



Dedicated Full Scale Testing — An OEM's On-Site Solution

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October 20, 2022



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Overview

Today's Topics

- Company Introduction
- AS8992 and Speed of Implementation into New Design
- Existing Test Facility Solutions and Limitations
- Air Cargo Safety Research Center (ARC)
- Recent Tests with Li-Ion Batteries
- Future Capacity
- Discussion and Q&A



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Company Introduction

About Satco Inc.

Satco is a family owned and business that prides itself on building strong and lasting relationships with its customers, many of whom rank among the largest cargo airlines in the world. Our continued success over the past 52 years can be attributed to strict adherence to our proven process.



Innovating ULDs Since 1968

EXPERIENCE THE SATCO DIFFERENCE

- * No Nonsense Design & Engineering Philosophy
- * Firm Commitment to Total Customer Satisfaction
- * Competitive Lead Times Backed by World Class Suppliers
- * Consistent Quality & Performance
- * Extensive Repair Network & Spare Parts Inventory
- * Expert Technical Support

Manufacturer of Air Cargo Containers, Pallets, Nets, Straps & Hardware



Satco's True Contour™ Container Design Offers Optimal Structural Strength & Cargo Volume Capacity



Satco's Patented H.D. Stringer Pallet at Work Supporting Jet Engine Transport



Satco's Versatile, Lightweight & Durable Net has been the Proven Workhorse for over 30 Years

Company Website



Source: Satco Inc.



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AS8992 and Speed of Implementation into New Design

AS 8992 was released October 2020 and incorporated into TSO-C90e for Fire Resistant Containers (FRCs) in July 2021.

For the first time specific full scale testing became a requirement for production of FRCs.

This additional set of requirements expands and enhances the standard for fire safety and increases the resources required to apply for TSO authorizations.

Some of those resources include:

- Access to facilities of suitable size and adequate protection for cargo fires
- Equipment to record the results of those tests to meet or exceed the requirements
- Engineers and technicians to design, execute, and document those tests



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Existing Test Facility Solutions and Limitations

Current facilities that meet the needs of full scale burn tests are multi-functional facilities that often times are multi-industry facilities as well.

The ability for that company to pivot from their prior test conditions (aircraft engines, warehouse fire protection, firefighter training) increases the cost of test due to facility reconfiguration and refamiliarization with the AS8992 test criterion or other challenge fire test criterion.

Another limitation is the ability of those facilities for various challenge fires. Since full scale tests involving lithium-ion batteries produce hazardous gases different from typical fuel and building material fires, some of the available facilities that can accommodate class A materials per AS8992 cannot accommodate challenge fires involving lithium-ion batteries.

Of those that are suited for lithium-ion batteries in a fire, local and state laws for their disposal can create a financial burden on planned tests can limit the number of tests that are economically feasible for the ULD OEMs.

With the demand from other industries creating large lead times to use each facility and the economic limitations listed above, Satco identified a need to create an economic and timely solution to complete full scale tests.



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Air Cargo Safety Research Center (ARC)

Satco Designed, Built, and Completed the Air Cargo Safety Research Center (ARC) in 2021-2022 at our facility in Miami Township, OH (Cincinnati Metro).

Key Features

- Designed for the Class A materials in AS8992, Lithium-Ion battery fires, and challenge fires designed by Satco, customers, or regulators.
- Capable of testing G-Size Containers (20 ft.) up to 118" tall.
- Tests are completely isolated from engineers and technicians running the test and test witnesses for safety.
- On-site test witnessing outside the control booth and remote test witnessing is available streamed over WebEx.
- Up to 10 visible light and 2 IR Cameras are available to record all sides of the ULD.
- Satco Engineering Staff is on-site for support during all tests.



The first validation test was completed in April 2022 and the first revenue test was in May 2022.



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Air Cargo Safety Research Center (ARC)

Limiting Environmental Impact

The ARC is designed with a custom built air filtration system (pictured on the right) to clean the air collected from inside the building and release back into the environment. Solids are collected and sent for treatment.

