# Xtralis – Advanced Detection by Honeywell Inc.
# Smoke & Gas Detection Solution
# University of Maryland / FAA Performance Testing
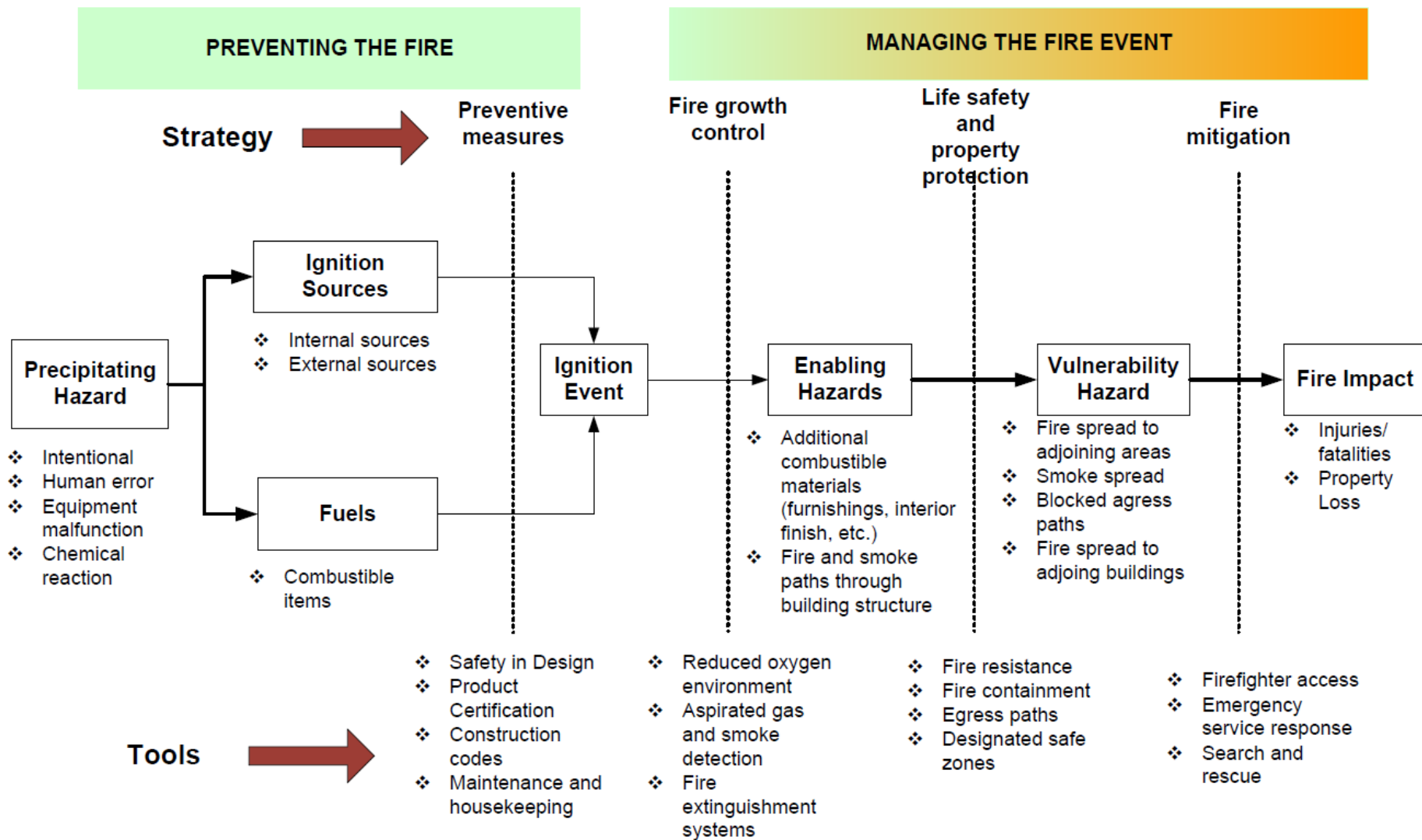
Phase III − July 2019
FAA William J. Hughes Technical Center, Atlantic City - NJ

Research Grant Number :16-G-014

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# Mitigating the Fire Risks

**NFPA 550**

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# Fire Detection Monitoring Issues:

- **ULD**
  - Prevent undeclared hazardous material from entering
  - shipping system (SE 125)
  - Develop or improve containment systems (SE 126)
  - New standards for the construction of standardized cargo containers (SE 127)
  - Detection (maintain responsiveness, reduce nuisance alarm susceptibility)

- **Hidden Areas**
  - Not normally exposed or seen from inside of aircraft
  - Contents include insulation, wire bundles, electronics, batteries, ducts, and piping
  - Currently no detection or monitoring for hidden areas
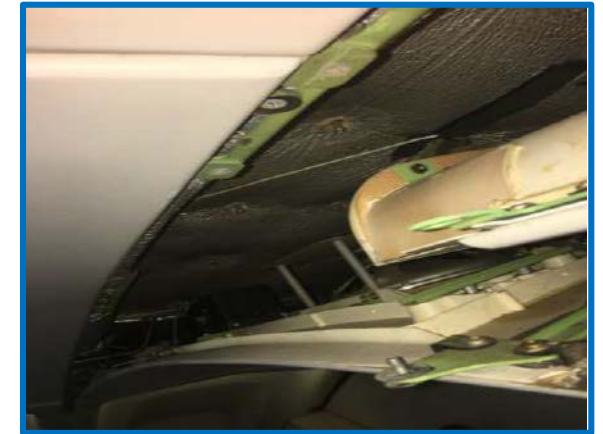


**91.5% of cargo compartments reported incidents are nuisance alarms or likely nuisance alarms**

# VESDA-E VEA

## Industry First Addressable ASD with Assured Detection and Centralized Maintenance

- **Reliable VESDA detection with end to end system integrity monitoring**

- **Flexible microbore tubes** with push fit sampling points allows simple and fast installation

- **Unique centralized test and maintenance** saves significant time and money

- **Active sampling** continuously draws air for earliest detection smoke and gas and intervention preventing loss of life and assets

- **Full supervision** of microbore tubes 6mm/4mm and sampling points ensures total system availability and no missed alarms

- **Self cleaning** sampling points prevent contamination and blockages and minimises false alarms
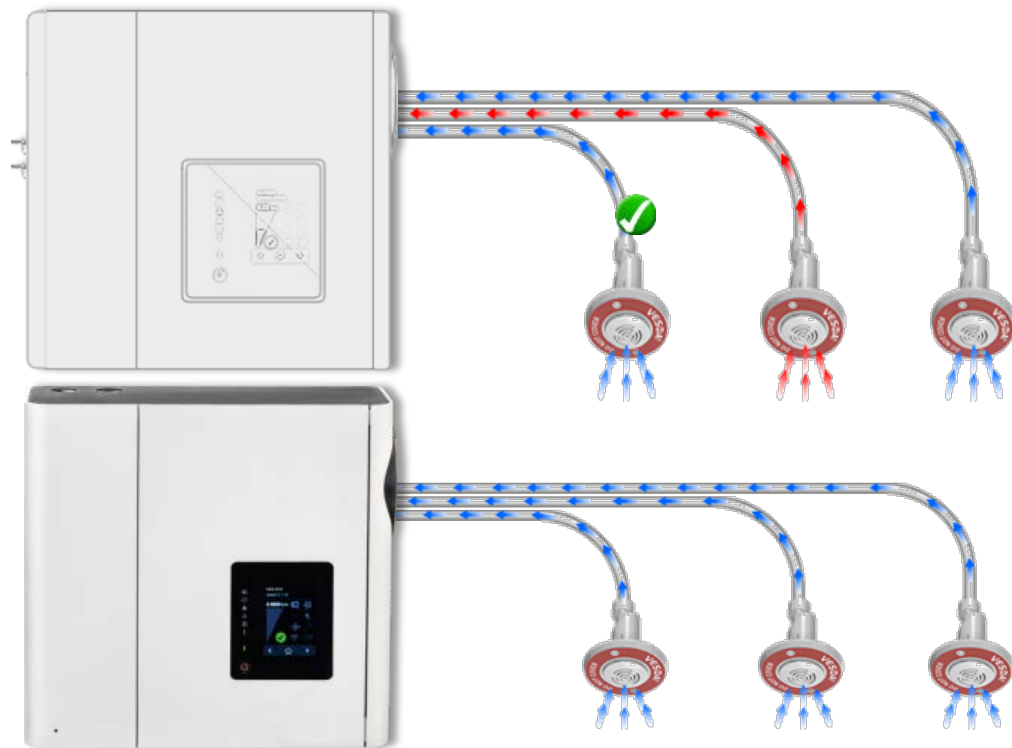
Supervised

