Developing blanket protection from wildfires

March 31 2010

Case Western Reserve University and NASA researchers are looking for the right material, the right design, the right thickness and the right weight for a new fire-resistant blanket. To protect houses.

"The overall objective is to help the safety of the public and firefighters from fire," said Fumiaki Takahashi, research professor of mechanical and aerospace engineering.

"If we can protect the house, firefighters can do other things and be much safer," said James T'ien, professor of mechanical and aerospace engineering.

The professors, who specialize in combustion and fire science research, are working with Sandra L. Olson a spacecraft fire safety scientist at NASA Glenn Research Center in Cleveland. They believe blanket protection for vulnerable homes would be more effective and more environmentally-friendly than traditional wildfire measures.

The research is funded by a $1 million grant from the Federal Emergency Management Agency's Assistance to Firefighters Grant program.

In western states each summer, wildfires burn through neighborhoods built in the border between forests and towns, an area called the wildland-urban interface. Among the worst, 3000 homes and other buildings in the East Bay Hills of Oakland, CA. burned in 1991. The fire killed 25 people and cost nearly $1.2 billion in property losses.

The government estimates that 38 percent of new houses in the West are now in the interface.

Costs of fighting fires in the interface are also sky high. The U.S. Forest Service estimates that the total cost of fighting large fires to protect private homes adjacent to Forest Service lands has accounted for half to 95 percent of all costs - a range of $547 million to $1 billion in 2003 and 2004. Annual appropriations for wildland fire management on federal lands have risen from an average of $1.1 billion from 1996 to 2000 to $2.9 billion from 2001 to 2007, driven by drought, increased fuels in the forest understory and more housing, according to the General Accounting Office

While wildfires can rage for days or weeks, a blanket needs to protect a house for only about an hour, including a critical period of 10 minutes. That's the typical amount of time a passing wildfire's radiant heat and airborne embers, flaming leaves or other materials pose a threat to ignite a house, the researchers say.

In the lab, the researchers and engineering students have tested more than 40 fabrics made primarily of four material groups or combinations of them to determine which have the properties they need: lightweight protection from radiant heat and direct flame.

The material groups include: Aramid-based fiber, a cloth used to make the protective uniform firefighters wear when fighting a blaze; woven fiberglass; amorphous silica and carbon. Some materials were aluminized.

The team has also placed dollhouse-size wooden structures draped in various cloths into donated homes that were then burned down for training by Cleveland-area firefighters and cadets of the Cuyahoga Community College Fire Training Academy. During those trials, some

wood of the model houses turned black but did not ignite during a 6-minute exposure.

As in the lab, the team found aluminized materials perform best, but concerns remain about weight. One aluminized material was only 1 millimeter thick but a 10-meter by 10-meter blanket would weigh more than 100 kilograms, making an unwieldy cover.

The team has begun investigating and designing mechanisms to spread blankets over the outside walls of a house. It is a challenge, especially under windy conditions.

The researchers plan to scale up their testing. A blanket made of a composite of several materials will cover half of an 8-foot-by-10-foot shed, and a blanket of woven fiberglass will cover the other half. Both blankets will be aluminized. The shed will be put in a forest in the path of a prescribed burn.

"We'll see if these fire blankets protect under a realistic fire scenario," Takahashi said. "It is a test of performance versus cost. The composite-based material is very expensive."

The researchers will use the test to further validate computer models they've built. The models will then be used to optimize the design and mix of materials for a house blanket, the researchers say.

Environmentalists and those who don't want their taxes to pay for firefighting in high-risk areas are calling for a limit or halt on housing in the interfaces. But, even if limits are imposed the risk of wildfires may well increase during drought.

Provided by Case Western Reserve University