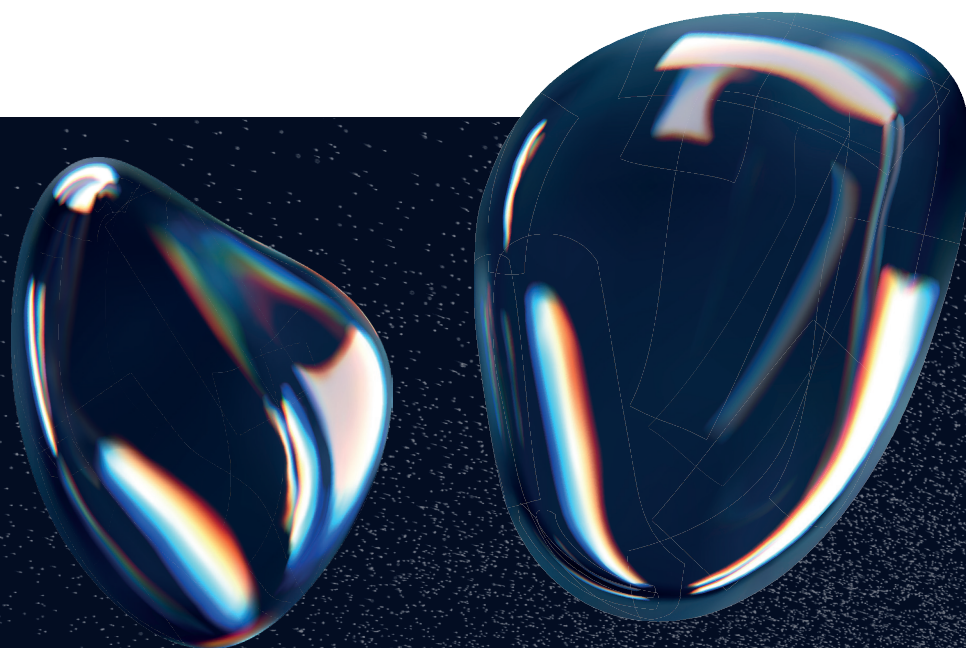


Max Lakkonen,
President of IWMA,
looks back at the
past three decades
of water mist systems



“Water mist’s eco-friendly attributes—**reduced water usage, no harmful additives**—make it more appealing as regulations tighten.”

Progress and potential

Water mist technology has been part of the fire protection landscape for over 30 years, evolving from an emerging innovation to a well-established solution. My own journey with water mist began in the early 2000s during my time in Finnish academia, where I came across its development as a by-product of research into water hydraulics.

At the time, Finnish and Danish companies were exploring water-based hydraulic systems as a safer and more sustainable alternative to oil-based solutions, which led to advancements in high-pressure water mist components.

Through my work with the International Water Mist Association (IWMA), industry collaborations, standardisation committees, and research

initiatives, I have gained broad experience with this technology. Its ability to suppress even complex fires using only water, without harmful additives, makes it both effective and environmentally responsible—qualities that are more important than ever.

This article will explore the advancements in water mist technology over the past 30 years, highlighting its progress and continued role in modern fire protection.

What are physical fundamentals of water mist technology?

Modern water mist firefighting systems are founded on several key principles that collectively enhance their efficiency and effectiveness in extinguishing fires. These principles include

the cooling effect, oxygen displacement, and radiant heat attenuation.

Cooling effect

One of the most significant advantages of water mist systems is their ability to maximise the cooling effect of water. Traditional sprinkler systems produce larger droplets, which are not as efficient in heat absorption or blocking radiant heat as the finer droplets produced by water mist systems.

The smaller droplets created by water mist systems dramatically increase the surface area of the water exposed to the fire, allowing the water to absorb heat more efficiently and rapidly. This rapid cooling effect helps to lower the overall temperature of the fire, slowing down the combustion process and aiding in extinguishing the flames more quickly. The

small droplets can also penetrate complex fire geometries and are suitable for flammable liquid or grease fires.

Oxygen Displacement

In addition to their cooling effect, water mist systems also leverage the principle of oxygen displacement to combat fires. When the fine droplets are introduced into the fire zone, they evaporate rapidly due to the heat, expanding the volume 1680 times and displacing oxygen. Oxygen is a critical component of the fire triangle, along with heat and fuel. By displacing oxygen, water mist systems effectively starve the fire of one of its essential elements. This dual-action approach makes water mist systems highly effective.