Unsupervised

Self Clean

Contaminated

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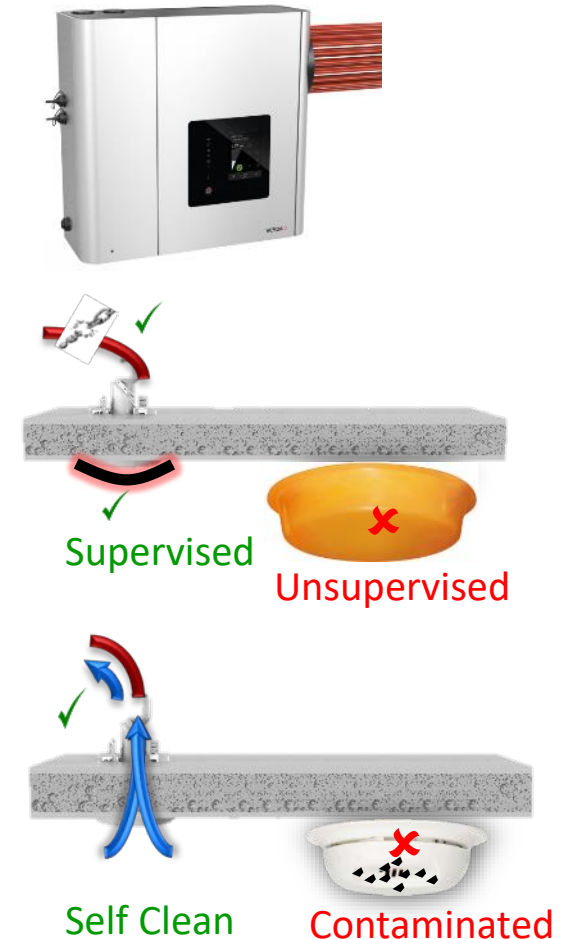
# VEA Sampling Port – Placement and Coverage

## NFPA 72 – Ch. 17 Initiating Devices

**17.7.3.6 Air Sampling–Type Smoke Detector**

**17.7.3.6.1** Each sampling port of an air sampling–type smoke detector shall be treated as a spot-type detector for the purpose of location and spacing.



**17.7.3.2.3.1\*** In the absence of specific performance-based design criteria, one of the following requirements shall apply:

1. The distance between smoke detectors shall not exceed a nominal spacing of 30 ft (9.1 m) and there shall be detectors within a distance of one-half the nominal spacing, measured at right angles from all walls or partitions Extending upward to within the top 15 percent of the ceiling height.
2. *All points on the ceiling shall have a detector within a distance equal to or less than 0.7 times the nominal 30ft (9.1 m) spacing (0.7$S$).

VESDA Design Notes:
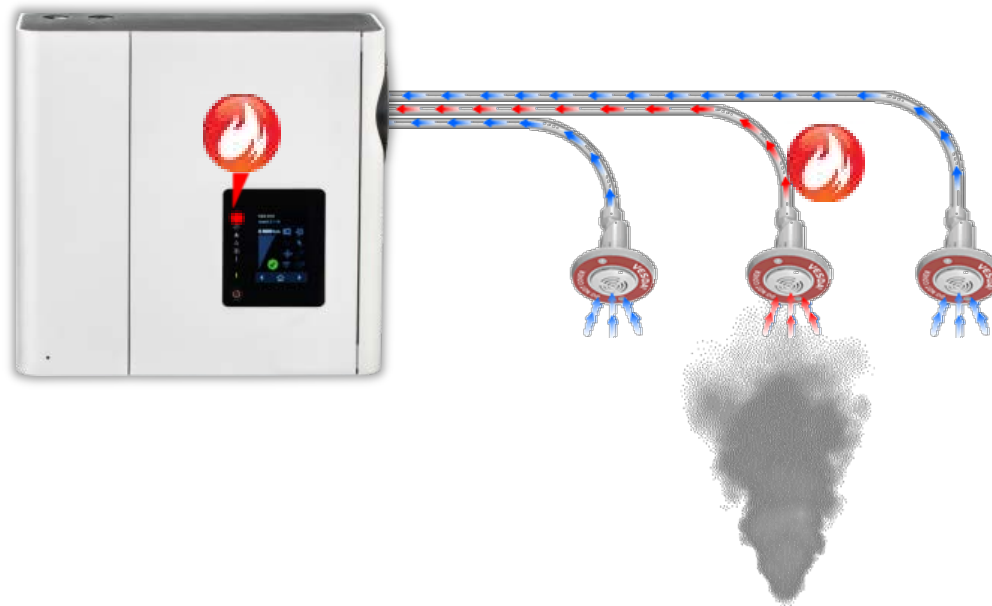The maximum area covered by a sample point is 82.81 m² (891 sq.ft)
The sample hole will not be more than 4.55 m from walls (14.56 ft)
The maximum space between sampling holes is 9.1 meters (29.12 ft)
A sample point shall not be more than 6.4 meters (20.4 ft) from any point in the room

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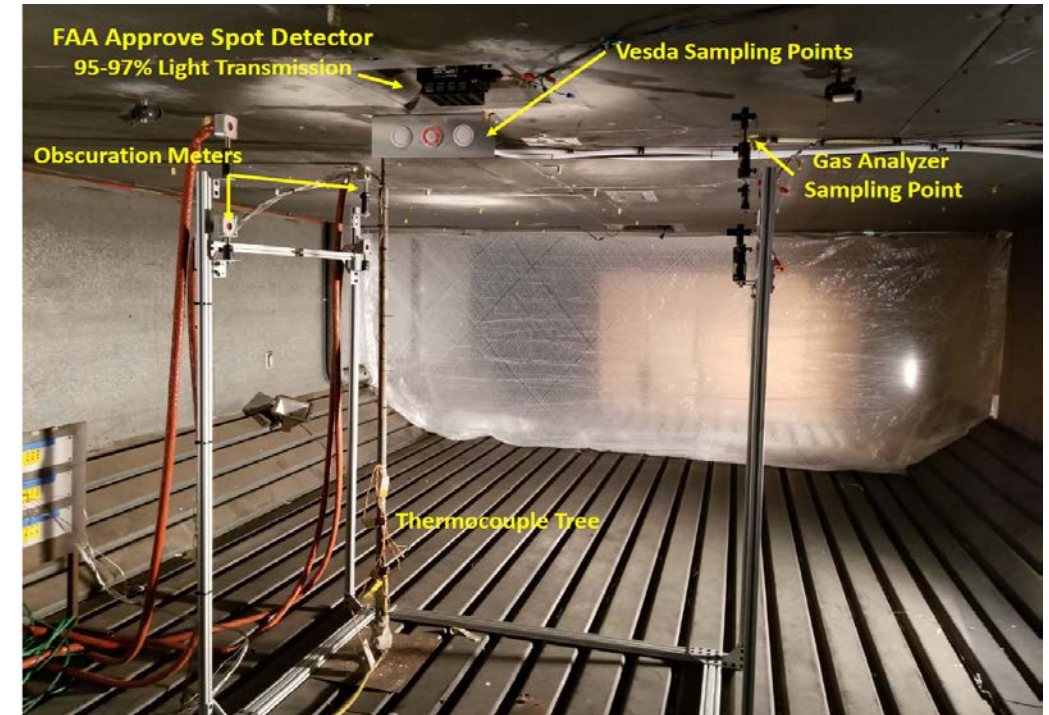
# VEA – Operation (Smoke Event)

- Upon detection of smoke it raises a global alarm, upon reaching Fire 1 Threshold it then scans each tube in pairs.