The ARC is also fitted with a catch basin that collects any liquid that leaks out from the test article and isolates it from the nearby environment. The catch basin can be pumped out and sent to a liquid sanitation facility.

Community Involvement

The Miami Township Fire Department has been a key partner as we have built the ARC and we share information and training opportunities for them at our facility so that they may serve the public better with the rising popularity of electric vehicles.



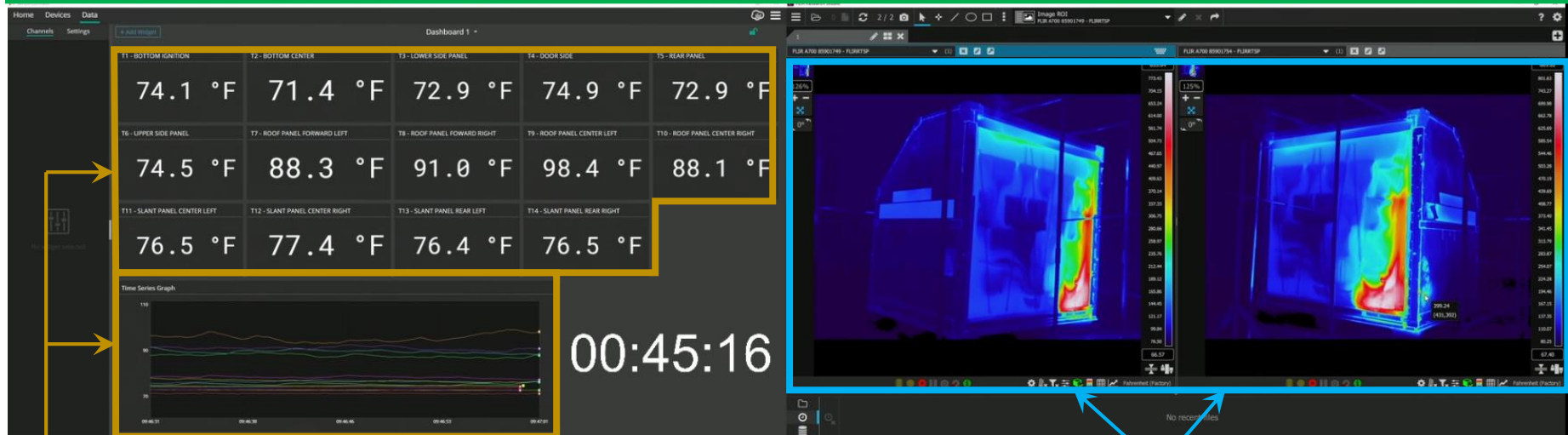


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Air Cargo Safety Research Center (ARC)

Real Time Data Readouts

High Definition Visible Light Cameras (can be configured for any of 8 angles)



