FLY-BAG2 Project

FLY-BAG2: Advanced Technologies for Bomb-Proof Cargo Containers and Blast Containment Units for the Retrofitting of Passenger Airplanes

Terrorist Threats to Commercial Aviation

The threat of attacks to passenger airplanes with explosives **hidden in luggage** loaded in the **cargo holds** or **taken onboard** is dramatically evident from terrorist events in the past years

FLY-BAG2 Project

FLY-BAG2: Advanced Technologies for Bomb-Proof Cargo Containers and Blast Containment Units for the Retrofitting of Passenger Airplanes

Project Type: Collaborative project
Call: FP7-AAT-2012-RTD-1
Topic: AAT.2012.5.1-1. Aerostructures
Start date: August 2012
End date: July 2015
Coordinator: Alessandro Bozzolo, D'Appolonia S.p.A. (RINA Group)

FLY-BAG2 Partners

D'APPOLONIA
consulting, design, operation & maintenance engineering

ZIPLAST
The essence of quality

DeltaSch
AIR CARGO EQUIPMENT & REPAIR

University of Patras

AERnnova

APC Composite

CARGO NETWORK

easc European Aviation Security Center e.V.

Blastech

CETMA

Maintenance Meridiana

stfi

INASCO
INTEGRATED AEROSPACE SCIENCES CORPORATION

FLY-BAG2: follow-up of FLY-BAG Project

- **FLY-BAG2** is a **follow-up of the previous FP7 Research Project FLY-BAG** (GA No. ACP7-GA-2008-213577)
- FLY-BAG developed and successfully tested a **blast-resistant flexible composite luggage container** for the protection of aircrafts from on-board explosions from explosives hidden in luggage in the **cargo hold**