- This Scanning function identifies the smoke source by tube with the highest level of Obsc.

- Commissioning stage, smoke test each sampling point, using walk test to make it easier.

# FAA/U of M Test Layout



DC-10 Below Floor Center Cargo Compartment

172"
552"
64"
138'
138"
Perforated ventilation duct extracts air at 87 CFM.
240"
138"
29"  29"
50"
66"
133"

■ Ceiling Thermocouple
● Ceiling Smokemeter

Volume ≅ 3500 ft³



FAA Approve Spot Detector
95-97% Light Transmission
Vesda Sampling Points
Obscuration Meters
Gas Analyzer Sampling Point
Thermocouple Tree

**VESDA Sensepoint XCL – General Installation Practices**



<100m (328 ft)

- Connects to 6mm (1/4") OD VEA tubes via flexible tubes (supplied)
- Connects anywhere on the VEA tube (up to 100m from sample point)
- VEA pump delivers the gas to the gas sensor
- Suited to operate for the range of VEA tube flowrates and pressures
- Operates under any orientation and flow direction
- MUST not be installed on the VEA exhaust

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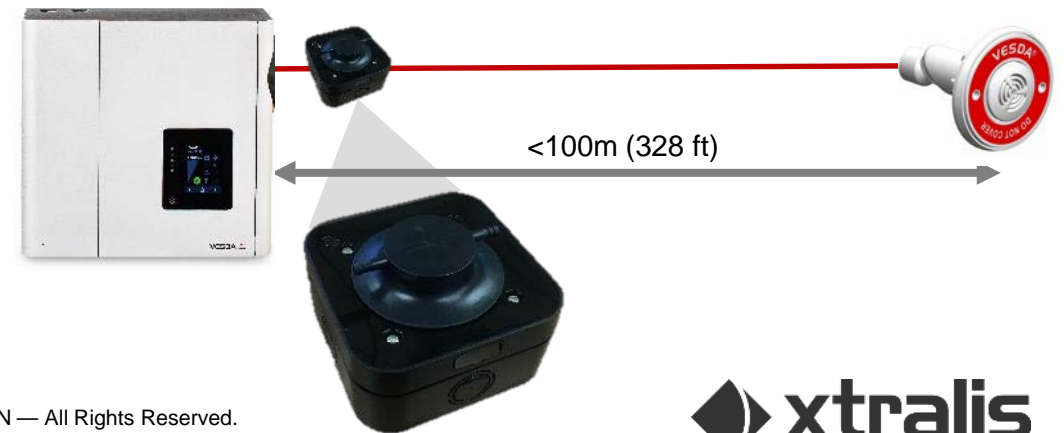
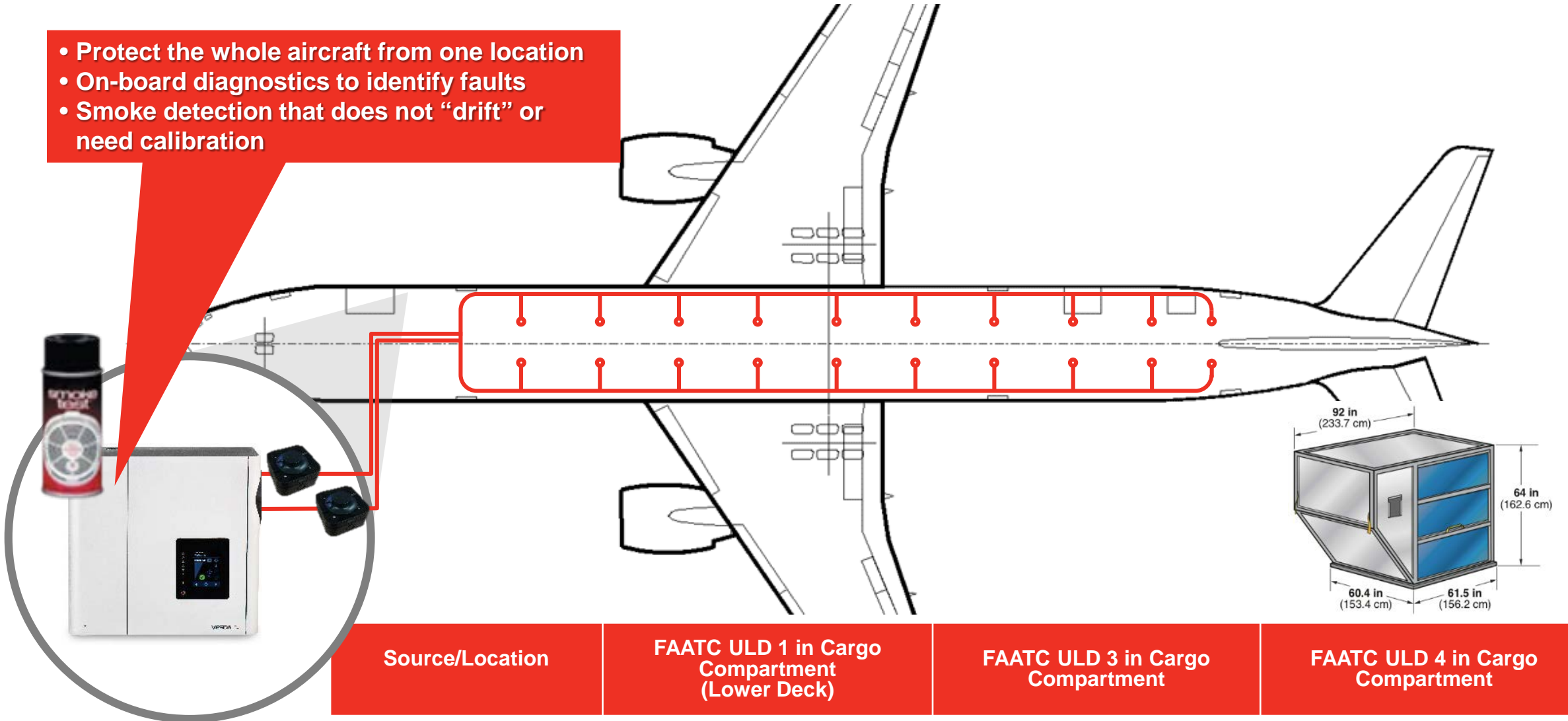# Smoke & Gas Detection Solution for UoM/FAA Performance Testing
## Phase IV coming up Nov 2019 at FAA William J. Hughes Technical Center, Atlantic City, NJ



92 in (233.7 cm)
64 in (162.6 cm)
60.4 in (153.4 cm)
61.5 in (156.2 cm)

| Source/Location | FAATC ULD 1 in Cargo Compartment (Lower Deck) | FAATC ULD 3 in Cargo Compartment | FAATC ULD 4 in Cargo Compartment |
|---|---|---|---|

