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The history of modern water mist fire protection

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Association
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The effectiveness of water as a fire fighting agent has always been known. Applying water with fixed fire fighting installations started already in the 19th century when sprinklers were invented and the design of sprinklers has not changed a lot from the early days.

Conventional sprinklers remain the main technique for fixed fire fighting installations around the world. An alternative and innovative water based fire fighting solution has been developed extensively over the last almost 30 years. The development of the so called modern water mist fire fighting technology was driven by the drawbacks of conventional sprinklers and gaseous systems. Water mist fire fighting today has achieved a well established position in fire protection and it has become an accepted alternative solution for a large number of applications.

Water mist fire fighting is in point of fact quite an old idea which has been tested and developed in several contexts and locations around the world for many decades. The *International Water Mist Association* has started to assemble this historical evidence. This article presents the current status of this accumulated knowledge. Some parts of the history are already well known and documented. A good example of such is the high-pressure water mist development in Sweden during 1975-1990, which can be identified as the real start of modern water mist technology. But there probably have been many efforts and trials that are not publicly known. This article wants to start the discussion in order to finally collect the history of water mist fire

protection as one story. The main focus in this article is in high-pressure water mist since this has been the main stream of modern water mist fire fighting after the technology was commercialized.

Early days before 1950 – A possible alternative

The origin of modern water mist technology leads back to the use of small or fine droplet sprays. The first known efforts were done for manual fire fighting in the USA. For example the company F.E. Myers from Ashland Ohio, USA, was selling a back-bag system with a lance producing small water droplets to fight small forests fires already in 1880. This technology gained more reputation in the beginning of 1900s when the pumping equipment and new sealing materials were developed. Higher pressure levels made it possible to create higher fluxes of small droplet sprays. The first pioneers also recognized the extreme efficiency of small droplet sprays compared to conventional sprinkler systems. Already in the 1930s there were several companies offering systems that applied finely atomized water in form of mist or fog (*also the terminology fog and mist was already used*). For example, the company Lechler of Metzingen, Germany presented during this time the same key

Herzog water mist nozzle from 1986



benefits of water mist (*cooling effect, oxygen displacement and low water damages*) that are still used as the main arguments when promoting the water mist technology nowadays. The key innovation of Lechler was a multiple orifice nozzle called a water dust nozzle. There were some scientific and non-scientific activities with small droplet sprays with fixed installations in this era. For example, Factory Mutual's engineering division carried out a test series with small droplet nozzles fighting 19MW gasoline fires in the 1940s. The performance was noticed to be comparable with conventional sprinklers whereby the flow rates were much lower. Many fire brigades in Europe and the USA adopted water mist fire fighting as a manual fire fighting strategy. The fire fighting tactics with water mist were developed especially by the US Marine corps in the 1940s.

During the early days of water mist fire fighting the effectiveness of water in the form of mist was already well understood. Water mist fire fighting

these activities were not systematic but rather trials. The commercial interest was also still at a low level. The main research work was carried out by research institutes and scientists. Commercial companies had been more seldom involved. The main focus was still in conventional sprinkler systems but also other new technologies like powders and especially systems utilising gases.

However, there were some efforts taken for example by FM in the USA and A. Herterich in Germany. Also D.J. Rasbash started his research work with fine droplet sprays in this era.

There are some other names and research groups that have worked with water mist or fine water sprays in this time period but the documentation does not exist anymore or is not known to the author.

Time between years 1970-1990 – Early development of modern water mist technology

The development of water mist fire fighting changed a lot during this time period. The basic knowledge of small droplet sprays and their effect on fire had been generated and made public by the first pioneers many years ago. Meanwhile supporting technologies like hydraulic systems using high-pressure had become commonly known in other industries. The logic consequence was to increase the working pressures of water mist systems to provide more energy at the nozzles for the splitting up of the water and the acceleration of droplets.

The pressure levels of the applied systems were still well under the ones of today's systems mainly due to the lack of suitable components. The water mist technology was therefore mainly applied for manual fire fighting.

was seen as a possible alternative. However, commercially and technically water mist systems were not yet seen to be competitive for fixed installations. The idea of replacing conventional sprinklers with water mist systems was not really feasible during these times. The pressure levels of the applied systems were still well under the ones of today's systems mainly due to the lack of suitable components. The water mist technology was therefore mainly applied for manual fire fighting.

