MANTLE by AMSAFE BRIDPORT

ULD CONTRIBUTION TO CARGO COMPARTMENT FIRE PROTECTION – CLARIFICATION ON THE APPLICATION OF FCC/ FRC

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- The Specialist in Aviation Restraint and Safety Technology products including
  - _ Tarian® Armour System
  - _ 9G aircraft barrier nets, with smoke/thermal protection
  - _ Fire containment products

- Tier 1 supplier to Airbus, Boeing etc
- World leader in cargo restraint equipment
- Leading supplier to Defence forces worldwide

Declared Li-ion Bulk Shipments

- Flammable gas release
- Even at 30% SOC, a 2600mAh 18650 battery cell releases 1.5 liters of flammable gas

Undeclared Li-ion content

- Rechargeable device sales rising
- Cross Border E-Commerce rising
- Increase in individual shipments
- DG shipments are complex and expensive
- Risk of fires that cannot be stopped by existing Halon systems

WHAT IS FCC / FRC? WHAT IS THE OPTIMUM SOLUTION?

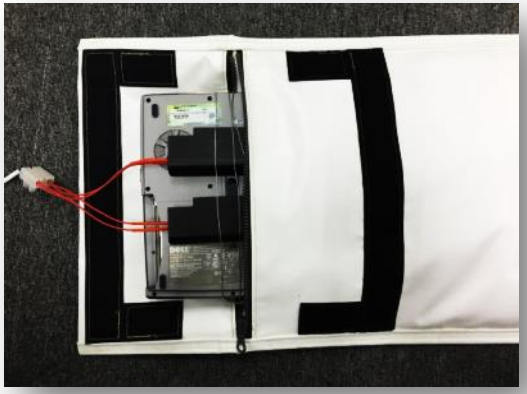
- **FCC** – Fire Containment Cover (for palletized loads)
  FRC – Fire Resistant Container (for ULD containers)
- Developed as solutions to UDG, Lithium battery shipments, rises in E-Commerce and rechargeable device sales
- FCC – TSO-C203 (FAA/EASA), SAE AS6453 & ISO 14186 released
- Fire Resistant Fabric / Materials used
  - Passive system
  - Fire Barrier - Oxygen suppression secondary function
  - Patented designs
- FRC – ISO 19281 released, AS8992 close to being released
- Both solutions have been extensively tested with Class 'A' fire & Lithium-ion battery fire
- Main deck cargo – Class E & B (optional Class C & other compartments)
- Extensive trials & testing fed back into design
- Already in revenue service and trials
  (UPS, LH, Blue Dart, Northern Air Cargo, etc.)

FIRE CONTAINMENT BAG (FCB)

- A derivative of the FCC, developed for smaller cargo loads
- Uses same technology as FCC, and will contain Class ‘A’ and Lithium-ion fires for up to 6 hours
- Allows smoke to be released, ensuring detection systems continue to activate
- Can be used as an ‘OVERPACK’ at any stage of supply chain
- Protected aircraft in real life fire

FIRE CONTAINMENT POUCH (FCP)

- Developed to contain PED fires in pax cabin
- Uses same technology as FCC and FCB
- Tested with laptops and spare batteries



USER FRIENDLY SOLUTION

- Installation of an FCC typically takes less time that a standard pallet net (10-12mins)
- Patented Deployment Kit allows quick and easy deployment and storage of the FCC
- Safety instructions printed directly on FCC/FCB
- Customer markings & tracking
- Reparable

- Lithium-ion technology develops faster than regulators can handle
- No test-norm for lithium fire or lithium assisted Class A fire. No two fires are the same.
- Weight & Cost
- 1800°F flame penetration resistance under all conditions
- Limit heat transfer to aircraft structure
- Durability
  - Resistance to environmental exposure (contamination, abrasion, UV etc)
  - Reparability on field
  - Allowance for damage
- Operation
- Off-gas & pressure waves

Flame penetration resistance testing of Fire Containment Cover seam in accordance with FAR Part 25 Appendix F Part III