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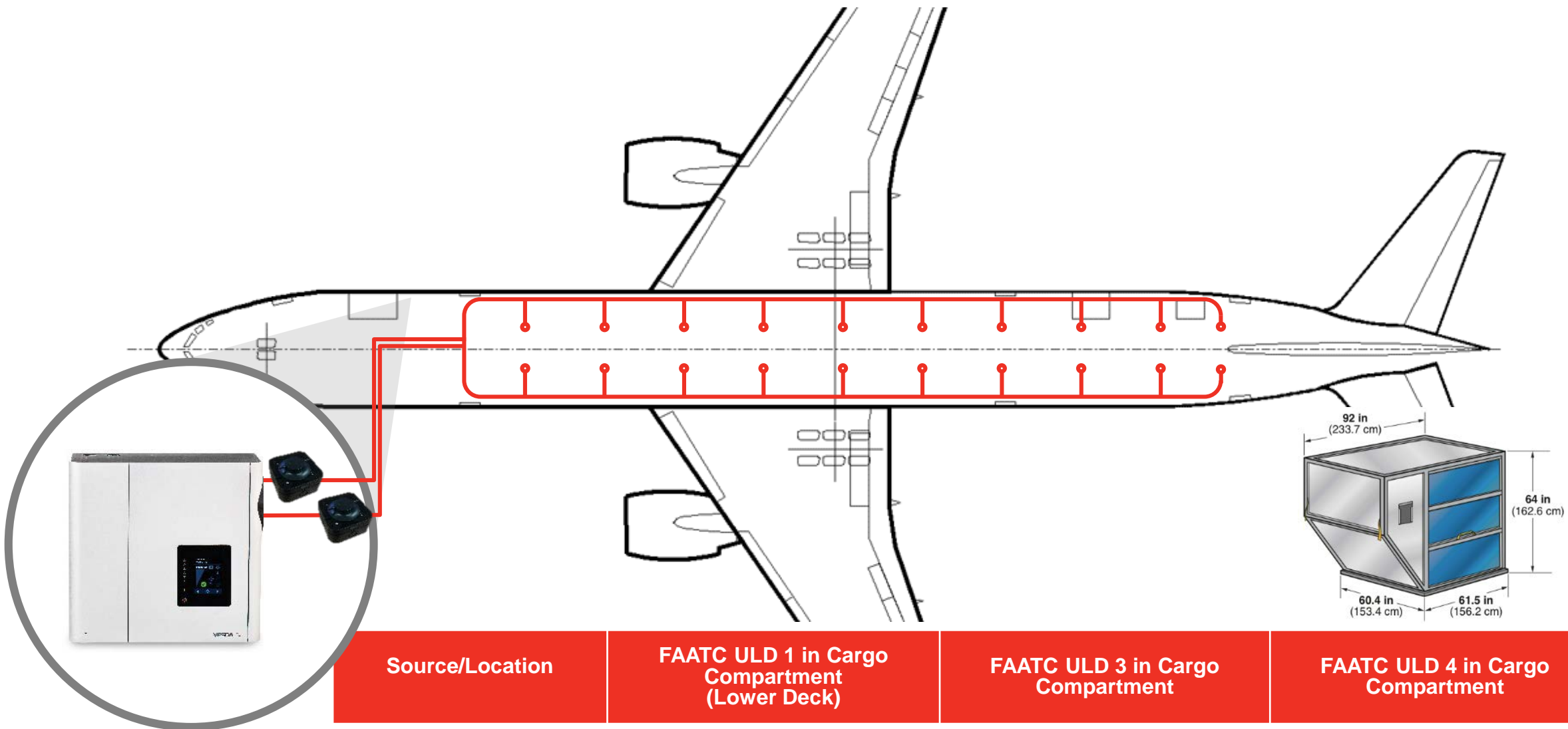
# Centralized Testing & Maintenance

- **Protect the whole aircraft from one location**
- **On-board diagnostics to identify faults**
- **Smoke detection that does not "drift" or need calibration**

92 in (233.7 cm)

64 in (162.6 cm)

60.4 in (153.4 cm)

61.5 in (156.2 cm)

| Source/Location | FAATC ULD 1 in Cargo Compartment (Lower Deck) | FAATC ULD 3 in Cargo Compartment | FAATC ULD 4 in Cargo Compartment |
| --- | --- | --- | --- |

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# VESDA VEA – Centralized Test and Maintenance

## All automated tests can be selectively done manually after servicing

- 👍 Centralized manual testing for blockage, breakage or self cleaning
- 👍 Centralized smoke testing at detector
- 👍 No need to test at remote locations
- 👍 One man operation
- 👍 No special tools required
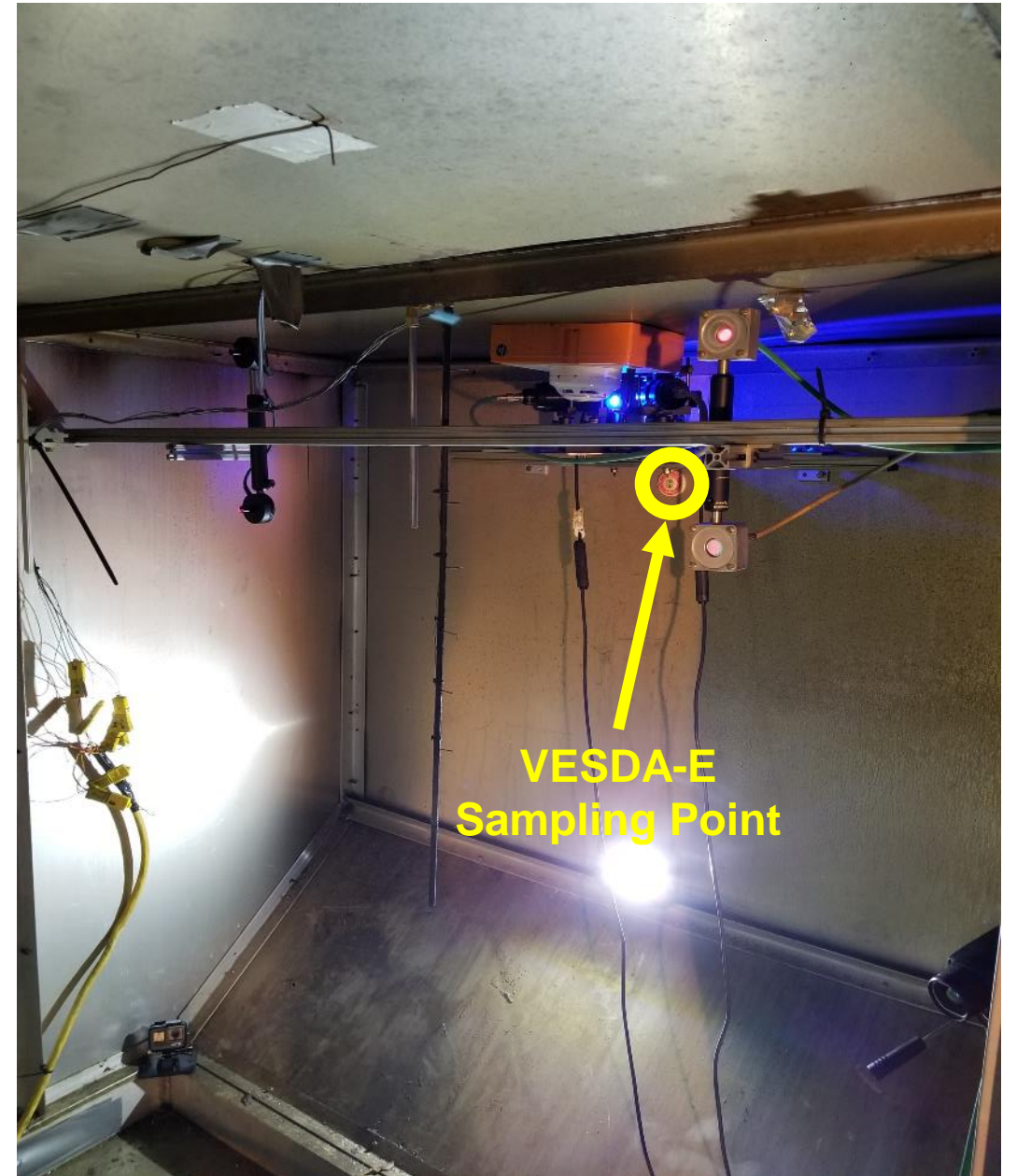- 👍 Secure

