships and coordination with Federal agencies such as NIST, DoD, CPSC, ATF, and the National Aeronautics and Space Administration (NASA).

3. Identify potential roles of academic, and other research institutions in achieving the research agenda.

USFA recognizes that academic and other research institutions participation can be an important asset in achieving the research agenda. Other research institutions can include both Federal laboratories and private sector research companies. These kinds of organizations have worked with the USFA in the past on a variety of research issues. As examples, these organizations have participated in research on residential sprinkler technology, emergency responder protective clothing and equipment, and arson related issues. Currently USFA has projects being accomplished in cooperation with the University of Arkansas, the University of Alaska, and Virginia Polytechnic Institute and State University. As it does now and has in the past, the USFA will work with these kinds of institutions whenever possible.

4. Provide cost estimates, anticipated personnel needs, and a schedule for completing the various elements of the research agenda.

In Fiscal Year 1999, USFA's funding for research reached less than \$500,000. The budget for Fiscal Year 2000 included a specific enhancement of \$1,500,000 for research and brought that year's research funding to \$2,000,000. For Fiscal Year 2001, the target is \$2,500,000 plus \$600,000 for supporting data analysis. The goal for Fiscal Year 2002 is \$3,250,000 in research and research support.

USFA personnel assigned to manage the research program include the equivalent of four full-time project officers with part-time administrative support and management. The continued expansion of research initiatives will demand similar staffing enhancements. USFA has established a Research and Technology team to coordinate the research needs of the organization. In addition, there are a number of contractor staff and staff of other Federal agencies, such as NIST and ATF, who partner with the USFA.

Estimates for completion of the work undertaken in FY2000 and the work to be started in FY2001 are essentially short-term (1 year to 18 months from the time of award to completion). A goal is to have projects underway and turned around within 1 to 3 years thus allowing constituency groups to utilize USFA research products as soon as possible. However, the very nature of research is to answer some questions while opening new issues for further investigation.

5. Describe ways to leverage through partnerships, cooperative agreements, and other means.

USFA attempts to leverage resources whenever it plans to undertake new initiatives. Current research activities include working relationships with NIST, CPSC, and NASA. These relationships range from technical consultation, peer review, and coordination to cost-sharing on projects of mutual interest.



A particularly effective means of leveraging resources has resulted from the regular physical presence of other agency personnel (ATF and NIST) at NETC. Co-location, even on an intermittent basis, promotes better communication and cooperation resulting in greater productivity. Teamwork increases efficiency exponentially.

6. Discuss how the proposed research agenda will enhance training, improve state and local firefighting services, impact standards and codes, increase firefighter and public safety, and advance firefighting techniques.

The USFA research agenda covers a wide range of projects with implications for training, services, codes and standards, safety, and operations.

The USFA Research and Technology Team ensures that the USFA's National Fire Academy (NFA) is aware of current developments to be addressed in the classroom and considered in course development priorities for both resident and field programs. The NFA's off-campus curriculum feeds into State and local fire training programs, thereby having a broad impact on the training of the Nation's fire service. In 2001, a specific effort is being undertaken to review and identify linkage between the research of NIST's BFRL and the curriculum of the NFA.

The results of USFA research are documented in a variety of publications that are distributed to the fire service and allied professionals through the USFA Publication Center. Such reports have versatile usage among our constituency including use by standards-making organizations, product developers and manufacturers, fire departments and other emergency services organizations, Federal, state, and local government agencies, training entities, and others.

As an example, work on firefighter protective clothing is expected to result in improved protective clothing and equipment thus increasing the safety and health of firefighters while improving the effectiveness of local firefighting services. This work will be made available to the NFPA Committee on Protective Clothing and Equipment as that Committee updates the relevant standard(s). Manufacturers of protective clothing and equipment will also have an interest in this research and will have ready access to the documentation. USFA and NIST (which is conducting this research with USFA) are considering the value of this research in the development of improved training in the expectations and use of protective clothing and equipment.

To ensure the widest possible dissemination and application, the results of USFA research are available on the USFA web site for reference and download. In 2000 alone, the web site had more than 1.6 million visitors.

### Closing

The framework for the USFA research agenda is the goal of reducing the Nation's fire loss by focusing on the high-risk populations of children of 14 years-of-age and younger, adults of 65 years-of-age and older, and firefighters. The selection of specific initiatives is influenced by the needs and interests identified in consultation with the variety of constituents and partners represented by trade associations, State and local firefighting

services, academic and research institutions, and other Federal agencies. Regularly scheduled workshops, professional conferences and meetings hosted by the USFA and our partners will serve to continuously update the USFA assessment of fire service needs and ensure that those needs are addressed in the national fire research agenda.

Attachment 1: [Fire Service Needs Workshop Proceedings](#)

Attachment 2: [Fire Research Needs Workshop Proceedings](#)

Attachment 3: [A Research Agenda For Fire Protection Engineering](#)