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# **Briefing to Congress on Aqueous Film Forming Foam (AFFF) Replacements and Alternatives**

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Environment)**

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The estimated cost of this report or study for the Department of Defense is approximately \$3.650. This includes \$1,750 in expenses and \$1,900 in DoD labor. Cost estimate generated on December 14, 2021 RefID: F-E963A41



## Purpose

- **Official response to Public Law 116-283, Section 331, William (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021:**  
“SEC. 331. SURVEY OF TECHNOLOGIES FOR DEPARTMENT OF DEFENSE APPLICATION IN PHASING OUT THE USE OF FLUORINATED AQUEOUS FILM-FORMING FOAM.  
  
(a) SURVEY OF TECHNOLOGIES.—The Secretary of Defense shall conduct a survey of relevant technologies, other than fire-fighting agent solutions, to determine whether any such technologies are available and can be adapted for use by the Department of Defense to facilitate the phase-out of fluorinated aqueous film-forming foam. The technologies surveyed under this subsection shall include hangar flooring systems, fire-fighting agent delivery systems, containment systems, and other relevant technologies the Secretary determines appropriate.  
  
(b) BRIEFING.—Not later than 1 year after the date of enactment of this Act, the Secretary shall provide the congressional defense committees a briefing on the results of the survey conducted under subsection (a). The briefing shall include—  
  
(1) a description of the technologies included in the survey;  
(2) a list of the technologies that were considered for further testing or analysis; and  
(3) any technologies that are undergoing additional analysis for possible application within the Department.”



## Overview

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- **FY 2020 NDAA Sec 322**
- **Summary of Non-Foam Alternatives Considered**
- **Detailed Descriptions and Assessments**



## FY 2020 NDAA Section 322

“(a) (1) MILITARY SPECIFICATION.—Not later than January 31, 2023, the Secretary of the Navy shall publish a military specification for a fluorine-free fire-fighting agent for use at all military installations”

**New MILSPEC**  
by Jan 31, 2023

“(b) LIMITATION.—No amount authorized to be appropriated or otherwise made available for the Department of Defense may be obligated or expended after October 1, 2023, to procure fire-fighting foam that contains in excess of 1 part per billion of perfluoroalkyl substances and polyfluoroalkyl substances.”

Cannot purchase  
**foam with >1ppb PFAS**  
after Oct 1, 2023

“(c) PROHIBITION ON USE.— Fluorinated aqueous film-forming foam may not be used at any military installation on or after the earlier of the following dates:

Cannot use  
**PFAS AFFF**

after Oct 1, 2024\*

(1) October 1, 2024.

*\*SECDEF may grant two  
1-year extensions = 2026*

(2) The date on which the Secretary determines that compliance

with the prohibition under this subsection is possible.”



# Non-Foam Alternatives to AFFF

Option	Cost	Pros	Cons
Ignitable liquid drainage floor (Safespill™)	\$\$\$\$	<ul style="list-style-type: none"> <li>• Most effective fire containment &amp; suppression</li> <li>• No chemicals involved so avoids environmental and health concerns</li> <li>• Fire code compliant</li> </ul>	<ul style="list-style-type: none"> <li>• Expensive</li> <li>• Longer to install</li> <li>• Single supplier that must scale up to meet DoD demand</li> <li>• New product with unproven long-term performance</li> </ul>
High expansion foam (Hi-Ex)	\$\$\$\$	<ul style="list-style-type: none"> <li>• PFAS Free</li> <li>• Well-understood and trusted</li> <li>• Fire code compliant</li> </ul>	<ul style="list-style-type: none"> <li>• Very expensive</li> <li>• Some structures unable to bear heavy foam generators</li> <li>• Longer extinguishment time leads to more damage</li> </ul>
Trench Nozzles	\$\$\$\$	<ul style="list-style-type: none"> <li>• Very effective containment and suppression</li> <li>• Fire code compliant</li> </ul>	<ul style="list-style-type: none"> <li>• Expensive retrofit option</li> </ul>
Water-only sprinklers	\$	<ul style="list-style-type: none"> <li>• Inexpensive</li> <li>• Water-only avoids environmental concerns</li> </ul>	<ul style="list-style-type: none"> <li>• Not effective against fuel fires</li> <li>• Does not meet DoD fire code for hangars with fueled aircraft</li> </ul>
Optical Flame Detection only	\$	<ul style="list-style-type: none"> <li>• Inexpensive</li> <li>• No chemicals involved so avoids environmental concerns</li> <li>• Little to no maintenance</li> </ul>	<ul style="list-style-type: none"> <li>• Will not suppress a fire</li> <li>• Detectors alone are not compliant with DoD fire code</li> </ul>
Water mist	\$\$\$	<ul style="list-style-type: none"> <li>• Excellent heat removal</li> <li>• Water-only avoids environmental concerns</li> </ul>	<ul style="list-style-type: none"> <li>• Still under development</li> <li>• Moderate cost to retrofit existing sprinkler systems</li> <li>• Not yet compliant with DoD fire code for hangars with fueled aircraft</li> </ul>