**VEA Microbore Tubes**

Plenum rated flexible microbore tubes provide fast and easy installation

**VEA Sampling Points**
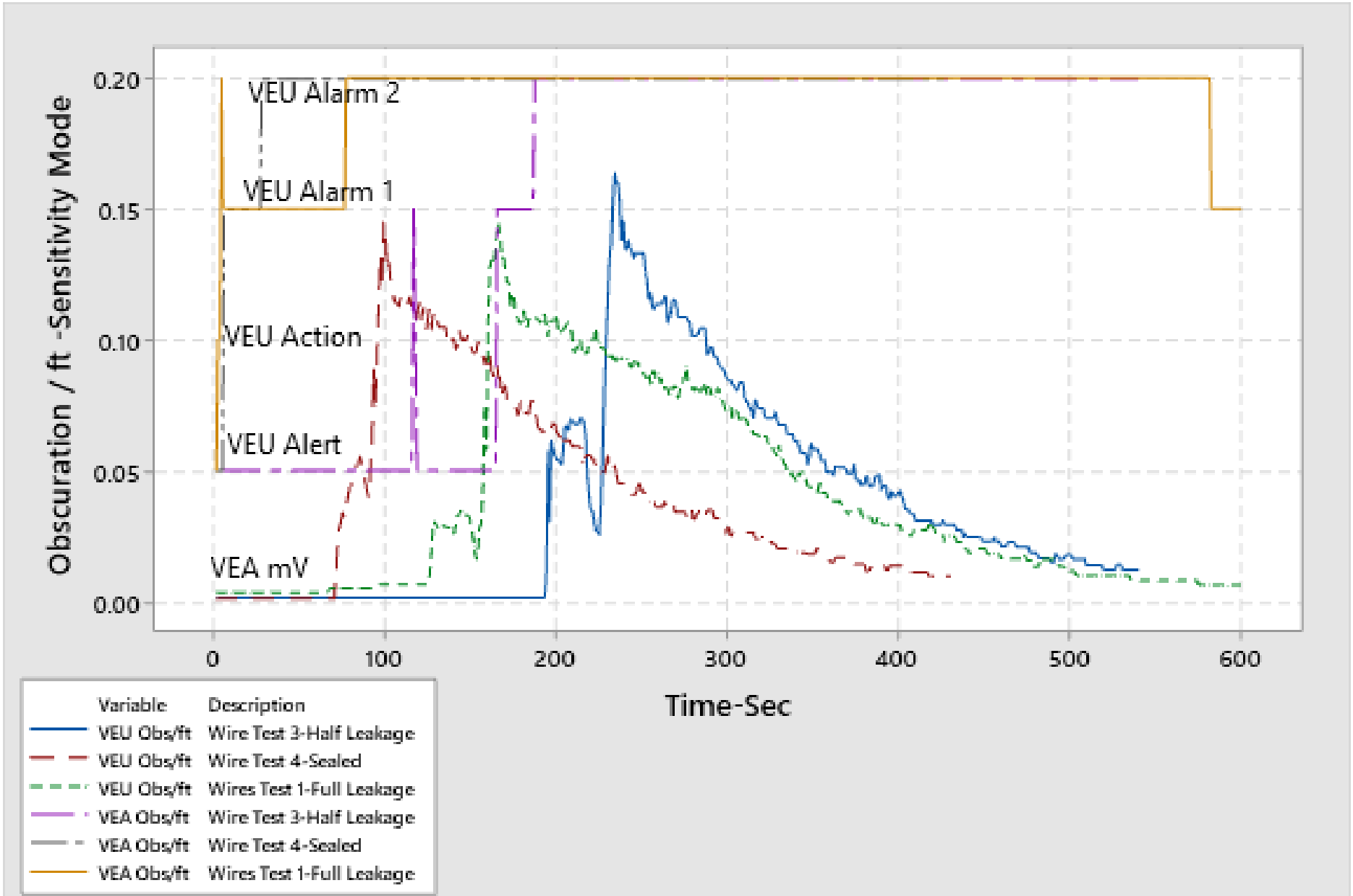
Push-fit connect sampling points enable fast and easy installation

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**VESDA-E Sampling Point**

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# VESDA VEA & VEU Detectors Smoke Trend Results in Wire Burn Test

# Smoke Trend Results-Materials Burn Test
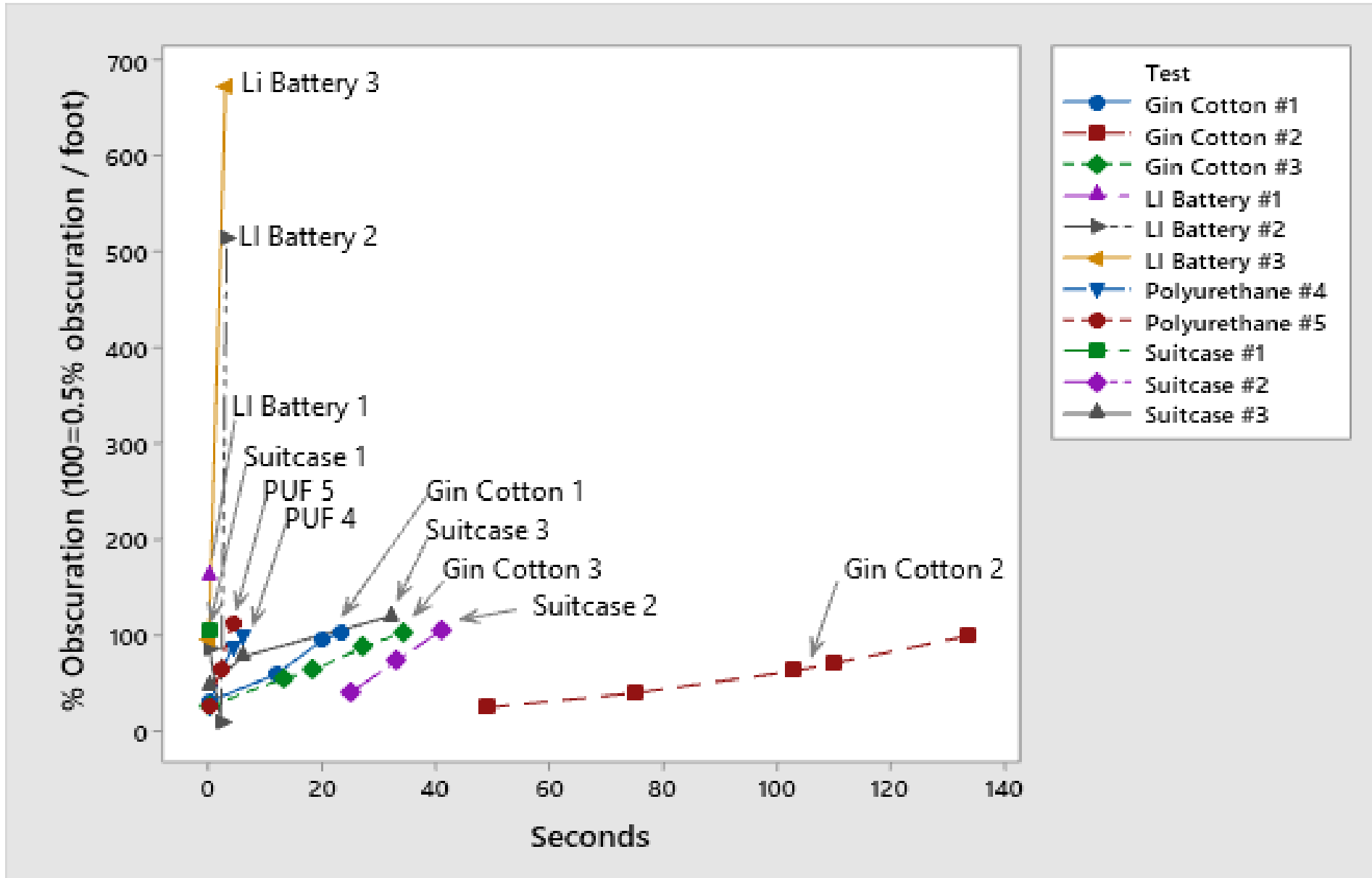
H2 ppmV vs Seconds

CO ppmV vs Seconds

Li Battery
Suitcase
Gin Cotton
Urethane Foam

Fire 1 Threshold
High Gas Alarm = 100 PPM

Alert Threshold
Low Gas Alarm = 30 PPM

Test_2
- Gin Cotton #1
- Gin Cotton #2
- Gin Cotton #3
- LI Battery #1
- LI Battery #2
- LI Battery #3
- Polyurethane #4
- Polyurethane #5
- Suitcase #2

