National Institute of Standards and Technology

FEMA

FIRE.GOV

Better fire fighting through research

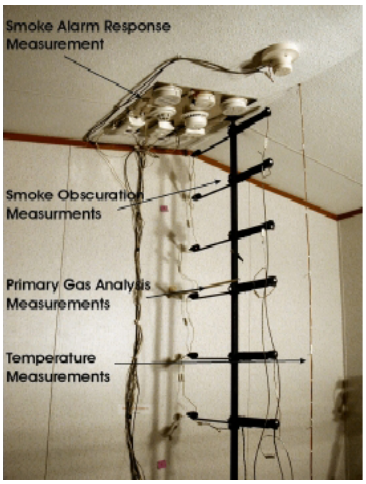
Spring - 2004

Home Smoke Alarms Work with Faster Fires

"The three-minute escape window for flaming fires differs from the 17 minutes NIST recorded in its seminal smoke alarm tests in the 1970s" said Richard Bukowski, the NIST researcher who conducted both the early work and a new series of fire tests.

New research demonstrates that the three-minute warning time provides enough time to save lives. It also shows that two types of commercially available home smoke alarms (ionization or photoelectric) are effective. In addition, the recent two-year NIST home smoke alarm study indicated ionization smoke alarms responded faster to flaming fires; photoelectric smoke alarms responded quicker to smoldering fires. Smoke alarm placement was studied in the tests that revealed how closed bedroom doors and proper placement of smoke alarms affected one's chances of survival.

Cont. on page 2



Instrumentation for measurement of temperature, primary gas analysis, smoke obscuration, and smoke alarm response time.

Mini Fire Trucks Part of the Iraqi War Effort

To fight wars, fire suppression is vital and space is critical on aircraft. For equipment deployment, the smaller the vehicle, the greater the number of vehicles or other supplies that can be carried per flight.

The U. S. Air Force Research Laboratory (AFRL) studied the capabilities of reduced-size high pressure fire extinguishment for Aircraft Crash and Rescue Fire Fighting (ARFF), and for the First Response Expeditionary (FRE) fire response vehicles.

Helping to meet the challenges faced by deployment of fire fighting equipment for the Iraq war, small, compact, and effective fire fighting vehicles based on the results of AFRL research were produced in a short amount of time.

The FRE consists of a 22 HP Briggs and Stratton engine with a 3-cylinder 1500-psi plunger pump. The 52-gallon system is capable of flowing 14 gpm of foam/water in a mist, stream, or aspirated foam.

This compact, lightweight system is an invaluable contribution because it allows for lightweight systems to be transported on military HUMMVs, Gators or other small vehicles.

The benefits to the military are that the FRE Fire Vehicle provides a lightweight system for effective crash/rescue fire fighting services on deployments. FRE Fire Vehicles can effectively extinguish 2-D and 3-D fires with one-fifth the agent. They are easy to use, are virtually maintenance free and adaptable to a wide variety of vehicle platforms.

Aircraft Crash and Rescue Fire Fighting (ARFF) vehicle [right] and First Response Expeditionary (FRE) vehicle [left].

Cont. on page 3

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Home Smoke Alarms Work with Faster Fires, cont.

Residential detector sample test board used in study.

Interaction between smoke alarms and residential sprinklers of the type required in new homes also was studied. Tests reaffirmed earlier findings that smoke alarms of either type will activate faster than sprinklers. Another observation was that later activation times implied that residential sprinkler installations always should include smoke alarms (as currently required in National Fire Protection Association Standards 13D and 13R) to provide greater escape time for those capable of escaping. To learn more about the tests, the complete report, *Performance of Home Smoke Alarms: Analysis of the Response of Several Available Technologies in Residential Fire Settings*, may be downloaded as a PDF file at: http://smokealarm.nist.gov.

For additional information, contact Richard Bukowski (1) + 301-975-6853, richard.bukowski@nist.gov .

Australians Use Research to Attack Bushfires

The opening of the $100 million Bushfire Cooperative Research Center (CRC) is a salvo launched by the Australian government, firefighters, researchers, and industry in the fight against bushfires.

Bush fire fighting

Bushfire CRC is a relatively new resource that was established under the Commonwealth Government's Cooperative Research Centres Program to better manage the bushfire risk to the Australian community. It will not only increase understanding of bushfires but also offer better knowledge of how to control them. The risk of bushfires will be managed in a more economical and environmentally smart manner, in addition to increasing the ability of communities to independently manage this risk.

