

Cargo MPS Task Group

Issues and Potential Updates

Presented to: International Aircraft Systems Fire Protection Forum Meeting

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Date: May 14, 2019



**Federal Aviation
Administration**

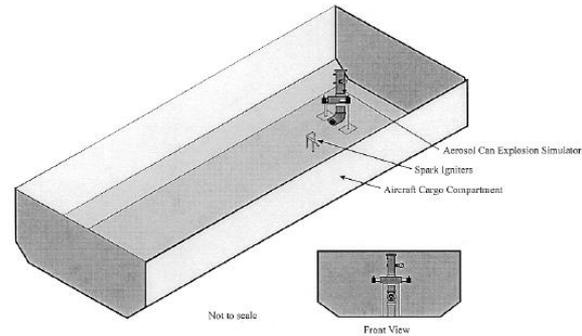
Background

- DOT/FAA/TC-TN12/11 is the latest version of the Aircraft Cargo Compartment Halon Replacement Fire Suppression Systems
- <https://www.fire.tc.faa.gov/pdf/TC-TN12-11.pdf>
- Range of issues with the current MPS document.
 - Test procedures
 - Test criteria
 - Minor typos

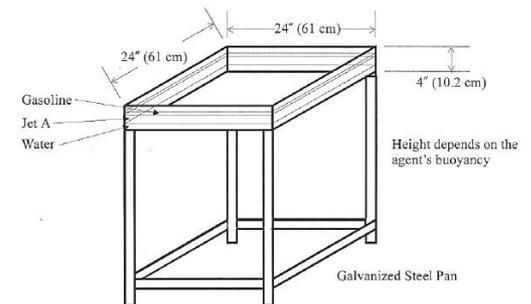


Main Talking Points

- **Aerosol Can Explosion Simulation Scenario**



- **Surface Burning Fire Scenario**



Aerosol Can Simulator Scenario

- Criteria for the Aerosol Can Simulator is stricter than what was tested in the MPS development tests with Halon 1301.
- “The criterion for the aerosol can explosion simulation scenario is that there is no evidence of an explosion or reaction. **Evidence of an explosion or reaction includes deflagrations, flashes, and overpressures, etc.** There shall be no overpressures (zero pressure rise). In addition, when the agent concentration is below its inert concentration, the explosion intensity and peak pressures shall not be greater than the values exhibited during an explosive event when no suppression agent is present in the compartment.” – §Acceptance Criteria, 2012 MPS Document
- “There was no ignition of the contents of the simulator in four of the five tests. There was a **very brief ignition** of some of the contents during one test (test 28), but no overpressure was recorded.” - §4.8, 2000 MPS Development Report
- Issue arose as we were testing a potential Halon replacement agent and observed a brief flash during the testing.



Boeing Sponsored Agent



Summary

- As per the current MPS, this test would be considered a failure.
 - Flash / Deflagaration was observed.
 - No overpressure was observed.



Halon 1301

- Can Halon 1301 pass the MPS test method as currently written?
- Tested the Aerosol Can simulator Scenario using the MPS Development Scenario.
 - Discharged Halon 1301 into the cargo compartment.
 - Activated aerosol can simulator when the point conc. near the ignitor reaches 3% in the compartment.
 - Activated aerosol can simulator when the bulk average conc. reaches 3% in the compartment.