15
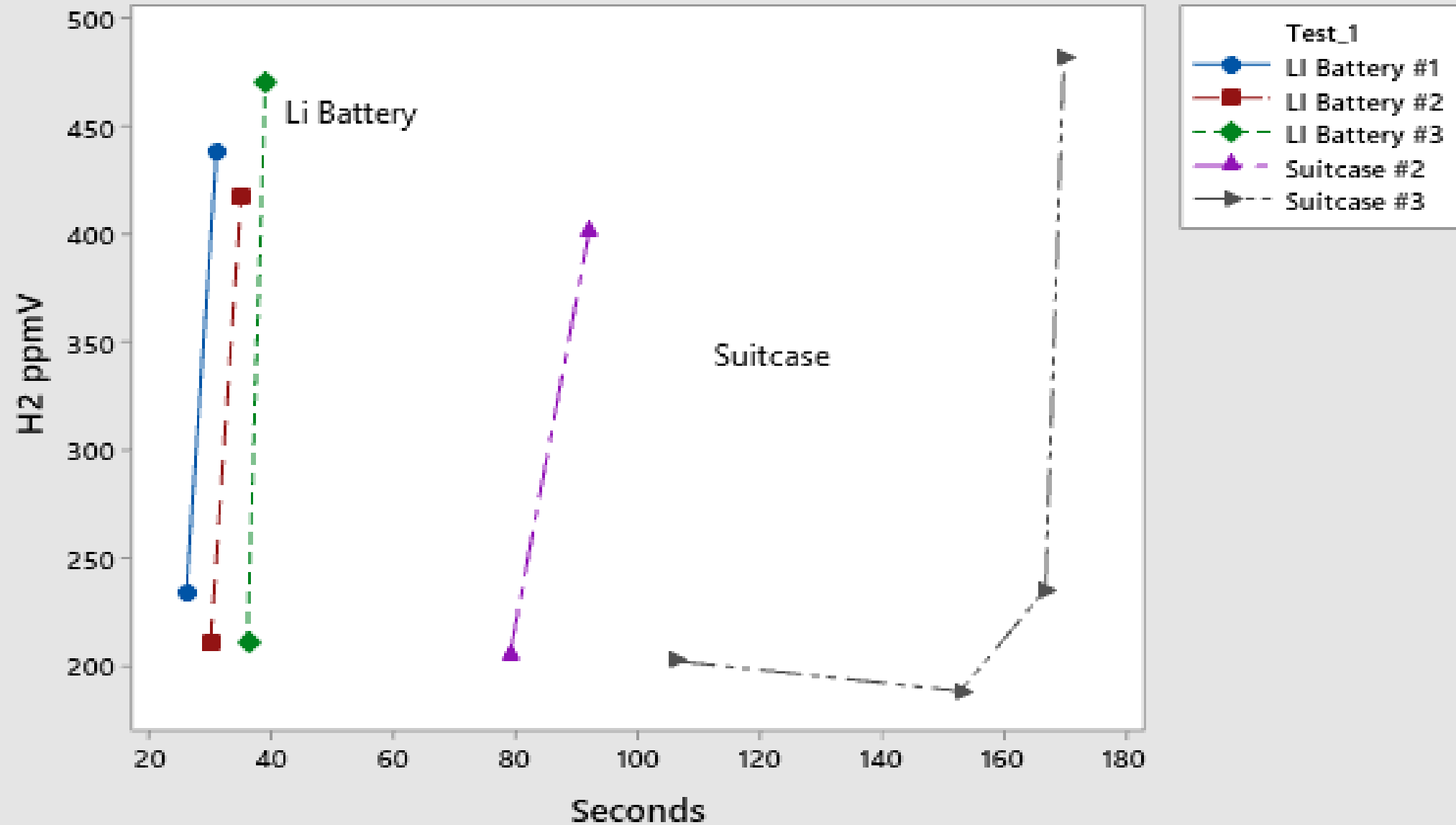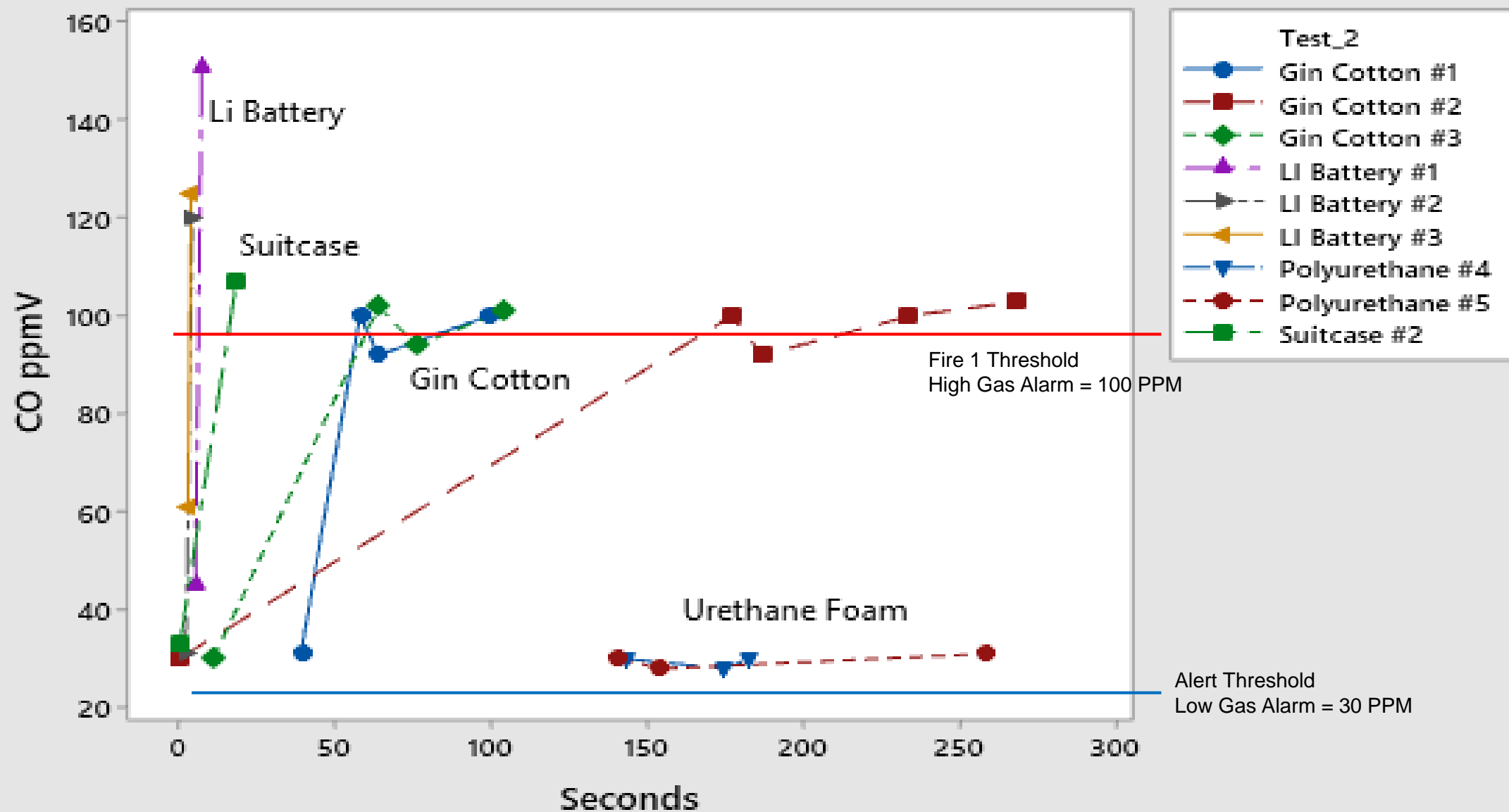
# Sensepoint XCL for VESDA Systems Product Range