Time between years 1950-1970 – Random efforts

The development between the years 1950-1970 can be summarized in general as a time of random efforts, because there were independent research activities in both the US and Europe. However,

There were several separate research groups that were working with water mist fire fighting techniques simultaneously in different parts of the world. Probably some groups even did not know the efforts of others involved in the very same topic. The main stream was changing from lower pressures to higher ones. This meant that droplet sizes were decreasing. Names like Vincent, Beyler Pietrak&Patterson and Rasbash can be mentioned in connection with this research in fine water spray fire fighting. A probably less familiar name is Hans-Joachim Herzog from former GDR (*Deutsche Demokratische Republik*) who worked intensively with low- and medium pressure water mist since the beginning of the 1980s. His company's products were actually installed in a number of industrial and public buildings like e.g. the Leipzig

Bowling Center in the middle of the 1980s.

However, the development work with the strongest impact on modern water mist technology probably originated from Sweden. The development there was started by Krister Giselsson, a teacher of the Swedish Fire School. He developed jointly with his colleague Mats Rosander a new manual fire fighting tactic against indoor fires. This so called offensive fire fighting was based on applying small droplet sprays in short bursts to cool the combustion gases effectively without disturbing the thermal balance or creating large volumes of scalding steam. On the basis of their experiments for manual fire fighting Giselsson and Rosander started to develop a fixed water mist system in the beginning of the 1980s. They co-operated with the company Electrolux Euroclean, which was a high-pressure cleaning company. Electrolux Euroclean got the inspiration to develop high-pressure water mist fire fighting systems as a result of an accident in which their cleaning equipment was used to extinguish a deep fat fryer under fire. The key people in Electrolux Euroclean were Omar Vestli, Håkan Ungerth, Bengt Crener and Sten Hansen. Electrolux Euroclean did not have fire engineering knowledge so Giselsson was consulted by them. Giselsson got support by high-pressure equipment from Electrolux Euroclean in return. There were several fire



Electrolux Euroclean (HTC) automatic nozzle prototype from 1985 and deluge nozzle from 1983 tests (photo by Håkan Ungerth)

nozzles can be mentioned as an example. Further the widely known American research for aircraft protection.

The period from 1970 to 1990 can be summarized as a time of early development of modern water mist technology. All benefits of applying especially high-pressure water mist had been discovered and an early commercial system had already been marketed in Sweden. The technology was already very advanced in that time. Both deluge and heat activated nozzles (*water mist sprinklers*) were in their design principals very similar to

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tests and demonstrations organized by these two developer groups in Sweden during 1981 to 1983. Electrolux Euroclean carried out a series of tests in the Swedish research institute SP in order to prove and demonstrate the performance of the new technology since there were not references available. The pressures used ranged between 120 and 150bar and standard industrial nozzles were used. Electrolux Euroclean started to develop an own glass bulb activated (*sprinkler*) water mist nozzle in the middle of the 1980s. The company name was changed to HTC after the key people, working with fire fighting, bought the rights for water mist fire fighting from Electrolux Euroclean. HTC was focusing only on high-pressure water mist fire protection.

The impact of the coming change in environmental thinking was already noticed in the late 1980s when the Montreal Protocol was signed.

During the late 1980s also some other approaches with fine spray systems were made, but only very few with extremely fine atomized water. The extensive work of P.G Papavergos with small droplet sprays generated by dual fluid

the ones which can be seen in the market today. Mainly the size of the nozzles has decreased and the activation time of automatic nozzles has become shorter. Small droplets with different spray characteristics created from high pressure water (80-280bar) were used by the Swedish pioneers. The time was just not yet right for the breakthrough but first signs of change were seen.

Time between years 1990-2008 – Breakthrough of modern water mist technology

The year 1990 is very important for the history of modern water mist technology. As many times before the change was finally triggered by a catastrophe.

