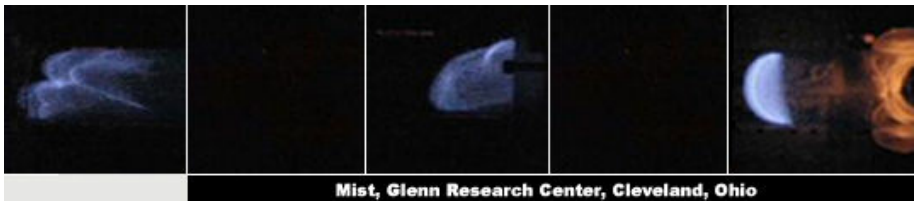

Water Mist Fire-Suppression Experiment

Water mist fire-suppression systems have become an important area of study since bromine-based chemical fire suppression agents, such as halons, were banned by international agreement in 1995.

Fine water mist—which is referred to on this web site as simply "mist"—has many advantages, including:

- Low toxicity
- Low cost
- Proven fire-suppression capabilities


Mist Experiment Mounting Structure (EMS).

As a replacement for halons, mist systems can be used most effectively in computer rooms, aircraft, ships, and historic buildings. Although much is known about mist systems, more research is needed to fully understand the exact methods by which water mist extinguishes a flame. This will lead to more effective and efficient water mist fire suppression equipment that will save lives and property on Earth and in space.

Who We Are and What We Are Doing


Mist EMS installed in Combustion Module-2.

The Center for the Commercial Applications of Combustion in Space (CCACS) at the Colorado School of Mines, in conjunction with NASA Glenn, is investigating the properties of mist fire suppression in microgravity. These experiments consist of varying water droplet sizes and water mist concentrations applied to flame fronts of different propane/air mixtures. Observations from these tests will provide valuable information on the change of flame speed in the presence of water mist. Scientists will be able to use this data to refine computerized models of the mist fire-suppression process.

Microgravity provides ideal conditions in which to study the water mist/flame front interaction because:

- Gravity causes mist droplets to sink.
- Gravity alters the size of mist droplets.
- Gravity-induced convection distorts the flame front.

The CCACS has constructed and tested an experiment apparatus that contains the necessary components for generating both a fine water mist and propane/air combustion. The tests were conducted in the CCACS one-second drop tower and in NASA's KC-135 aircraft.

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The Mist experiment is scheduled to fly aboard the space shuttle's STS-107 mission in 2002.

A Brief History of Water Mist

Water mist fire-suppression systems have been around for about a century. The first models were steam-flooding systems used for the protection of lumber drying kilns. Later, water mist systems were developed for use on ships.

In the late 1960s, the chemical fire suppressants Halon 1301 and 1211 were developed. These largely replaced water mist systems because they were much more effective at putting out fires. Recently, however, it has become clear that Halons are not environmentally safe. In 1995 the international community agreed to ban the use of Halons, which prompted scientists to begin searching for an alternative. Ironically, water mist has become a leading candidate.

Much of the current water mist research is in response to the problem of fire suppression aboard ships and spacecraft. For example, the International Maritime Organization requires sprinkler systems on ships. But, the heavy weight of water makes water-based systems impractical. Water mist is a viable alternative because it and its delivery system are much lighter than water-based systems.

It is hoped that the current research will lead to much more effective water mist fire-suppression systems than have ever existed before, and that water mist will prove to be one of the primary solutions to the fire safety problems encountered aboard ships and spacecraft.

Spacecraft Fire Safety Initiative

Fire Protection In Space

Since the very beginning of the manned space flight program, NASA engineers and scientists have gone to great lengths to prevent fires from occurring on spacecraft. They have done this by adapting fire safety systems and procedures developed on Earth to the unique conditions and operating environment of spacecraft. However, microgravity combustion experiments have shown that fire can behave very differently in space and the best methods to prevent, detect, and extinguish fires on a spacecraft may be very different than those used on Earth.

In 2000, NASA's Bioastronautics Initiative began with the objective of ensuring and enhancing the health, safety, and performance of humans in space. As part of this effort, the Microgravity Combustion Science Branch at NASA Glenn Research Center is responsible for developing and implementing a research plan to significantly improve fire safety on spacecraft and in space habitats. This goal will be achieved by applying the significant amount of fundamental knowledge and experimental capability of microgravity research to spacecraft fire safety questions.

Research Priorities

There are three major research areas being addressed in the Spacecraft Fire Safety Initiative. These are:

1. Fire prevention and material flammability
2. Fire signatures and detection
3. Fire suppression

Microgravity Science Division
NASA Glenn Research Center