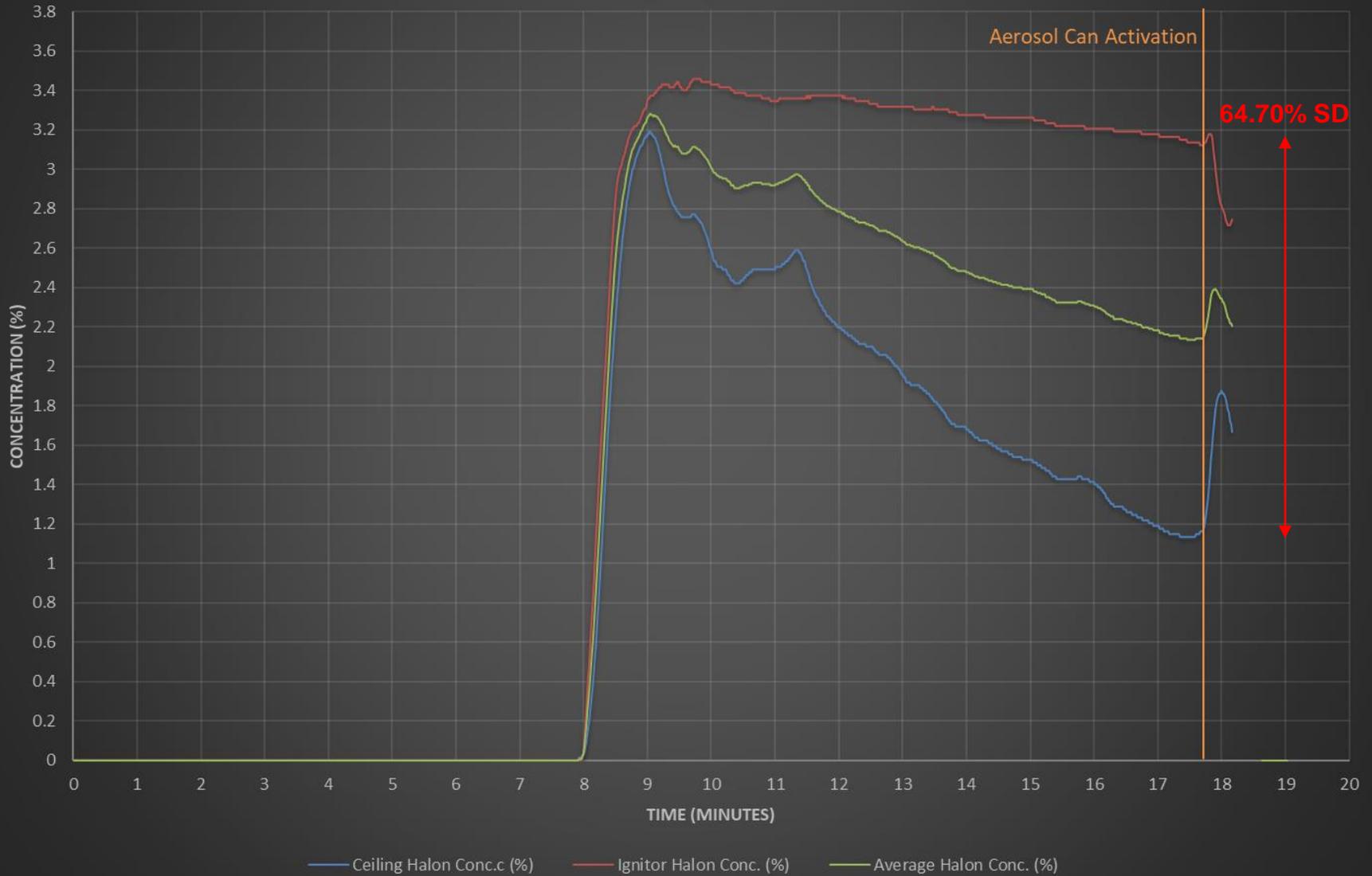
Halon 1301- Test 4

Overpressure of 0.045 psi



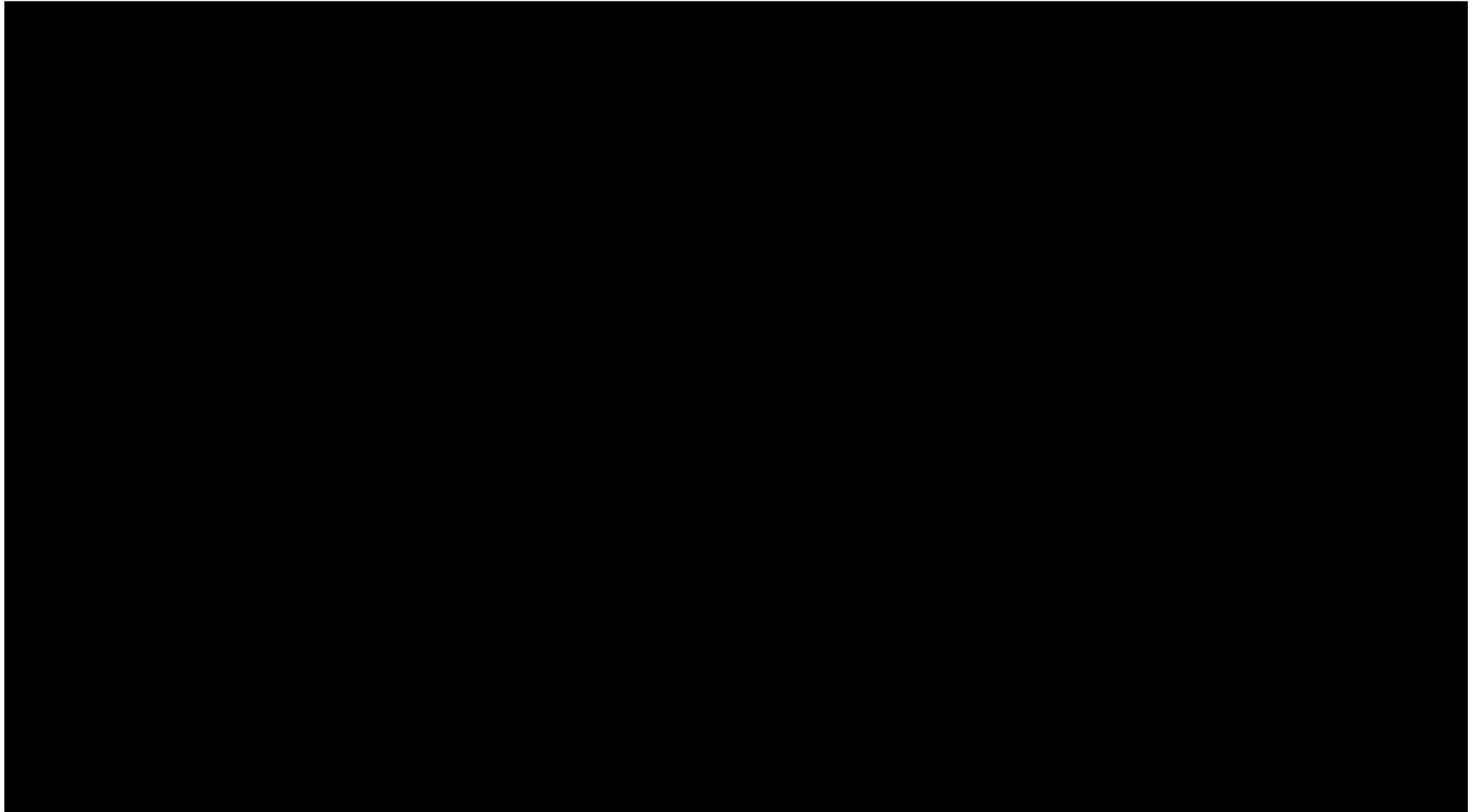
MPS Aerosol Can Simulator

Halon 1301 - Test 4 - Using Point Conc. @ Ignitor



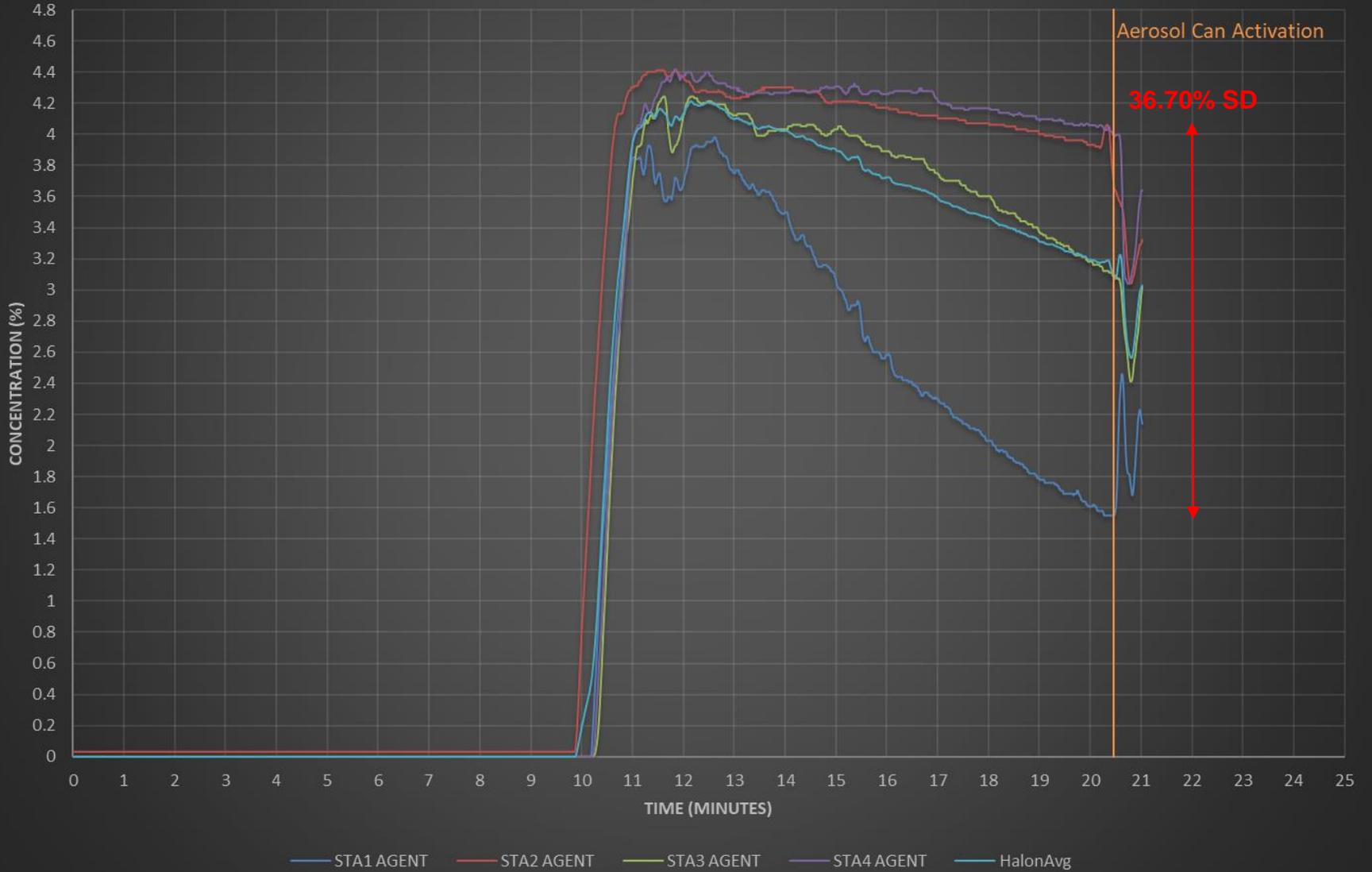
Federal Aviation Administration

Halon 1301 – Test 9



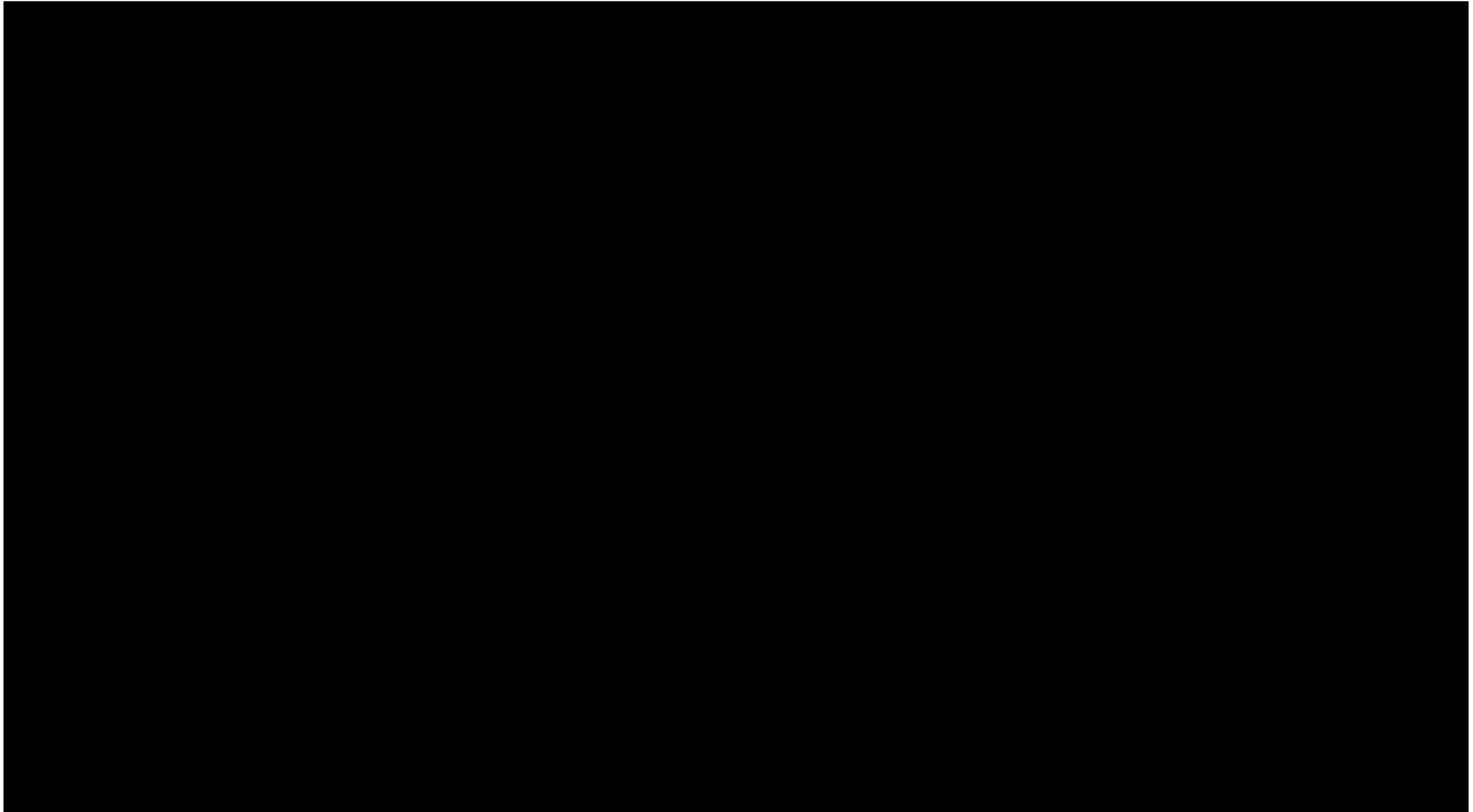
Aerosol Can Explosion Simulator

Halon 1301 - Test 9



Halon 1301 – Test 10

Overpressure of 0.095 psi



Halon 1301 – Test 10

- Overpressure of 0.095 psi was recorded in an empty compartment.
- This equates to 0.495 psi if the cargo compartment was 80% full.
- Blowout panels in cargo compartments fail in the range of 0.5psi – 1psi.



Issue with Test Criteria

- According to the MPS, the aerosol can is activated when the minimum inerting concentration (3%) is reached at the height of the ignitor.
- This creates an unintended behavior of a very low concentration of Halon near the ceiling.
 - Including stratification of the agent throughout the compartment.