A serious fire broke out on the passenger ferry “Scandinavian Star” in the early morning of April 7th in 1990. The result of this incident was that 40% (157 people) of the passengers did not survive the disaster. This was the final alarm for the marine industry and authorities who understood the problems related to common fire safety strategies. The amount of water needed and heavy

pipng made it almost unfeasible to use "classic" sprinklers to protect ferries. This was the time for the pioneers to present their solution. The key event probably was the fire demonstrations in Bålsta, Sweden on the 20.6.1990. The demonstrations were carried out by a new company Ultrafog founded by Krister Giselsson, Sven Brutsner and Stephan Forsström. The focus of this company was to market a high-pressure water mist fire fighting technology to the marine sector. Cabin fires with and without the use of a high-pressure water mist system were shown and a number of people from shipping companies, insurance companies, fire & rescue services and some other companies from the marine industry witnessed the demonstrations. For example the Finnish company Marioff KY, in these days a high-pressure piping company was among the invited parties in the Bålsta demonstrations. Only half a year later Marioff started their own development of high-pressure water mist fire fighting products. Marioff became the first commercial success story with water mist fire fighting supported by their knowledge in hydraulics and high-pressure piping.

The application areas for water mist have rapidly increased ever since. Such in the food industry were among the first land based applications. Soon the technology was adopted by the IT-industry and heritage buildings. Environmental and safety aspects have continuously gained importance which consequently has limited the use of various gaseous fire extinguishing agents. This again continues to be a main driver for the further development of modern water mist technology.

The foundation of the *International Water Mist Association* (www.IWMA.net) in 1998 is another important milestone in the history of the modern water mist technology. The purpose of the IWMA is to bring together all parties having an interest in water mist fire fighting. Today manufacturers, major research institutes, leading approval bodies, installation companies and engineering offices are part of the IWMA. They jointly promote the technology, at the same time giving advice on good practices to make its use safe and efficient.

The increased interest in water mist is well reflected in the development of IWMA; there were only 5 corporate members in 1998, nowadays

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The years after the Bålsta fire demonstrations were a time when several other companies were noticed as being involved in work with high-pressure water mist. The Swedish pioneers continued, but also at least Danish, Norwegian, German, English and Japanese companies were either developing and, or marketing high pressure water mist systems. The first large marine installations for accommodation areas were realised in 1992 (*M/S Danica, M/S Festival and M/S Karneval*).


The success story of modern water mist technology in the marine market was supported by IMO, *International Maritime Organization*, which accepted water mist systems as an alternative for conventional sprinklers. Several IMO resolutions during 1994 and 1995 accelerated the use of water mist in the marine industry. The requirement to replace Halon systems was gaining momentum during the same time period, what brought the water mist technology into machinery spaces and similar applications also on shore.

However, the wider use of modern water mist technology has taken a much longer time for the land based market than for the marine sector. An important starting point was a first standard created by NFPA. The standardization work started in the year 1993 and a first *NFPA750 Standard for Water Mist Fire Protection systems* was published in 1996. Nowadays there are also other standards and official guidelines for water mist available like FM5560, CEN TS14972, APSAD D2 and UPTUN 251.

there are more than 50 of such all around the world. The annual IWMA conference is a well known meeting point for the water mist industry.

Over the recent 20 years the market for modern water mist systems has steadily grown. According to market estimations by IWMA the Marine sector has started to stabilize, although some new application areas have lately been explored. Presently the major part of growth is coming from the land based market and a number of new applications. Water mist presents still only a small part of the fire protection industry compared to the market for sprinklers and gaseous fire fighting systems. However, since the fire demonstrations in Bålsta, Sweden in June 1990 modern water mist has continuously made its way in becoming a well accepted technology for the protection of risks previously unprotected as well as an alternative to traditional techniques. The many advantages of the modern water mist technology are the basis to the continuation of this success story.

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The author of this article is working on more comprehensive publication about the history of water mist fire fighting and asks your help to collect further information. Wanted are respective literature, tests reports, early components, brochures, videos, photos or just your verbal information. If you are able to support this work, please contact the author by phone +49-221962230 or by email history@IWMA.net