

# Wildland Firefighting:

Balancing Thermal Protection with Comfort and Heart Health



**ONCE THE CORE TEMPERATURE REACHES A CRITICAL LEVEL,**  
IT IS VERY DIFFICULT TO GET IT COOL  
DUE TO LACK OF PROXIMITY SUPPORT  
RESOURCES IN THE RURAL SETTING

Todd McNeal,  
Fire Chief of Twain Harte  
Fire and Rescue in  
Tuolumne County, CA

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On June 18, 2017, approximately 1,700 firefighters and more than 300 apparatus were on scene fighting a wildfire in Coimbra, Portugal. Six firefighters were seriously injured, and the civilian death toll reached 62.<sup>1</sup> Wildland firefighting is not an easy, low-risk job, and it's certainly not for the faint of heart – quite literally.





ON THE JOB AND ENGAGE IN BEST PRACTICES TO PREVENT HEAT-RELATED INJURIES.

### Cardiovascular Concerns

Since 1990, firefighters as a profession average 19 deaths per year, which equates to a rate of 47.5 deaths per 100,000 workers. This is a startling comparison to the average U.S. worker rate of 3.2 deaths per 100,000.

In 2013, the death rate spiked up to 85 deaths per 100,000 workers, a number only exceeded by loggers.<sup>2</sup> Although only 20% of wildland firefighter deaths from 1990-2013 were fire-related, there's still a significant amount of risk involved in the profession and other health considerations to keep in mind.<sup>2</sup>

A recent study with data from the National Interagency Fire Center showed that the leading cause of wildland firefighter line-of-duty deaths from 1990-2014 was medical issues that were cardiac in nature.<sup>3</sup>

A National Wildfire Coordinating Group (NWCG) study also found that in the most recent period, wildland fatalities due to heart attack increased from 3.2 per year to 4.9 per year, which indicates a 51% rise.<sup>4</sup> Heart attacks also increased for all firefighters in the U.S. by 88%.<sup>4</sup> Many studies have proven a correlation between firefighting and cardiovascular strain, but a recent study set out to "isolate the independent effects

of heat stress and dehydration on the cardiovascular system."<sup>5</sup> The study examined firefighters in a controlled setting by simulating conditions on a treadmill and with the use of PPE. Results demonstrated substantial cardiac strain with HR of 150-160 bpm and "3% exacerbated thermal strain [that] further contributed to cardiac strain experienced with heat stress."<sup>5</sup>

Todd McNeal, fire chief of Twain Harte Fire and Rescue in Tuolumne County, CA points out that the demand on firefighters in wildland environments is so great because of the prolonged exposure. "[Firefighters] are doing it for 16-24 hours a day, and frequently for 14 days straight," says McNeal. He adds that another factor is carrying equipment on uneven terrain and often at higher altitudes than the firefighter is used to, putting more strain on the body.



## COOLING AN OVERHEATED FIREFIGHTER

ON SCENE OF A WILDLAND FIRE  
IS NOT USUALLY AN OPTION.

### Core Body Temperature

Maintaining core temperature under incredible stress helps reduce the demands on the firefighter and minimize risk. The Missoula Technology and Development Center (MTDC) partnered with the NWCG to conduct the Wildland Fire Heat Illness Study. They measured 150 firefighters during a regular fire season, categorizing all activity as either physical or non-physical. When expending energy during muscle contraction, the study showed that only 30% of energy used was in the contraction itself whereas 70% was related to releasing heat. Hiking uphill creates the biggest demand on the body, with results showing a core temperature as high as 102° F.<sup>6</sup>

One common concern associated with poor maintenance of core temperature is dehydration. This condition can greatly impact the firefighter's cognitive function and physical performance, which are imperative for the highly skilled tasks of firefighting.<sup>6</sup> Although firefighters are at risk for cardiovascular strain, inability to properly cool the body temperature exposes them to other medical risks, such as heat stroke.

Heat stroke occurs with rapid increase in body temperature, such as 106° F in as little as 10-15 minutes.<sup>7</sup> Firefighters must be properly hydrated on the job and engage in best practices for risk reduction.

Cooling an overheated firefighter on scene of a wildland fire is not usually an option. "Once the core temperature reaches a critical level ... it is very difficult to cool the firefighter due to lack of proximity of support and treatment resources in the rural setting," explains McNeal. He mentions that a lack of ice, A/C units, prolonged or limited opportunity for extraction are all factors that make wildland firefighting more challenging and demand a greater need for proper hydration to avoid escalation of these risks.

But hydration is not enough to prevent heat-related injuries.<sup>6</sup> Preparation before the incident, management during, and rehabilitation after are all critical. Proper rehabilitation plays a key role in ensuring the firefighter's safety and health. The goal of firefighter rehabilitation post-incident is to allow for rest, rehydration, nourishment, and medical evaluation.<sup>8</sup> Low-level heat stress can lead to impaired cognitive function,



as discussed earlier, or reduced physical coordination that results in injury. Rehabilitation will keep the firefighter's condition from further deteriorating to a point of concern while also improving overall performance.