With Real Time Graphing
4Hz Readout of the 14 Required
Thermocouples in AS8992

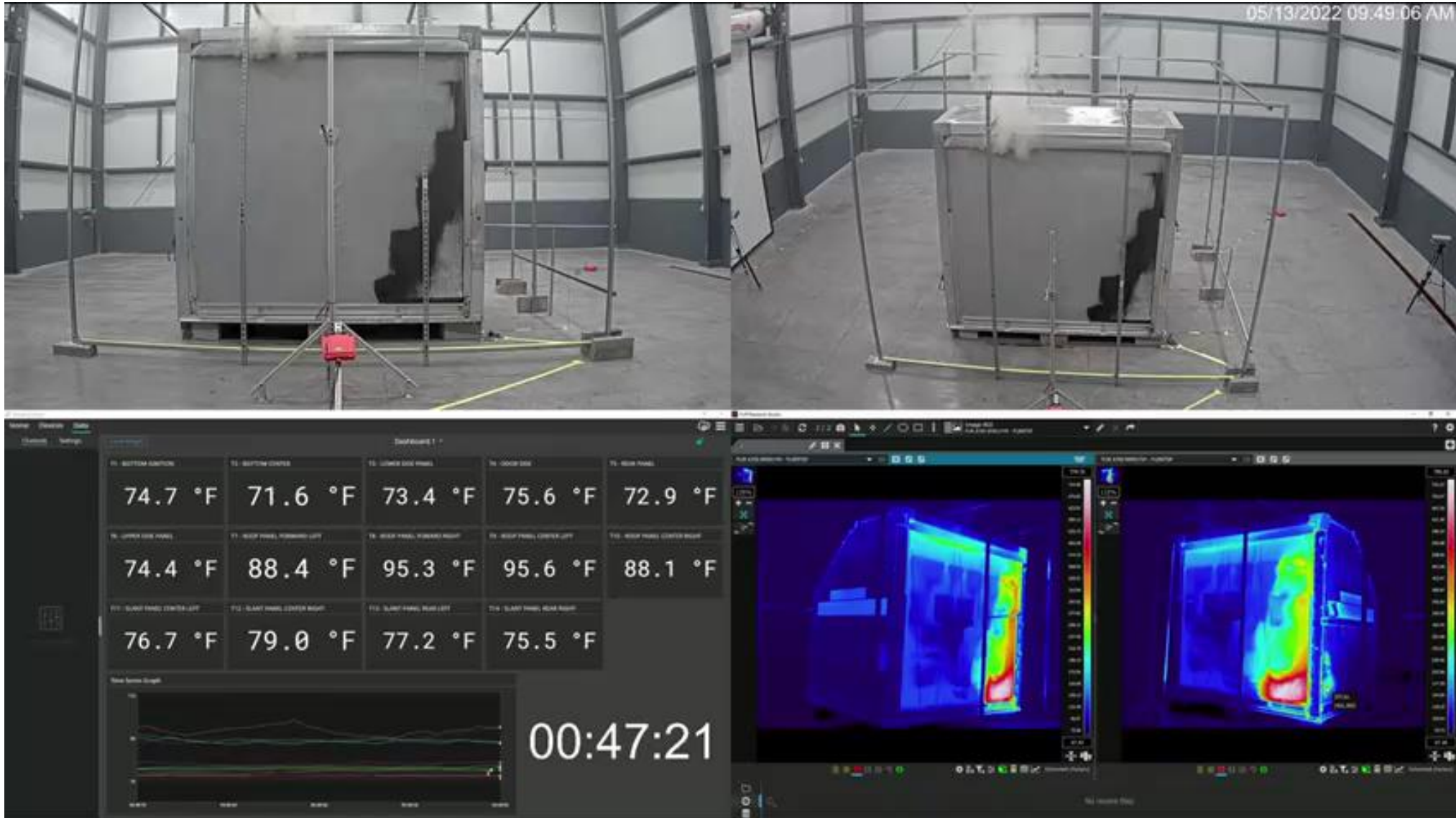
IR Cameras
(with Dynamic Range)



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Air Cargo Safety Research Center (ARC)

Streaming Capable



(Sample Video)