Introduction: from FLY-BAG to FLY-BAG2

FLY-BAG Demonstrator

JEC COMPOSITES FINALIST OF 2011 INNOVATION AWARD

WINNER techtextil innovationprize.2011 SAFETY+PROTECTION CATEGORY

M DESIGN+ TECHNOLOGY AWARD MATERIALICA 2011

EARTO IMPACT DELIVERED

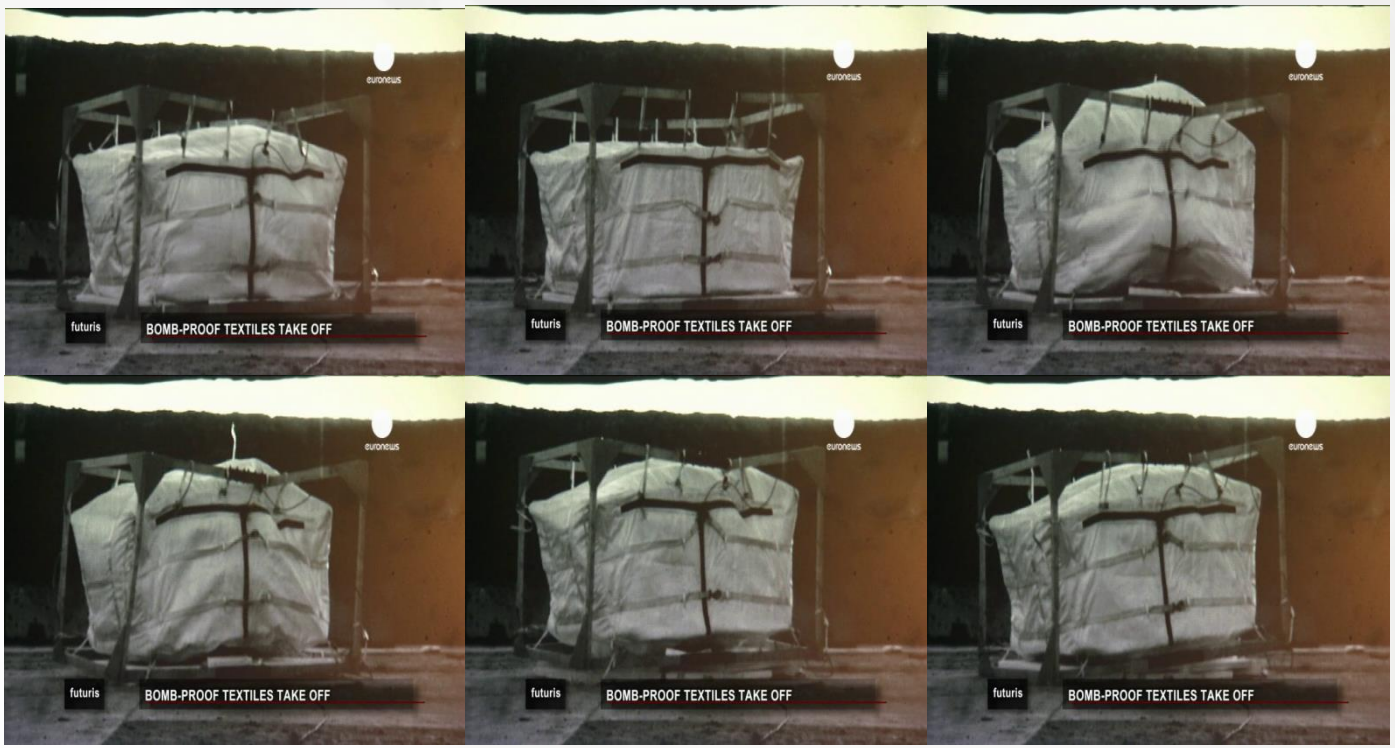
PREMIO NAZIONALE PER L'INNOVAZIONE

Blast Test of a LD3-45 ULD

WOULD MOST LIKELY LEAD TO FUSELAGE COLLAPSE

Final Blast Test on FLY-BAG

FLY-BAG blast test with the same explosive charge that destroyed the ULD



THE FLY-BAG SURVIVES SUBSTANTIALLY INTACT!

FLY-BAG Video

Watch the Video at

http://www.euronews.net/2011/01/25/bomb-proof-textiles-take-off/

FLY-BAG Patent

Entirely textile-based, lightweight, and blast resistant cargo container system and manufacturing method thereof

EP 2492217 A1

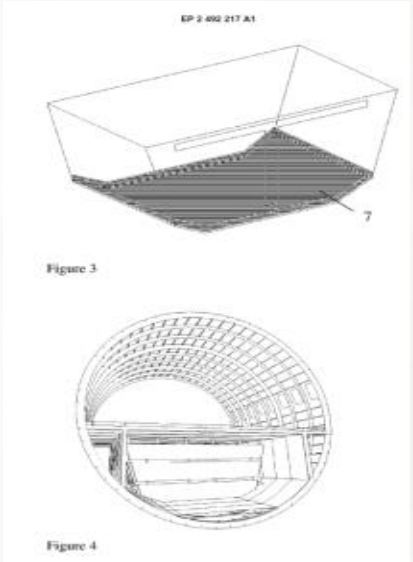
Europäisches Patentamt
European Patent Office
Office européen des brevets

(19) EP 2 492 217 A1

(12) EUROPEAN PATENT APPLICATION

(54) Entirely textile-based, lightweight, and blast resistant cargo container system and manufacturing method thereof

EP 2 492 217 A1



EP 2 492 217 A1

Figure 3

Figure 4

FLY-BAG2 Project

FLY-BAG2: Advanced Technologies for Bomb-Proof Cargo Containers and Blast Containment Units for the Retrofitting of Passenger Airplanes

Why FLY-BAG2?

FLY-BAG has demonstrated the feasibility of a textile-based blast resistant container, but:

- For a **specific configuration** (narrow-body, the container stays in the hold)
  - No use for wide bodies
  - No use against suicide bombers
- We only **blast-tested it in open air**
- The **interaction with airframe** is only known from **simulations**, not tested