Blocking radiant heat

Radiant heat is a significant factor in the spread of fires, as it can preheat surrounding materials, making them more susceptible to ignition. Water mist systems provide effective protection from radiant heat through the blocking properties of the fine water droplets. When water mist droplets are dispersed into a fire, they create a mist curtain that absorbs and scatters the radiant heat energy. By blocking radiant heat, water mist systems help prevent the fire from spreading to adjacent areas and materials, thereby containing the fire.

What is modern water mist technology?

Modern water mist technology is a sophisticated evolution of the systems

developed three decades ago. While the fundamental principles have remained consistent, advancements have broadened the scope of applications, approvals, and validation processes. Over the years, water mist systems have undergone extensive validation through experimental fire tests, leading to standards and approvals.

The technology has expanded beyond its initial applications, now used in commercial and residential buildings, industrial facilities, marine, and transportation infrastructure. Many of the applications are traditionally protected with sprinkler or gaseous systems, further demonstrating the adaptability of mist technology.

Recent developments have addressed fire safety issues related to cross-laminated timber (CLT) structures, tunnel protection, lithium-ion battery applications, power generation, air hangars, data centres, and various industrial risks. Ongoing improvements in system design, nozzle technology, and control mechanisms have enhanced performance and efficiency.

Why modern water mist is gaining popularity?

The principles of water mist systems have been known for over 100 years, but their popularity has risen particularly over the past 20 years. Contributing factors include physical fundamentals, technical benefits and environmental considerations. ▶

Technical and environmental benefits

Water mist systems offer several technical benefits that increase their popularity in a wide range of applications.

Among these benefits is the relative ease and speed of installation, which is due to the smaller components, such as pipes and tanks, and the typically larger nozzle spacing.

Retrofitting these systems into existing buildings, including those with high architectural significance or heritage status, is also more straightforward because of the small size of the components.

In addition, water mist systems do not require compartmentation, unlike many gaseous systems, and can be activated immediately, limiting damage in sensitive areas. The distribution and penetration of mist is effective because the small droplets fill many nooks and crevices within seconds of activation, allowing it to control even concealed fires. The technology also efficiently cools the smoke layer, helping to clean out some of the smoke particles and improving visibility.

Water mist systems offer significant environmental benefits that contribute to their growing popularity. They use notably less water compared to traditional sprinkler systems, reducing water damage and downtime. They do not contribute to ozone depletion or global warming and they do not produce toxic by-products or require complex decommissioning

procedures, making cleanup and disposal simpler and safer for both humans and the environment.

What is the future of modern water mist technology?

In my opinion, the trend of growth and expansion within the water mist industry is set to continue. The commercial value of this sector is already substantial, and the technology is being increasingly applied across a wide range of applications. Several factors will play a crucial role in this ongoing development. One is the scope of

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applications: the industry has shown an ability to develop reliable solutions for emerging risks, such as energy storage systems, data centres, and the automotive sector, supported by the rise of performance-based design.

Environmental and sustainability considerations will also drive wider acceptance. As regulations tighten,

water mist's eco-friendly attributes—reduced water usage, no harmful additives—make it more appealing. Standardisation of water mist systems will continue, with new standards emerging for broader applications. This progress will help ensure system consistency and facilitate broader adoption, leading to deeper market penetration. As the technology becomes standard in various regions, costs are likely to decrease, making water mist more accessible.

Education and training will be key to closing the expertise gap. Expanding such programmes will promote more effective system implementation, and ongoing research will refine system performance for emerging fire risks. This includes new materials, testing novel applications, and further validating water mist's capabilities in controlling complex fire scenarios.

Conclusions

Over the past 30 years, water mist technology has evolved from an emerging concept into a well-established, commercially viable fire protection solution. Its influence extends beyond market success, driving innovation in fire suppression and challenging traditional approaches. Future growth in the water mist industry looks promising, with advancements in system design, expanding applications, and increased emphasis on sustainability.

As costs decrease and industry knowledge expands, water mist systems will be even better equipped to address longstanding and emerging fire risks. Continued progress will require technological innovation, regulatory backing, and collaboration within the fire safety community. Water mist has proven highly effective against emerging risks such as lithium-ion batteries and battery energy storage systems, requiring only limited water and no enclosures. Additionally, it is eco-friendly, utilising only water in its operation.

Having closely followed the development of water mist technology for over two decades, I have witnessed its transformation firsthand. With its deep roots in Europe, the industry has made remarkable progress. I look forward to seeing how the next 20 years will shape the future of water mist fire protection. ■