Proposal for Alternate Test Method

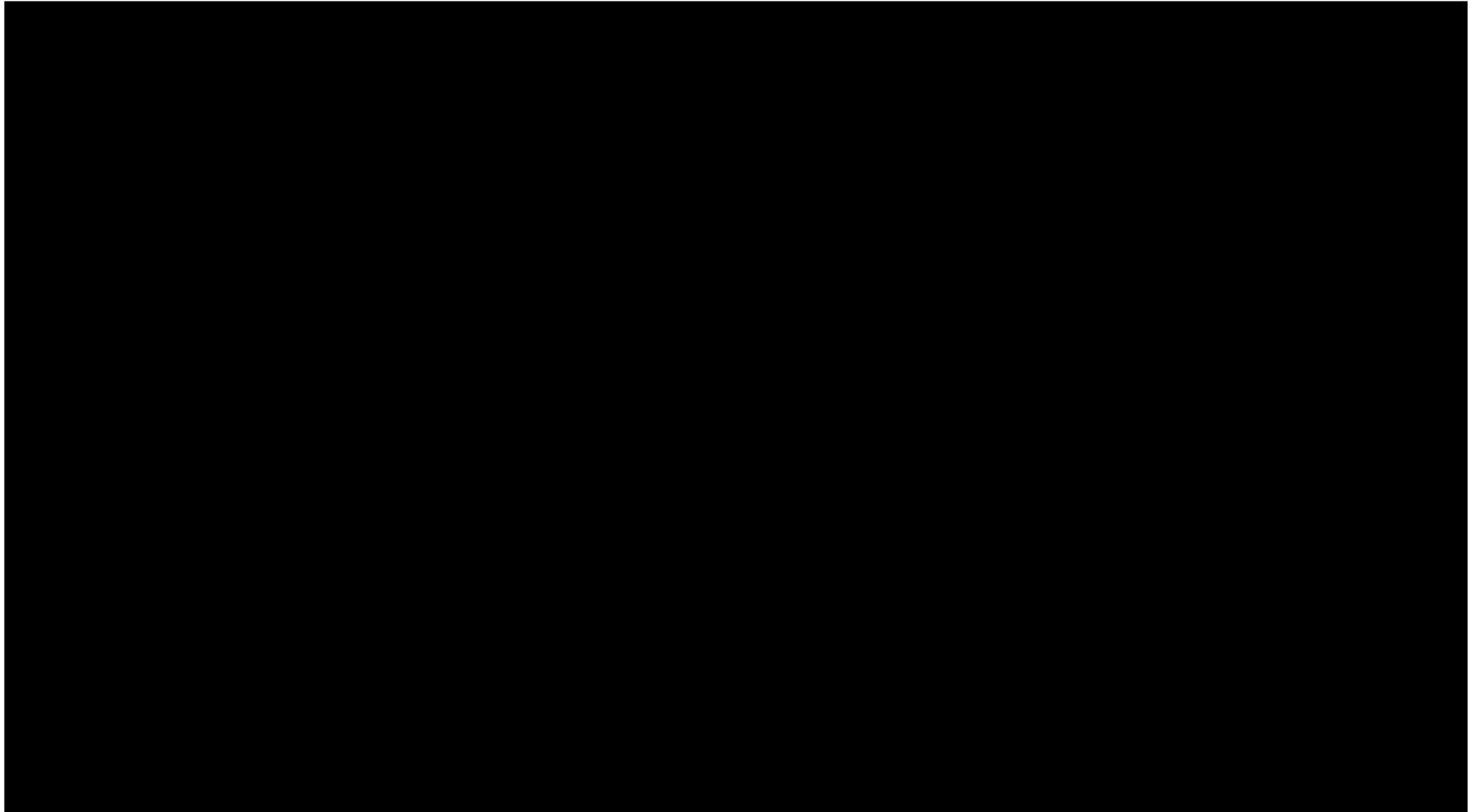
- Use mixing fans in the compartment to ensure there is not a stratification effect of the agent.
- Increase the height of the setup so that the simulator is activated with a higher concentration of agent at the ceiling.