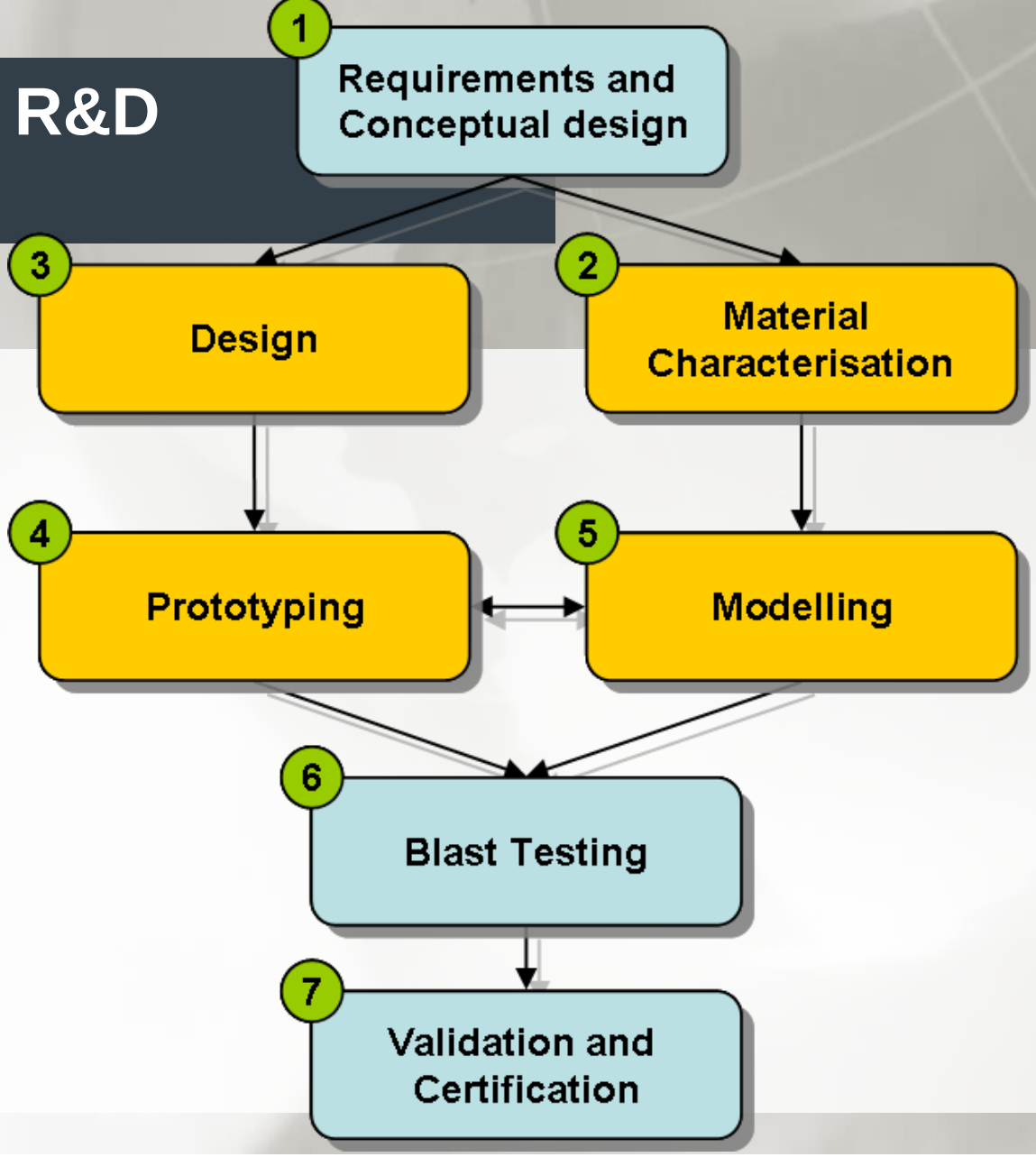
FLY-BAG2 Objectives

FLY-BAG2 aims at developing two entirely new classes of bomb-proof devices, namely:

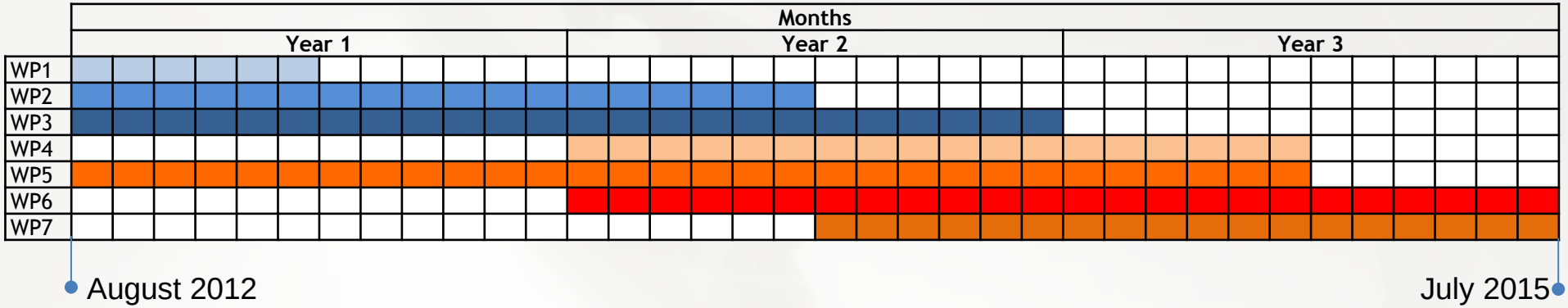
- **cabin device**, meeting the *Least Risk Bomb Location* (LRBL) requirements
- **cargo device,** for cargo holds of narrow body and wide body aircrafts

Full scale blast tests on disused aircrafts are being performed

FLY-BAG2 R&D Activities



FLY-BAG2 R&D Activities

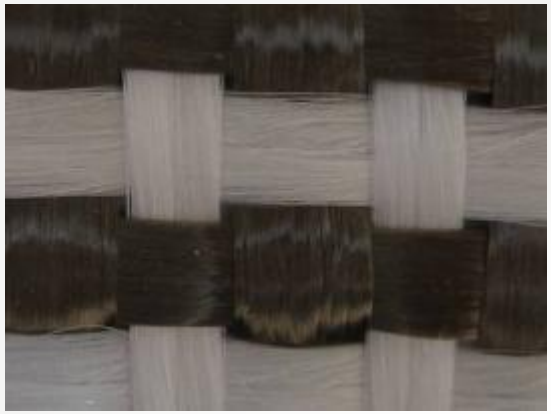


WP1	Requirements and conceptual design
WP2	Material characterisation
WP3	Design
WP4	Prototyping
WP5	Modeling
WP6	Blast testing
WP7	Validation and certification