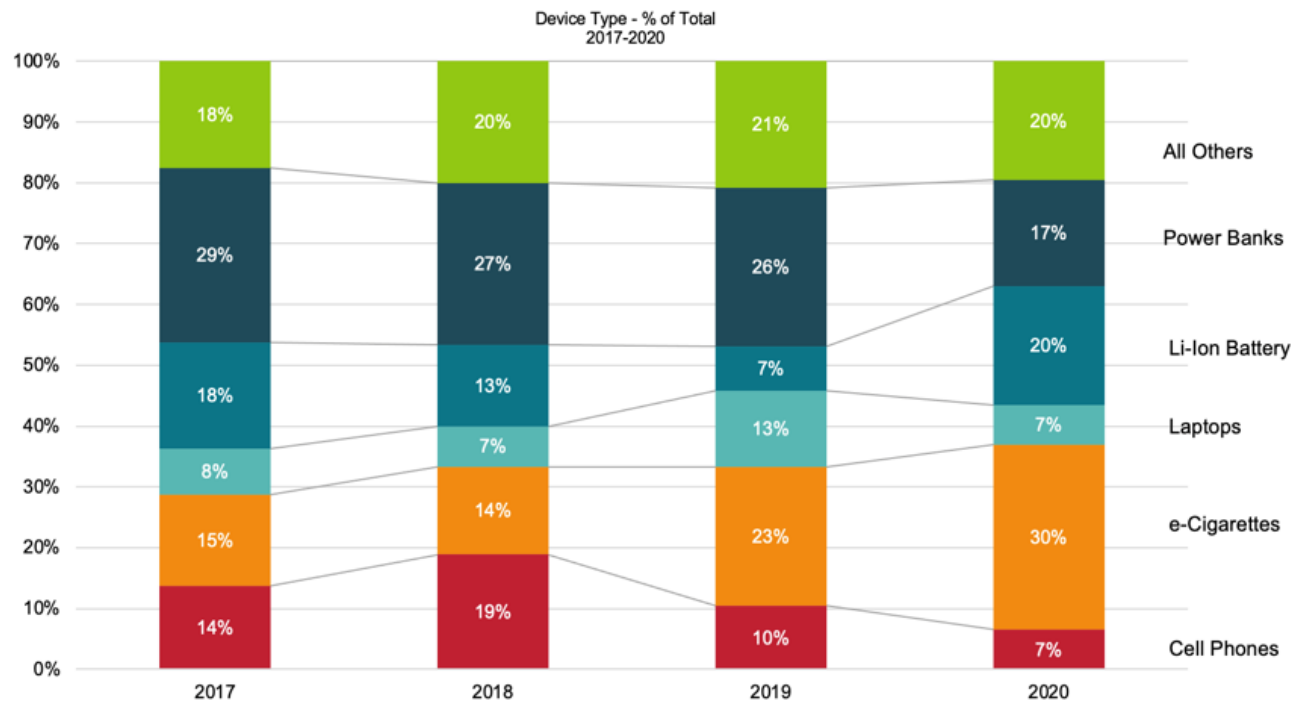


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Recent Tests with Li-Ion Batteries

As the risk of Lithium-ion Batteries increases, airline customers have increased interest in protection against fires resulting from damaged batteries. Recent tests have showed encouraging results for FRCs and FCCs alike. In 2020, Satco completed a passing test similar to the test in AS8992 with the addition of 5000 lithium-ion batteries in the as-shipped charge state.

On September 20, 2022, we completed a test with 1500 lithium-ion batteries in the as-shipped charge state protected by our FCC in the ARC.



Source: UL TRIP Database, participant reported incidents from 2017 – 2021. As of 2021-03-31



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Future Capacity

Other ARC Functions

With the intention of being true to the facility's name, the Air Cargo Safety Center has also been built with the capacity beyond AS8992 full scale tests and Lithium-Ion Battery Fires including:

- Other challenge fires including:
 - Class B products (Fuels and Ethanol)
 - Full Scale FCC fire Tests
 - The next high energy storage devices
- Fluid Ingression and Retention Tests
- ULD Impact and Penetration Tests
- 14 CFR 21 Appendix F Part III Oil Burner Tests



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Discussion and Q&A

The resources needed to ensure that we minimize the lead time and collect all relevant data of evolving our fire protection solutions at the speed of evolving high energy storage systems are only possible if the dedicated resources are available in the timely manner to outpace those risks.

Satco has invested greatly in our future as a company and as part of the greater air cargo industry to reduce and eliminate those risks for the safety of air crews and the public that lives near to cargo operations.

Satco Experts Also in Attendance

Tom Gahan
Director Of Engineering
44 Years Cargo Experience – Brownline, Ancra, Satco

Scott Miller
Chief Engineer
16 Years Cargo Experience – Boeing, FedEx, Satco