- **Gas**
  - CO, 300 ppm full-scale range, selectable between 50 and 1000 ppm using the Sensepoint App
- **Output Versions**
  - mA or Modbus
- **Additional Interfaces**
  - Relay and Bluetooth
- **Polycarbonate Housing**
  - Black in colour
- **Tubing Connection**
  - 4 mm ID, 6 mm OD push fit onto Flow Housing ports
  - Detectors tested 100% in factory via flexible tubes for sealing under vacuum
  - UL2075

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# VESDA Sensepoint XCL – Installation to VEA Tube

1. Disable VEA – prevent Flow Fault

2. Cut VEA tube

3. Secure XCL on wall and complete wiring

4. Insert 50mm flexible tubes on both Cal Cap nozzles

5. Insert VEA tubes (6mm, ¼" OD) into flexible tubes (insertion length >15mm) and secure with tube clips

6. Power up XCL

7. Reset then Enable VEA (Normalise for new VEA installation)

8. Perform **Bump / Line Integrity** test



Flexible Tubes



VEA Tube

VEA Tube

Tube Clips
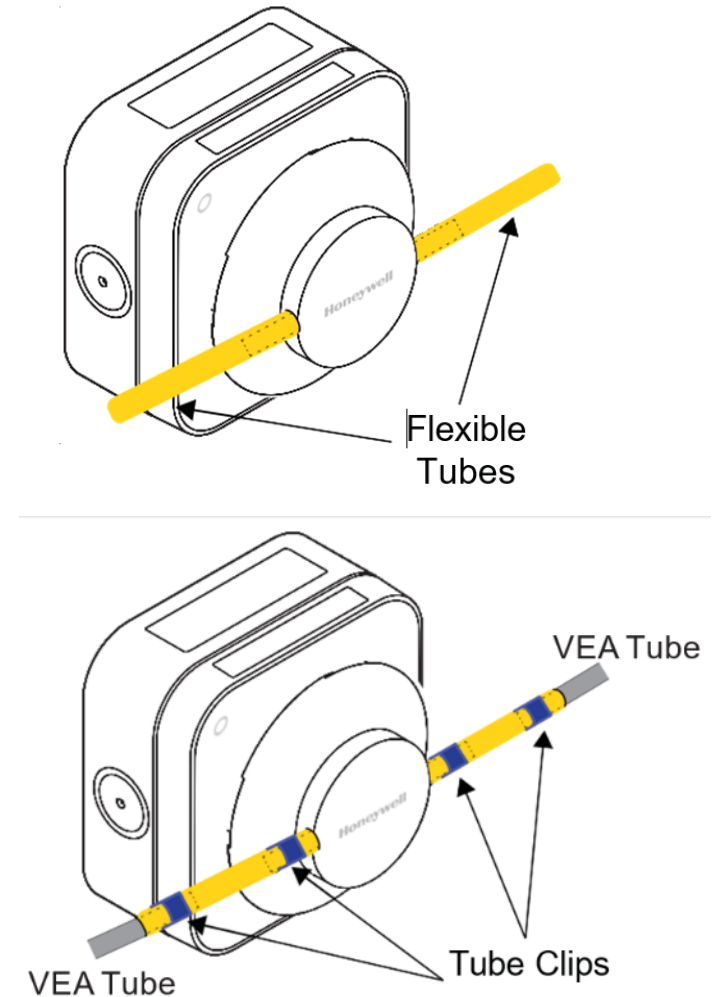
# Bump / Line Integrity Test

- **Aim: Functional and Operational check of XCL:**

  - Verify accuracy of XCL gas reporting

  - Verify XCL transmitter is responding

  - Verify integrity of XCL and XCL/VEA connections (i.e. airtightness)

- **Before Test:**

  - XCL and VEA detectors are Fault free

  - XCL in operation >30min

**Perform Bump /
Line Integrity Test
Twice per Year!**

# Bump / Line Integrity Test – Option #1

## Option #1: Gas intro at VEA sampling point



Demand Flow Regulator (DFR), 0-3L/min, demand pressure -750Pa
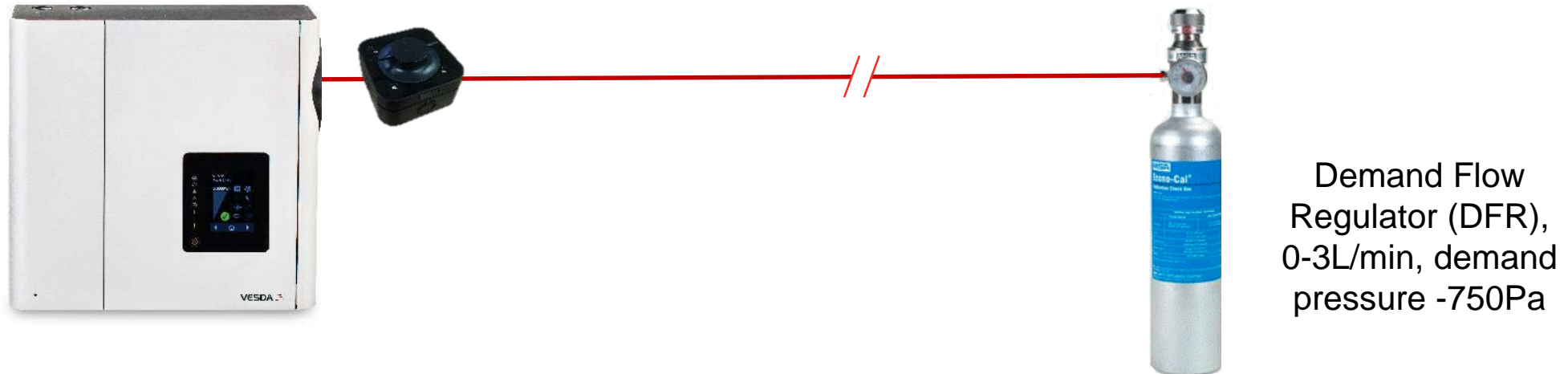
1. Connect DFR at end of VEA tube (remove tube from sampling point if present)

2. Wait for gas to reach XCL

3. 2min after XCL initial response check transmitter response and gas reading

# Bump / Line Integrity Test – Option #2

## Option #2: Gas intro at XCL

Demand Flow Regulator (DFR), 0-3L/min, demand pressure -750Pa

1. Disable VEA
2. Disconnect upstream tube from XCL. If VEA starts scanning stop scanning (VSC/VSM)
3. Connect DFR + tube length equal to installation or 100m (6mmOD) to XCL
4. Wait for gas to reach XCL
5. 2min after XCL initial response check transmitter response and gas reading
6. Reconnect upstream tube to XCL
7. Reset and Enable VEA