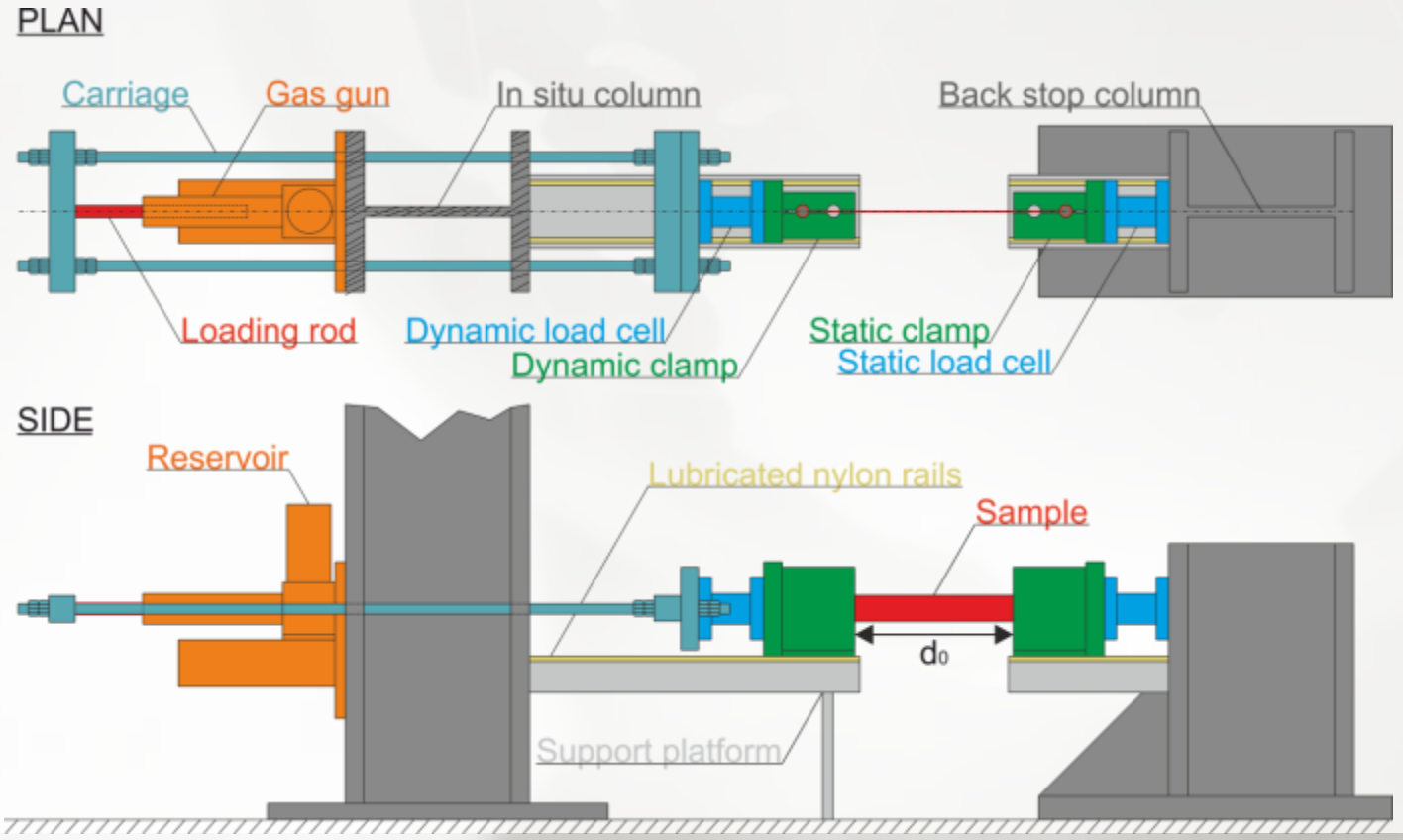
- Definition of requirements, conceptual design and material characterisation concluded
- Design of FLY-BAG2 containment units and composite panels on-going
- Preliminary cabin devices manufactured and tested
- Planning of full-scale blast tests

Material Selection

Selection of Advanced Materials (Fabrics, Composite & Zip)