### **More Wildfires**

Some experts predict increases in wildfires due to global climate change. Subtle changes in temperature have increased both the prevalence and severity of wildfires, and now wildfire season is lasting longer.<sup>8</sup> The warming climate makes dry areas even drier, because warmer spring and summers create less snow-melt and drier soil with an increased probability for drought. Firefighters are also faced with wildfires that burn longer and cover a wider area. Already we've seen a steady rise in wildfires since the mid-1980s. Now wildfires occur "four times more often, burn more than six times the land area, and last almost five times as long." According to Forest Ecology and Management, some have estimated an increase in the traditional fire season from 7 months to year-round.<sup>9</sup> With a likely increase in demand for wildland firefighters working in even more challenging and potentially unsafe conditions, the preparation for this difficult job is paramount.

### **Outfitting the Job**

Keeping firefighters as cool as possible on the job and reducing the overall stress on the body is not only desirable, but also lifesaving. One of the ways to best prepare a firefighter to do their job safely is to invest in the right equipment that can help mitigate risk. The Frontline™ Bushwacker pack by True North is designed to do exactly that. These packs feature an Air-Pocket™ back panel that maximizes airflow to reduce heat stress. The packs are designed with a new H-style harness that assists with stability and load balancing. In addition to the pack's 3L HydroSpeed reservoir, side pockets on the pack are designed to hold an additional two 1L bottles, totaling access to 5L of water for the firefighter." There are six mesh organizers inside the pack that expand for additional storage and to assist firefighters in finding what they need, quickly.



**FRONTLINE™  
BUSHWACKER**

Firefighters should be focused on hydration and lowering their skin temperature to transfer heat from the body. The right equipment can make all the difference. The Frontline™ Defender pack series from True North is specifically designed to address red-zone heat stress. It minimizes heat stress with an open-back design that places the hydration reservoir at the waist so the back is free to perspire. The Defender features the same H-style harness as the Bushwhacker pack and a removable Next-Generation shelter case that can be belt-worn or rear-mounted. A built-in 3L hydration system will help keep firefighters cool and well hydrated when battling extreme conditions.



**FRONTLINE™  
DEFENDER**

“Our packs are designed to cover as little of the body as possible to prevent heat-trapping and allow maximum air circulation,” said Alyx Fier, founder and CEO of True North. “To prevent heat stress, air-flow is the way to go.”



**SPITFIRE™  
PACK/GEN 2**

True North also offers a mid-sized fire pack in the Spitfire™ Pack/Gen 2. This pack can carry extra gear with its large side pockets that are ideal for accessories or water. The Spitfire™ has two zippered pockets holding 1L each, totaling 5L water for the firefighter to ensure hydration. The Spitfire™ is Cal Fire approved and NFPA® 1977 certified. To keep firefighters as comfortable as possible, the pack has been redesigned for optimal ergonomic support with a new harness and MOLLE compatibility on the hip belt that conforms to the 1" MOLLE webbing standard. The Firefly™ Pack/Gen 2 is also compatible with the 1" MOLLE webbing standard and the ability to quickly remove



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of True North

the gear bag and keep just the essentials such as the 3L hydration, a 300 cu stash pocket, fuseses and a fire shelter.

### Conclusion

As wildland fires and cardiovascular-related firefighter deaths continue to increase, the fire community must be vigilant in planning for these events and equipping their crews with the best possible gear and training to keep them safe. Firefighters must be properly hydrated on the job and engage in best practices to prevent heat-related injuries.

But hydration is not enough to prevent heat-related injuries. Preparation before the incident, management during, and rehabilitation afterward are all critical.

“I believe that consistent training and recognition of changing conditions in the wildland fire environment, leads to faster tactical decisions and improved risk management. By avoiding hostile fire conditions, external heat exposure can be significantly reduced,” says McNeal.



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## About True North

This year marks the 25th anniversary of True North, a company known for providing innovative, high-quality products to fire departments around the world. The company founder, Alyx Fier, began the company in his garage in 1992 with a home sewing machine, and pizza boxes for pattern paper. Working nights and weekends, Alyx taught himself pack design and prototype sewing. Learning through trial and error, he successfully worked through the frustration and challenges of designing and sewing his first packs.

True North has grown from a one-person operation to an ISO 9001 registered company whose products are distributed worldwide. Now, 25 years later, True North's headquarters are just up the street from the garage where Alyx started the company. Instead of a home-sewing machine and pizza boxes the company now has a design room with CAD programs, plotters to print and cut pattern pieces and a room full of specialized sewing machines to turn out prototypes. What hasn't changed in the 25 years since Alyx founded the company is the passion to create innovative, highly functional designs and the willingness to work through the often-frustrating process of trial and error to get it right. The company has also held on to Alyx's vision of asking people what would make their job easier and creating innovative solutions, or reworking existing designs, to meet their needs. For more information, please visit [www.truenorthgear.com](http://www.truenorthgear.com).