Do you want to know about the intentional burning fire ban in Victoria? The Bushfire Cooperative Research Center (CRC) is just the place to find the answer(s). Go to www.bushfirecrc.com and click on the weather reports icon on the home page for the site of the Bureau of Meteorology. This site provides weather and related information including what should be (or should not be) done today! Other weather areas of interest, for example, Flood Warnings, Radar Images, Satellite Imagery and other weather phenomena are available.

Research results will be shared quickly by fire agencies, farmers, and communities because of the coordinated approach by the CRCs. Press releases providing timely information on current research projects are readily available. Publications and press releases are made available in the Public Documents area of the site. Another way to locate information on available publications would be to identify the researcher from the Research web page and contact them directly. For additional information contact: Derek McCormack, Communications Coordinator, e-mail, derek.mccormack@bushfirecrc.com .

Large Spaces Protected by Computer Controlled Monitors

A fire location and suppression system with computer controlled water nozzles for locating and suppressing fires in large open spaces has been developed by the University of Science and Technology of China (USTC). The fire location is identified by the computer vision system that looks at the space through a digital video camera fixed near the end of the nozzle. While the camera is pivoting, continuous images are taken by the video monitor and transmitted to a computer.

The images then are processed using the USTC's IFDM (Image Fire Detection Method) to determine whether a fire occurs in the computer controlled monitor's vision field. Once a fire is detected, the water stream from the nozzle is directed by the video for automatic pinpoint suppression.

To test and evaluate the technology, experiments were conducted in a large test hall which is 30 meters high, 30 meters long and 18 meters wide. The computer controlled nozzle and camera were installed on one wall at the height of 10 meters. Fuels in different tests were placed in a line on the ground of the hall every two meters apart from the nozzle. Different fuels such as diesel oil, wood, and paper boxes were tested separately. To learn more, see the paper: "Fire Location and Suppression with Automatic Hydrant in Big Space" by Hongyong Yuan, Tao Chen, Guofeng Su, and Weichen Fan, presented at the Second NRIFD Symposium—Science, Technology and Standards for Fire Suppression, July17-19, 2002, Mitaka, Toyko, Japan, sponsored by the National Research Institute of Fire and Disaster.

For additional information, contact Dr. Hongyoung Yuan, yuanhy@ustc.edu.cn.

Mini Fire Trucks Part of the Iraqi War Effort, cont.

The FRE is ideal for small aircraft/helicopter crash, hot pit refueling, and tent city fire protection. AFRL has delivered nine prototype units to the field. The technology is being transitioned to Rosenbauer America for General Services Administration (GSA) scheduling through the efforts of AFRL, Tyndall Air Force Base, Florida and AAC/WMO SPO, Eglin Air Force Base, Florida.

To learn more about continuing research areas, contact the AFRL, Fire Research Group, 139 Barnes Drive, Suite 2, Tyndall AFB, FL 32403, telephone: (01) + 850-283-3734, DSN 523, Fax: (01) + 850-283-9797.

Evaluating the High Pressure Fire Extinguishment in 3-D F 100 engine nacelle fire simulation at Tyndall AFB

Training Web Site and CDs Aid Firefighters

A new tool is available to the fire service, law enforcement personnel, fire insurers and others who are involved in arson investigations, fire investigation safety and fire scene training. InterFIRE Online makes available on their web site, www.interFIRE.org, several online tutorials. The interactive tutorials on critical fire and arson investigation are available through the online training center. The newest one is: First Response from an Investigative Perspective. The interactive tutorial was created from the perspective of fire, police and EMS professionals so that each user can have the same perspective of the incident regardless of the role they play.

Additional tools include a fire investigation resource center by subject and date. Fire investigations from before the fire through follow up and legal preparation are used. Information you can access on the web site includes arson investigation abstracts, United States Fire Administration technical reports, fire investigation link, etc.

The site is updated monthly. Anyone can sign up to receive an Update Alerts.

Stonehouse Media, Inc. designed and maintains the web site for the U. S. Bureau of Alcohol, Tobacco and Firearms. For additional information, contact: question@interfire.org.

Images from the InterFIRE on-line tutorials.

Predicting Structural Collapse

Can firefighter avoid life threatening structural collapses? To help answer that question NIST is being funded by the US Fire Administration/ FEMA/DHS, to explore if any technology can provide early warning of collapse during fire ground operations. *Structural Collapse Fire Tests*, a DVD created by NIST, contains three reports and accompanying video clips of fire experiments conducted on one story buildings in the first part of the project.