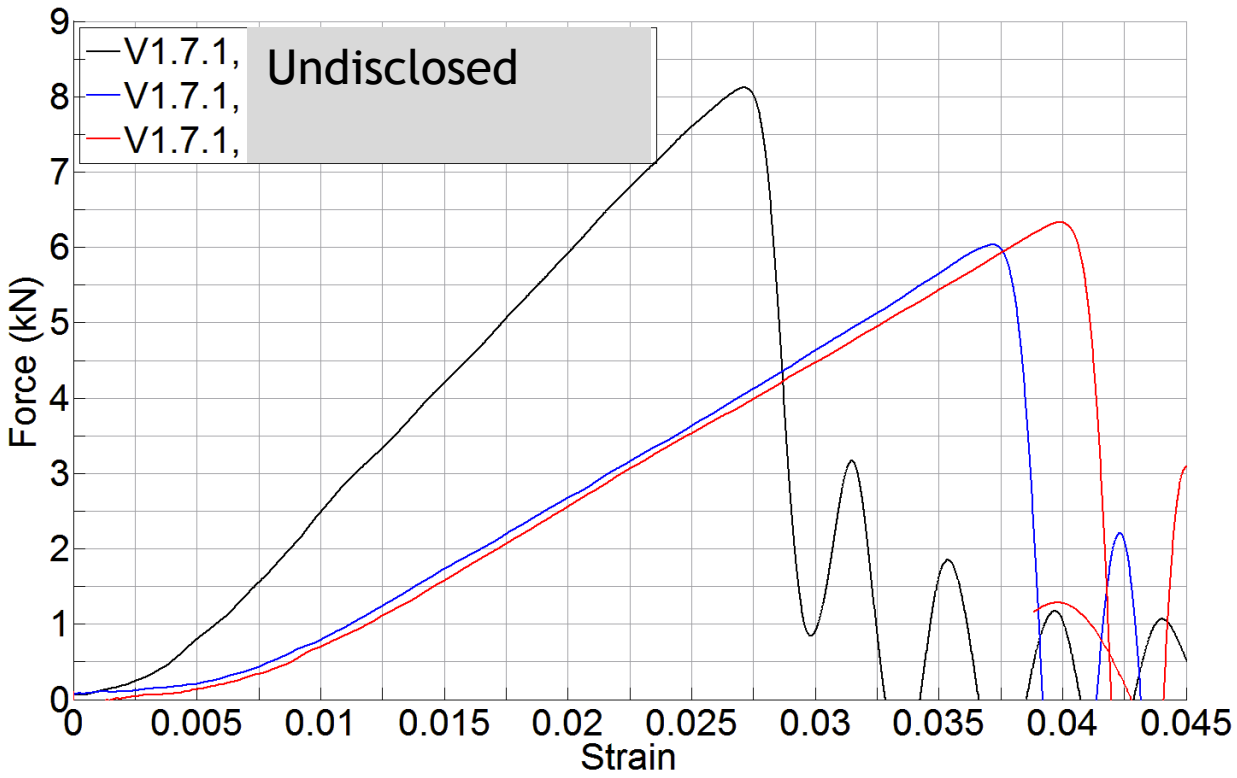
Dynamic Tests on Fabrics



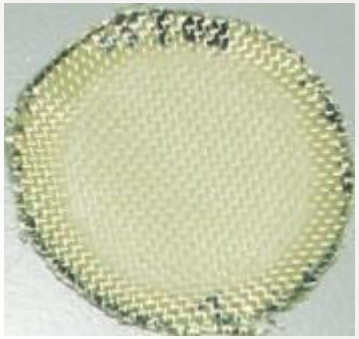
Dynamic Tests on Fabrics

- Test program: >50 tests conducted in total
- All samples 5cm wide by 40cm long
- Strain rates ~2-20 strain/second

Example of Dynamic Test Result on Fabrics



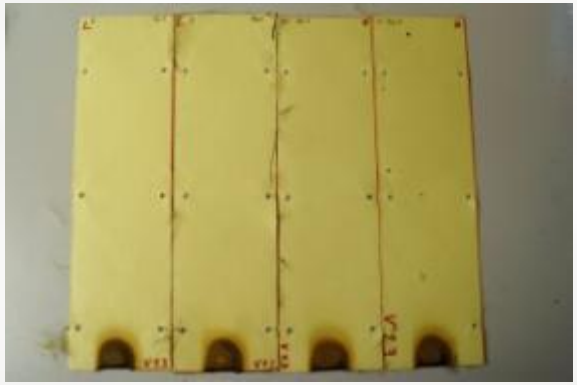
Mechanical, Flame & Burning Tests on Fabrics