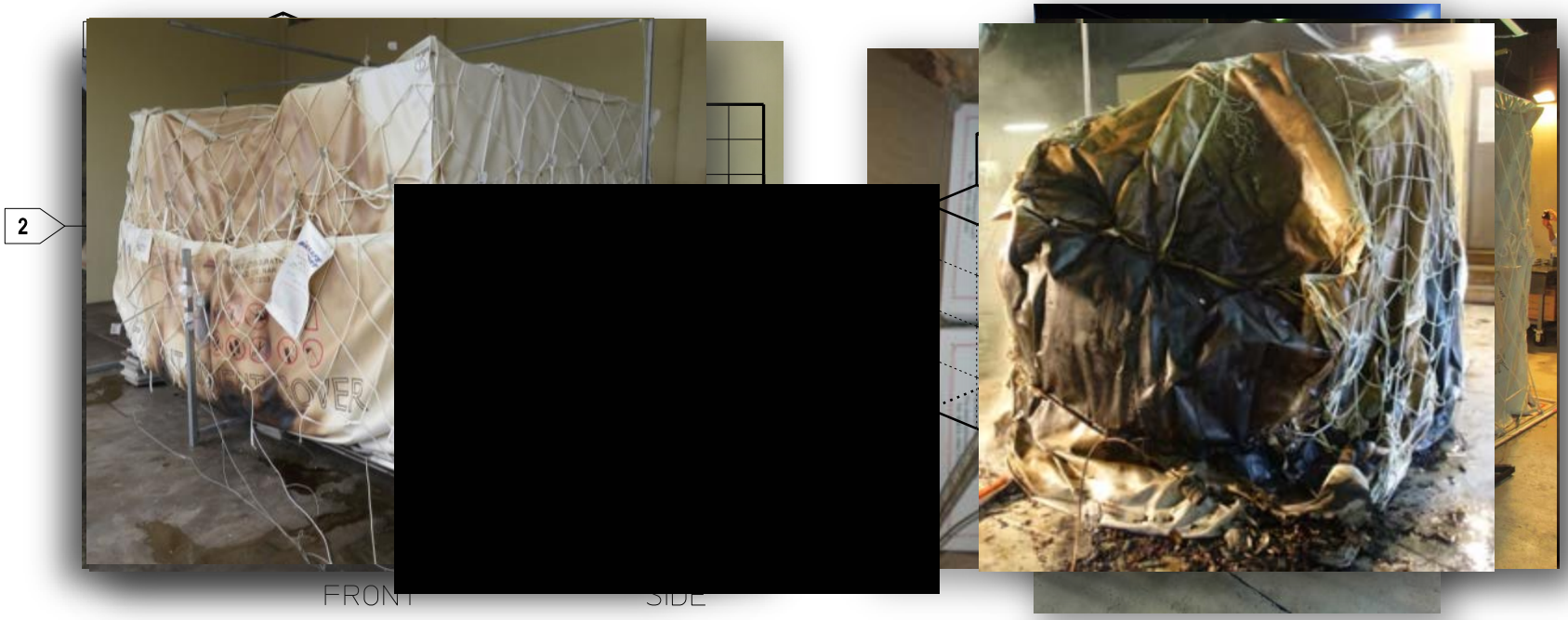
FCC LITHIUM-ION FIRE TESTS

AmSafe Bridport *(INTERNAL)* TEST

- Test method defined by Operator and AmSafe Bridport
- FCC dimensions 125” x 96” x 96” height
- Qty of 1,500 Lithium-ion batteries
- 18650 type cells – 2600mAh, 3.7V, SOC 70%-90%
- Battery boxes placed in 3 positions
- Remaining load consisted of Class ‘A’ load
  - All batteries vented
  - No external flames beyond limits

FAA *(EXTERNAL)* TEST

- Test method currently trial by FAA (no standardised test)
- FCC dimensions 125” x 96” x 96” height
- Qty of 1,000 Lithium-ion batteries
- 18650 types cells – 3000mAh, 3.7V, SOC 30%-40%
- Battery boxes placed in 1 position, pallet corner
- Remaining load consisted of Class ‘A’ load
  - All batteries vented



FCB LITHIUM-ION FIRE TESTS (EXTERNAL)

- Testing conducted by the FAA
- FCB dimensions 24” x 24” x 20”
- Qty of 1,000 Lithium-ion batteries
- 18650 type cells – 3000mAh, 3.7V, SOC 30%-40%
- Load consisted only of batteries
- Result: **PASS**
  - All batteries vented
  - No external flames
  - No batteries escaped confines of the FCB

FCB LITHIUM-ION FIRE TESTS (EXTERNAL)

- Testing conducted by the FAA
- FCB dimensions 24” x 24” x 20”
- Qty of 7 laptops 100% SOC
- Laptops packed in boxes as per recent PED ban
- Result: **PASS**
  - All batteries vented
  - No external flames
  - No batteries escaped confines of the FCB

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TRUTH	MISCONCEPTION
FCC/FRC is for Declared DG and Undeclared DG	FCC/FRC is for DG only
Largest risk is from Undeclared DG. Risk is increasing!	We don't ship DG
FCC/FRC does not delay smoke detection. Similar or better than ULD	FCC/FRC delays smoke detection
FCC/FRC can contain Li-Ion battery fire, to certain limits	FCC/FRC can't contain any type of Li-Ion battery fire
TCO of FRC is lower than Aluminium Container	FRC is more expensive than normal container
FCC installs faster than pallet net. Simple instructions	FCC hard to handle/install, too complex
FCC is usually mistreated. If handled correctly it will last 5 years. It is also reparable	FCC isn't durable
FCC has been in industry for 10+ years	FCC is a new untried concept

- Each individual airline should do a safety risk assessment
- Does the shipment contain general mail?
- Is the shipment from an unknown shipper?
- Has the shipper violated regulations in the past? Undeclared DG detected?
- Origin of the shipment? (e.g. Guangdong/Hong Kong vs. Hawaii)
- Is it during a peak time/big event? (e.g. Black Friday, Xmas, Singles' Day, etc.

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Thank you for your time