The first report, *Structural Collapse Fire Tests: Single Story, Ordinary Construction Warehouse,* by David W. Stroup, Daniel Madrzykowski, William D. Walton and William Twilley, NISTIR 6959, describes a series of tests done in cooperation with the **Phoenix [Arizona] Fire Department** on a single-story warehouse building scheduled for demolition. The fire department used the series of fires in various structures in an effort to better educate fire fighters about structural collapse.

Navigation Screen of DVD

Cont. on page 4

Predicting Structural Collapse, cont.

The second report, *Structural Collapse Fire Tests: Single Story, Wood Frame Structures*, by David W. Stroup, Nelson P. Bryner, Jack Lee, Jay McElroy, Gary Roadarmel, and William H. Twilley, NISTIR 7094, is another piece of knowledge for the system.

The fire test scenario was selected as part of the training video being prepared by the **Phoenix [Arizona] Fire Department**.

Four structures with different roof constructions were used for the fire tests. The roof of each structure collapsed approximately 17 minutes after ignition. In addition to the full scale experiments, fire properties of the plywood and oriented strand board (OSB) roofing materials were measured by NIST using the cone calorimeter apparatus.

Trends in Firefighter Fatalities Due to Structural Collapse, 1979-2002, by Lori D. Brassell and David D. Evans, NISTIR 7069, (the third report on the DVD) was discussed in the Fall 2003 issue of FIRE.GOV. Go to: http://www.fire.gov/newsletter/fall2003/page_four.htm#Trends .

An earlier report, *Early Warning Capabilities for Firefighters: Testing of Collapse Prediction Technologies*, NIST GCR 03-846, Ziyad Duron discussed the methodology developed to monitor vibrations in the structure induced by fire, was discussed in the Summer 2002 issue of FIRE.GOV.

Go to: http://www.fire.gov/newsletter/summer2002/page_three.htm#vibrations .

It does not appear on the DVD, but you may obtain a copy of it by clicking on its title.

To obtain a copy of the DVD, contact David W. Stroup, (1) + 301-975-6564 david.stroup@nist.gov

NIOSH/RAND Study for Protection of Firefighters

Firefighters, emergency medical service responders, and law enforcement officers face many hazards when protecting people and property during fires, medical emergencies, and other yet to be determined emergencies. Various forms of personal protective technologies (PPTs), for example, respiratory protection, environmental monitoring, protective garments, and communications equipment, and practices and protocols that focus on safety, can reduce the risk. A new report, *Protecting Emergency Responders, Volume 2: Community Views of Safety and Health Risks and Personal Protection Needs*, by Tom LaTourrette, D. J. Peterson, James T. Bartis, Brian A. Jackson and Art Houser, has been published by RAND as a result of studies performed with funding from the National Institute for Occupational Safety and Health (NIOSH). It is available in paperback or in PDF; for additional information go to: http://www.rand.org/publications/MR/MR1646/ .

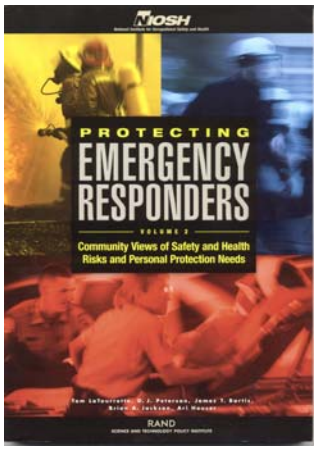
The authors interviewed 190 members of the emergency responder community. They identified the protective technology needs of responders and developed an initial personal protective technology research agenda.

To highlight a few of the results, the survey found that there are problems with component integration and compatibility and the poor functionality of gloves, and the inconsistent sizing of gear among different manufacturers. There is also a need to reduce the heat and physical stress produced by modern bunker gear.

Volume 1 in this series, *Protecting Emergency Responders: Lessons Learned from Terrorist Attacks* was discussed in an earlier issue of FIRE.GOV. http://www.fire.gov/newsletter/spring002/page_one.htm .

Both reports are being used by NIOSH to develop an R&D roadmap for personal protective equipment used by emergency responders.

For additional information go to http://www.cdc.gov/niosh/nppt/default.html or contact Ron Shaffer (1) + 412-386-4001, RShaffer@cdc.gov.



Cover of the RAND report, Protecting Emergency Responders: Volume 2

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