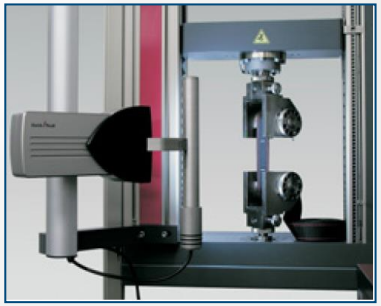


Abrasion resistance tests

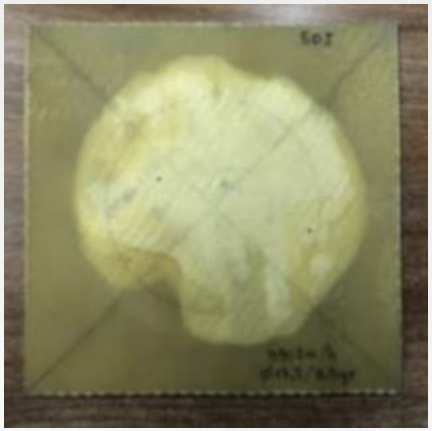
Burning Tests

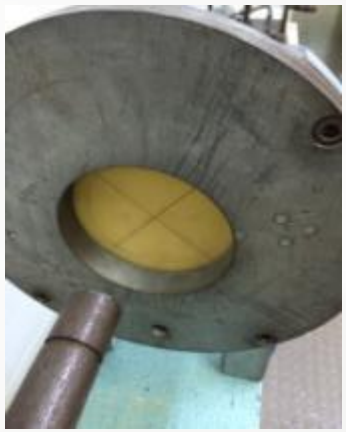
Wheatering Tests

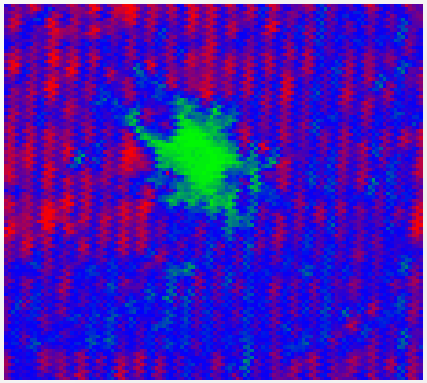




Low and High Velocity Impact Tests on Composites





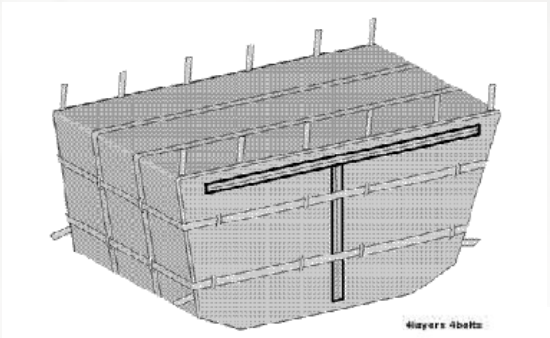


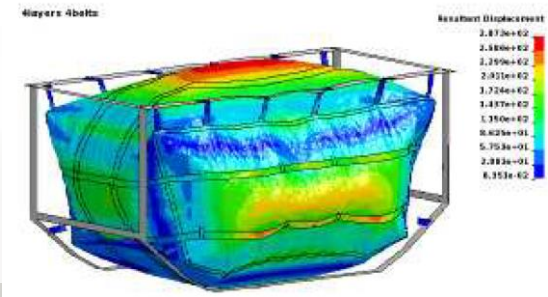
FLY-BAG2 Blast Containment Units: Design & Prototyping

Cargo Blast Containment Unit

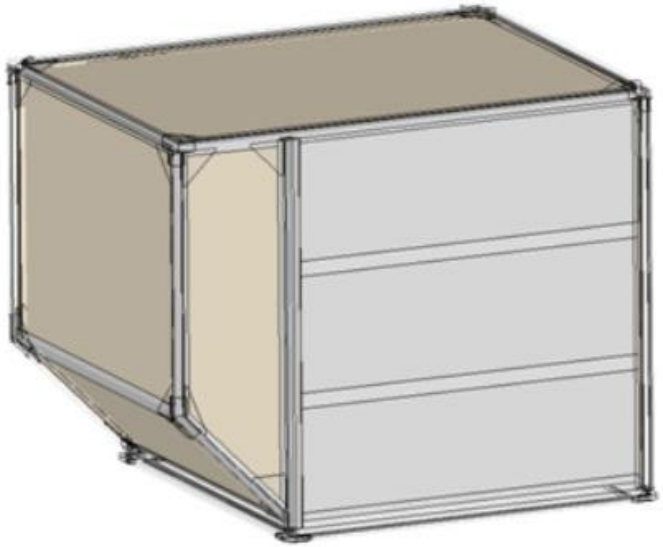
Cargo Blast Containment Unit

FLY-BAG2 cargo version, “tailored” for the MD80-87 cargo hold version. The protective bag is a sort of an “internal skin” to be installed onboard of a “narrow” body aircraft. The system can be easily removed from the internal cargo hold and folded