Mixing Fans Setup

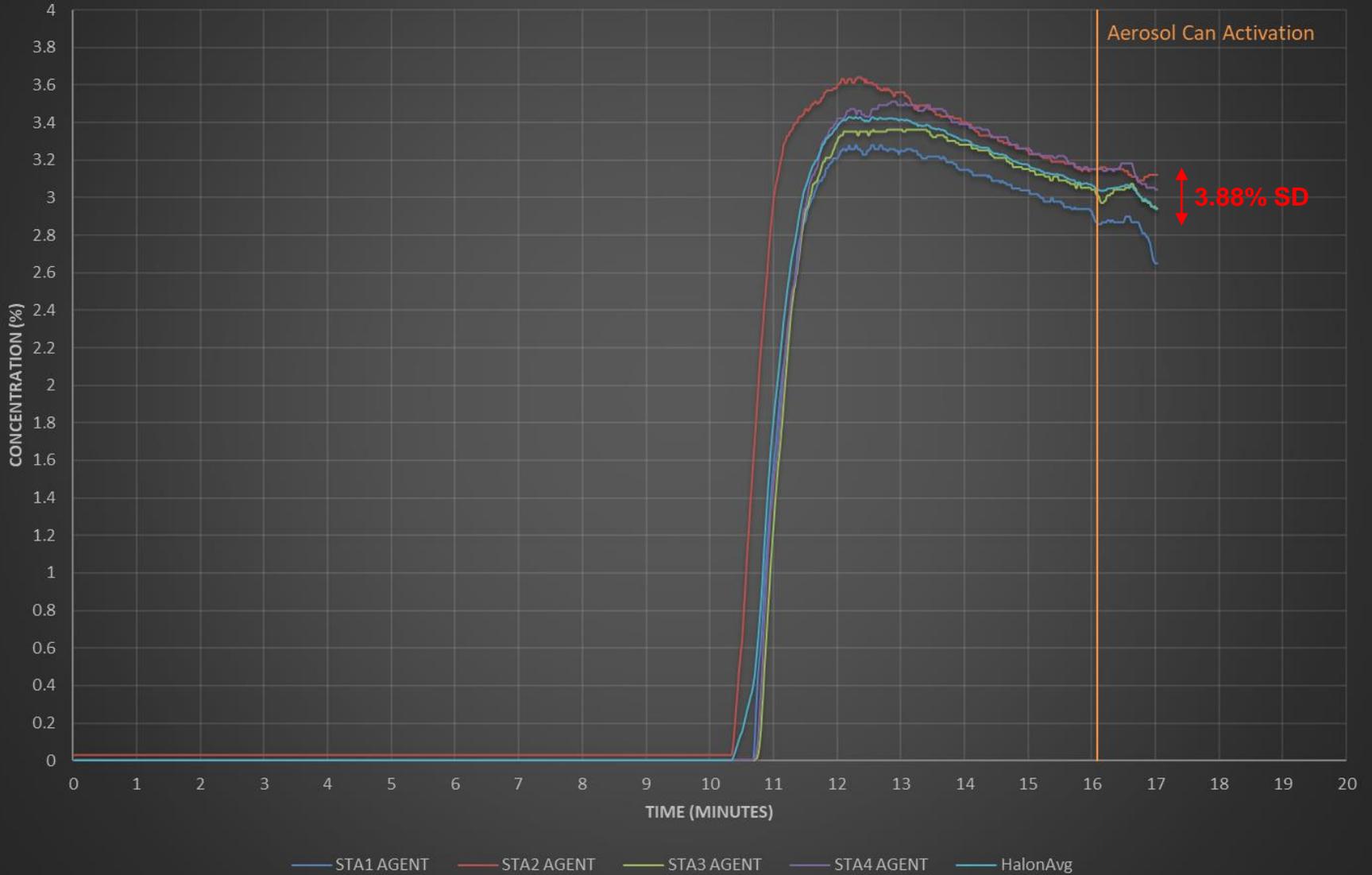


Mixing Fans Test Video – Test 14



MPS Aerosol Can Simulator

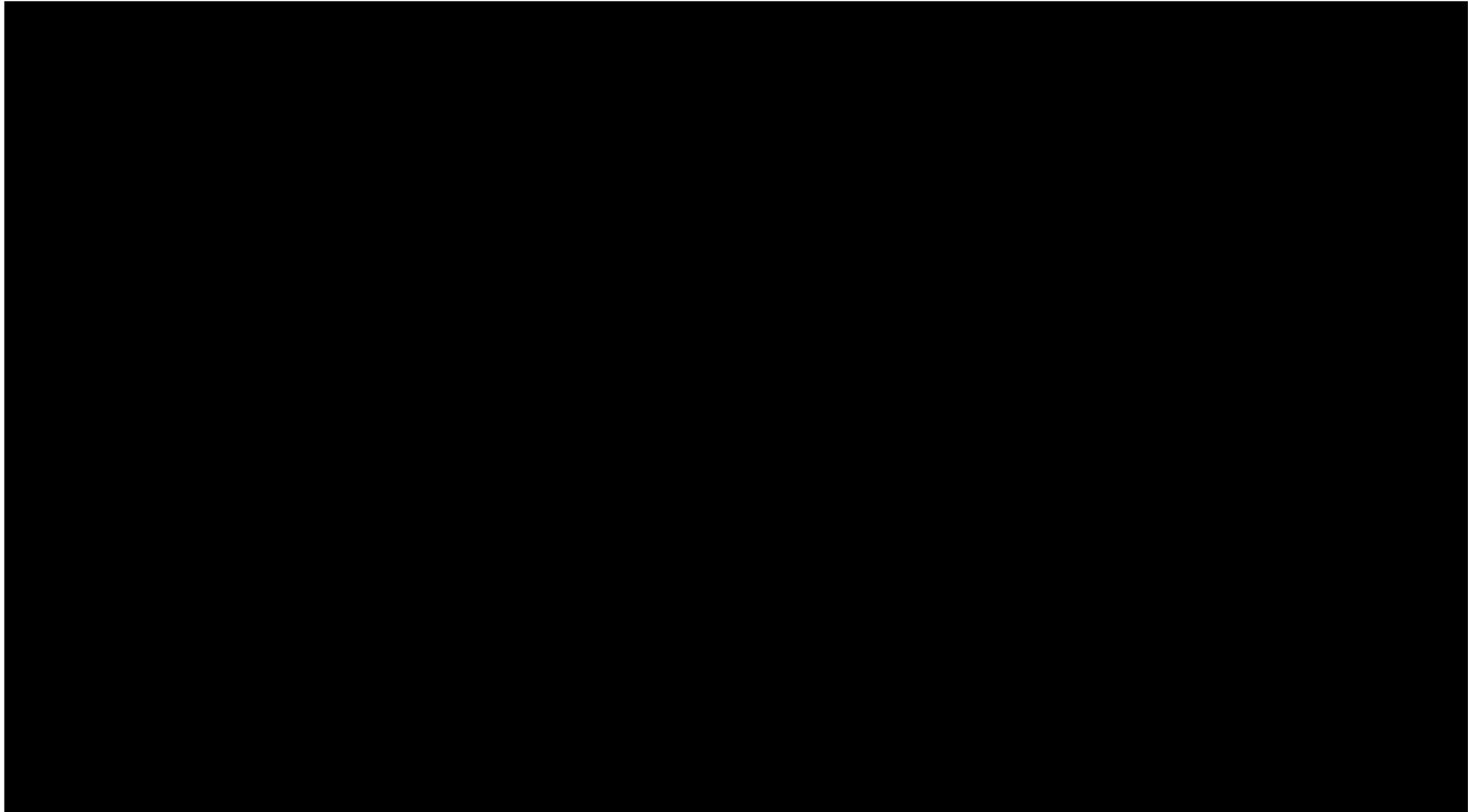
Halon 1301 - Test 14 - Mixing Fans



Increase Setup Height

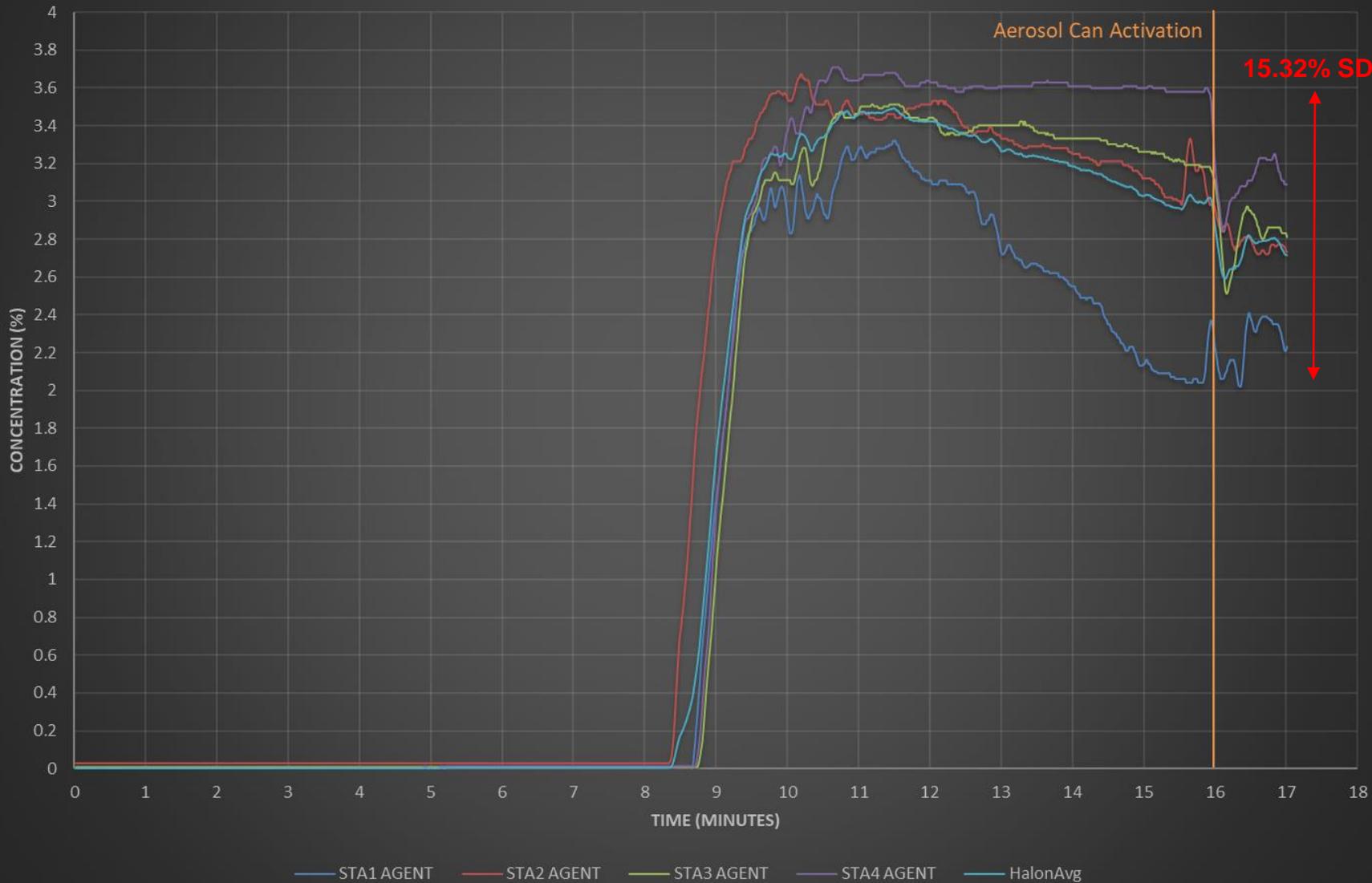


Increase Setup Height



MPS Aerosol Can Simulator

Halon 1301 - Test 15 - Increase Setup Height



Summary

- Issues with the current test methodology will be addressed in the Cargo MPS Task Group.
- Outcomes could lead to:
 - Changes in acceptance criteria
 - Changes in the test methodology.

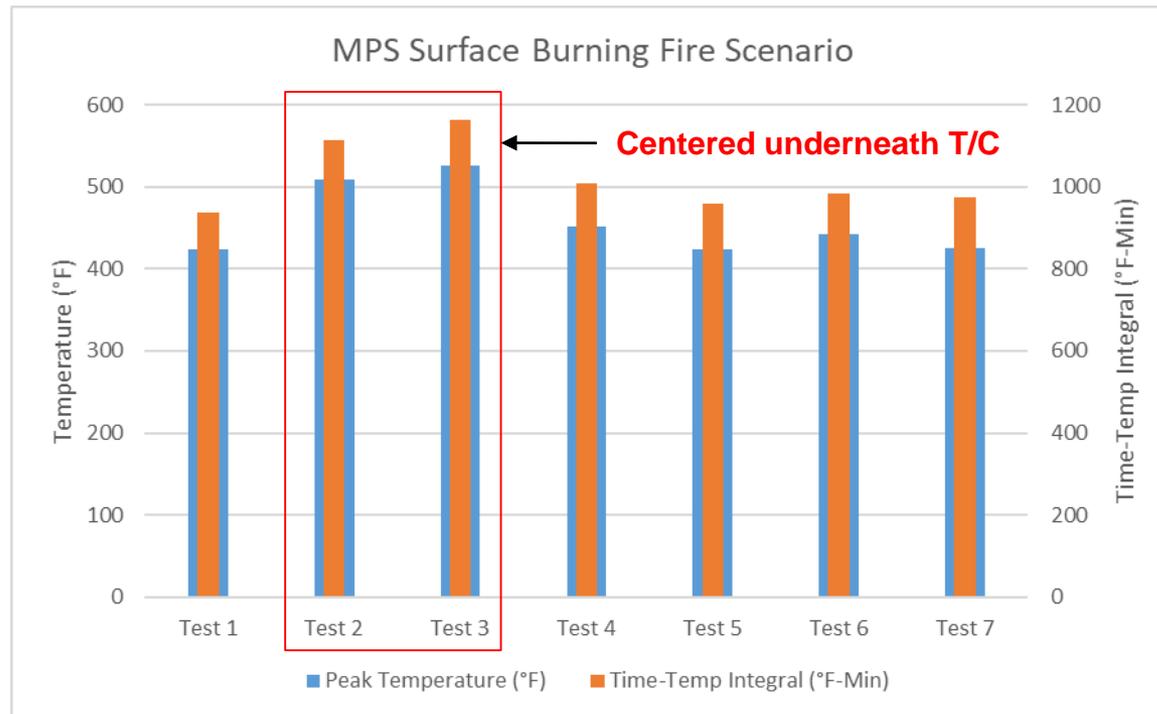


Surface Burning Fire Test Method

- Positioning of the pan can affect the peak temperatures and time-temperature integrals.
- “The pan should be positioned in the cargo compartment in the most difficult location for the particular suppression system being tested.” §Fire Scenario – 2012 MPS Update
- MPS development testing doesn’t specify the location of thermocouple in reference to the pan
- Results from Boeing Sponsored Agent shows an increase when the pan is placed directly underneath
 - 19% increase in average peak temperatures
 - 17% increase in average peak time-temperature integrals.



Surface Burning Fire Scenario Chart



Summary

- There is an observed effect on the peak temperatures by changing the location of the pan in the compartment.
- Compare data with other facilities to observe similar phenomenon, if available.



Other Issues

- Conflicting measurements of the size of the simulator pressure vessel.
- Opening timing of simulator.
- Standard Deviation miscalculation for the peak temperature criteria.
- Leak rate calculation for test compartment.
- Calculation methods / Interpretation of the acceptance criteria.
- Challenge Fire Scenario.



Cargo MPS Task Group

Date: May 16, 2019

Time: 9:00 AM

Room:



Questions

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