# Calibration (Zero / Span)



Fixed Flow
Regulator (FFR),
1 L/min

1. Disable VEA
2. Remove XCL from VEA tube
3. Connect XCL to Sensepoint App and follow the prompts
4. Expose XCL to gas for 3min and perform calibration
5. Re-connect XCL to VEA tube
6. Reset and Enable VEA
7. Perform **Bump / Line Integrity Test**

**Perform Calibration on new XCL units and when replacing sensor**

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# Gas Sensor Replacement

1. Disable VEA

2. <span style="color:red">Remove power</span> to XCL, or isolate circuitry (follow prompts in App or use buttons)

3. Remove XCL from VEA tube

4. Remove Cal Cap and unscrew sensor cover

5. Replace gas sensor

6. Re-connect all parts and <span style="color:red">power up</span> or de-isolate XCL circuitry

7. Perform <span style="color:red">calibration</span>

# Troubleshooting Following Bump / Line Integrity Test



**Bump Test** → Pass → *VESDA Sensepoint XCL ready for operation*

Bump Test → Incorrect Gas Reading → **Check Connections**

Check Connections → Repeated Incorrect Gas Reading → **Calibrate**

Calibrate → Pass → Bump Test

Calibrate → Fail → **Replace Sensor**

Replace Sensor → Calibrate

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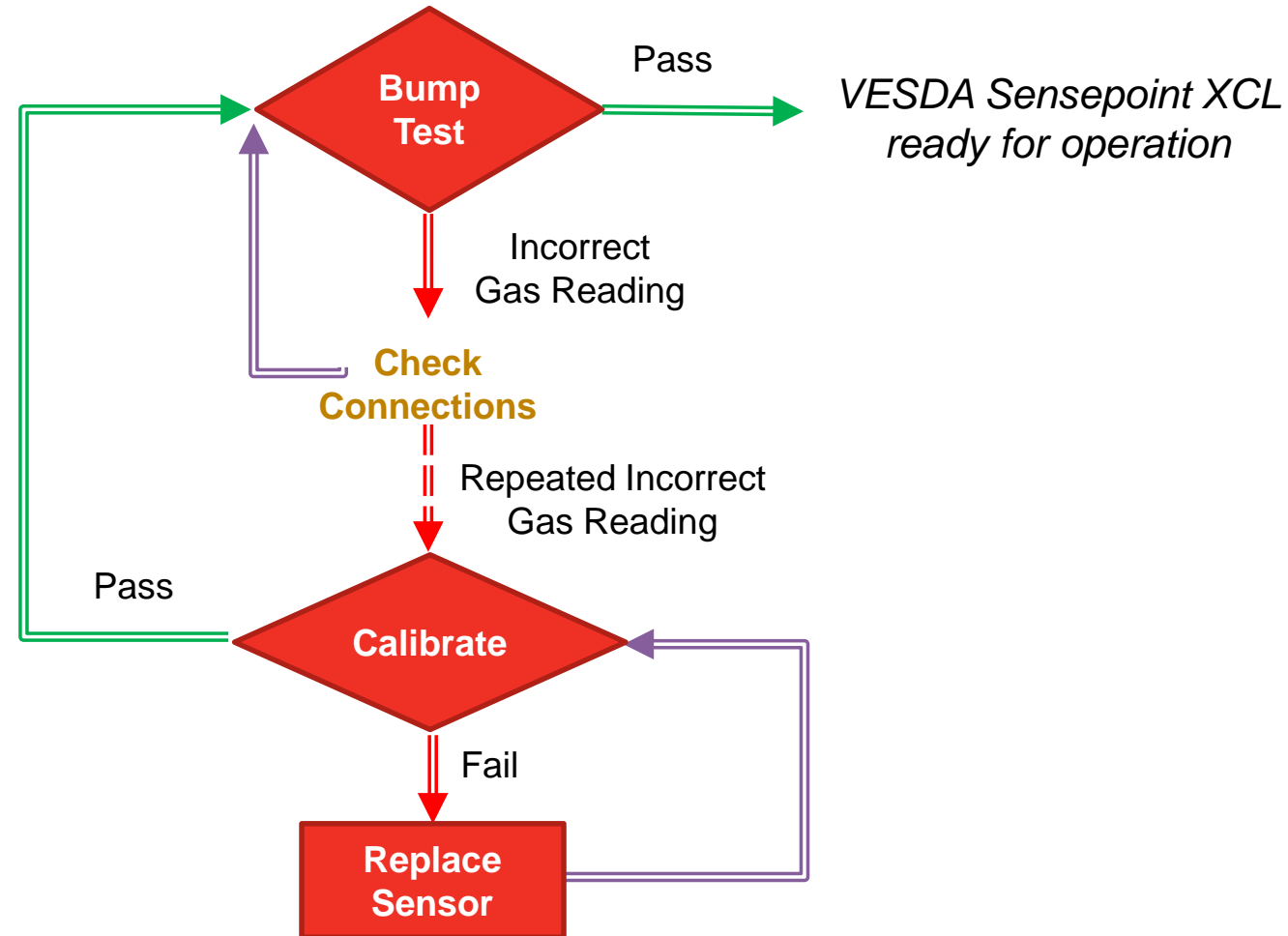
# VESDA VEA Smoke & XCL Gas Detection Value Proposition

**Assured Detection**

Full supervision; tube and sampling point integrity monitoring, self cleaning, chamber optics protection

**Flexible and Fast Installation**

Simple tube installation with push fit connectors; benign tube does not need to meet electrical installation codes

**Reduced Maintenance and TCO**

Centralized maintenance point can reduces service time up to 90% and eliminates need for access equipment

**Effective and Efficient Response**

Best in class connectivity and remote access with iVESDA offers direct access for real time status

**Interruption Free Operation**

Ideal where the protected area has security or access limitation and allows uninterrupted business operation

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# Conclusions

- Using both the presence of smoke and hazardous gasses such as carbon monoxide and hydrogen can be an effective way to eliminated false fire alarms on aircraft.

- The testing done on some common fuels of combustion show that smoke and hazardous gasses can be detected.

- More testing needs to be done to verify delay times between the detection of the individual components.

- With the raw cotton and suitcase tests, the 1st tests showed the detection of smoke before the detection of carbon monoxide, but the 2nd tests showed the detection of carbon monoxide before the detection of smoke.

- One possible area of study would be the effects of combustion temperature on the production of detectible smoke and carbon monoxide.

- The relatively delayed detection of hydrogen could be due to the placement of the sampling point on the side of the ULD.

# Disclaimer

Xtralis takes no responsibility for code compliance. Our design is a suggestion only and it is the responsibility of the consultant/contractor to verify the design for code compliancy and site suitability.

Any material list is provided for estimating and basic design purposes only. All materials may not be shown. It is the responsibility of the contract bidder to verify all quantities, specifications, drawings and other contract documents.

Any recommendation on system provided by Xtralis is an indication only of what is considered to be the most suitable solution to meet the needs of the common application environments described.

Smoke thresholds listed within the ASPIRE file are a guide only and are bound by a standard range. Exact smoke thresholds setting are to be modified and made suitable for the environment in which the detector in installed.

In some cases the recommendations on system design provided may not suit the unique set of conditions experienced in a particular application environment. Xtralis has made no inquiry nor undertaken any due diligence that any of the recommendations supplied will meet any particular application. Xtralis makes no warranty as to the suitability or performance of any recommendation on system design. Xtralis has not assessed the recommendation on system design for compliance with any codes or standards that may apply nor have any tests been conducted to assess the appropriateness of any recommendations on system design. Any person or organization accessing or using a recommendation on system design should, at its own cost and expense, procure that the recommendation on system design complies in all respects with the provision of all legislation, acts of government, regulations, rules and by-laws for the time being in force and all orders or directions which may be made or given by any statutory or

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