# Ignitable Liquid Drainage Floor

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## Description

- Ignitable liquid drainage is a perforated aluminum floor placed on a hangar floor.
- Holes draw the fuel into drainage channels as soon as it spills, effectively containing and quenching a fire before it can grow.

## Assessment

- Very effective at containing fuel fires
- No environmental or health concerns (uses only water)
- Easy to maintain
- High installation cost and longer retrofit times
- Only a few small manufacturers - concerns about scalability to meet potential DoD demand
- Currently awaiting feedback from aircraft maintainers participating in test applications



# High-Expansion Foam

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## Description

- High-Expansion (Hi-Ex) Foam systems fill up a space with foam, effectively starving the fire of oxygen to extinguish it.

## Assessment

- Hi-Ex Foam is well-understood in DoD, having been installed in hangars for years
- Mechanism (smothering) is effective against many types of fires
- Foam does not contain PFAS
- Time needed to fill a space with foam and smother the fire gives the fire time to grow and cause more damage
- Foam generators are heavy, making them inappropriate for some hangars
- System is susceptible to accidental activation, which can cause damage to sensitive electronic equipment in aircraft
- Very high installation and maintenance costs



# Trench Nozzles

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## Description

- A trench nozzle system is designed to contain a fuel fire within a grid of trenches cut in the floor, then suppress it with fire nozzles in the trenches.

## Assessment

- Very good at containing and suppressing fuel fires
- Navy has a lot of experience with this type of system
- Very high retrofit/installation costs





# Water-Only Sprinklers

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## Description

- Existing AFFF sprinkler systems can be converted to water-only by turning off the foam delivery parts of the system.

## Assessment

- Not effective at suppressing fuel fires
- No environmental or health concerns (uses only water)
- Less expensive option – however, some systems may have to be modified or replaced when switching to water-only, negating the cost savings
- Does not meet current DoD fire code requirements for fire suppression in hangars with fueled aircraft since the code requires protection against fuel fires



# Optical Flame Detectors Only

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## Description

- Optical flame detectors are faster at detecting fire than smoke or heat detectors. They simply detect fire and transmit the information to an alarm system

## Assessment

- Based on historical mishap data, the likelihood of a fuel fire in a hangar is very low
- Detection system would alert firefighters to respond and allow time for occupants to evacuate the building
- Does not meet current DoD fire code requirements for hangars with fueled aircraft since it does not provide fire suppression (but could be combined with other options)



# Water Mist Sprinklers

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## Description

- Water mist sprinkler systems atomize water to deliver a large number of tiny water droplets, improving the cooling effect of water

## Assessment

- System is still undergoing development and testing
- No environmental or health concerns (uses only water)
- This technology is not currently compliant with DoD fire codes for hangers with fueled aircraft since it only controls a fuel fire rather than extinguishing it



## Conclusion

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- There are many viable alternatives for replacing AFFF
- No single technology is suitable for every situation
- The Department continues to evaluate all available technologies to find the best fit for each mission need and level of risk