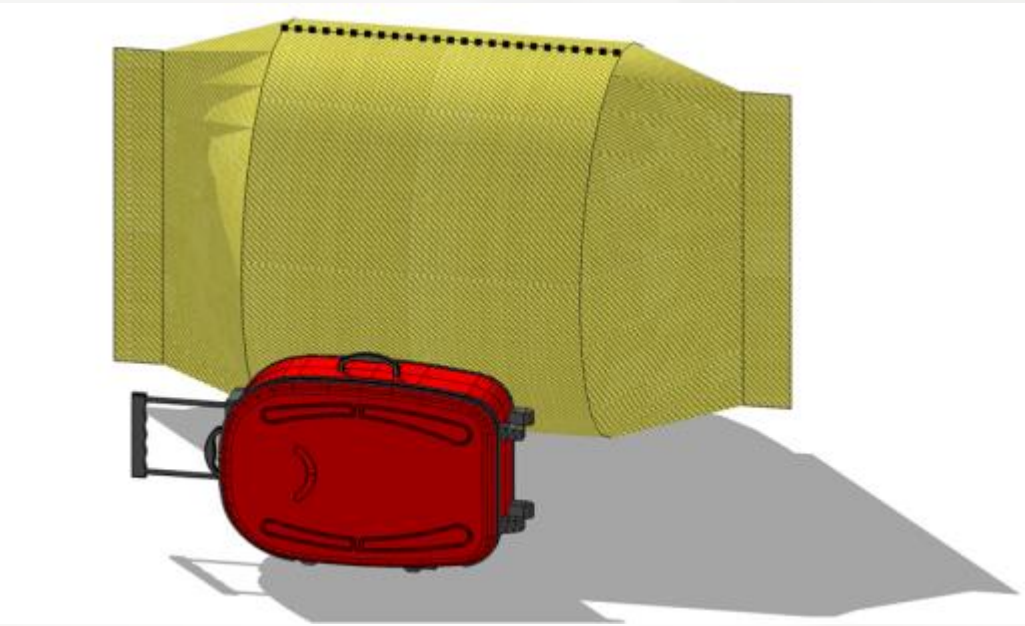
Cargo Blast Containment Unit



Cabin Blast Containment Unit

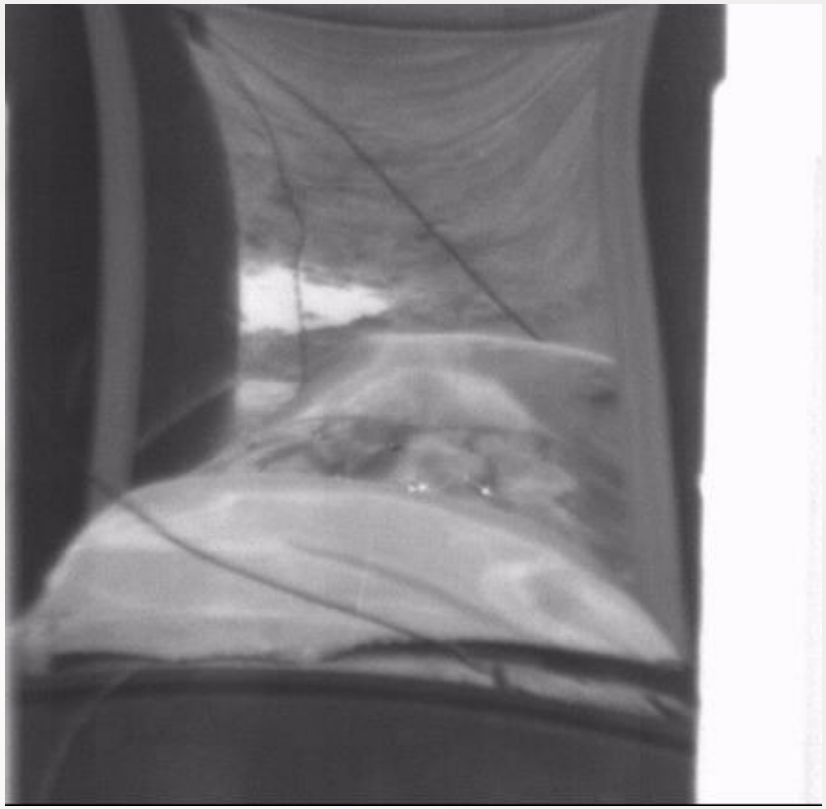
Courtesy: Virgin America A320 cabin

Cabin Blast Containment Unit

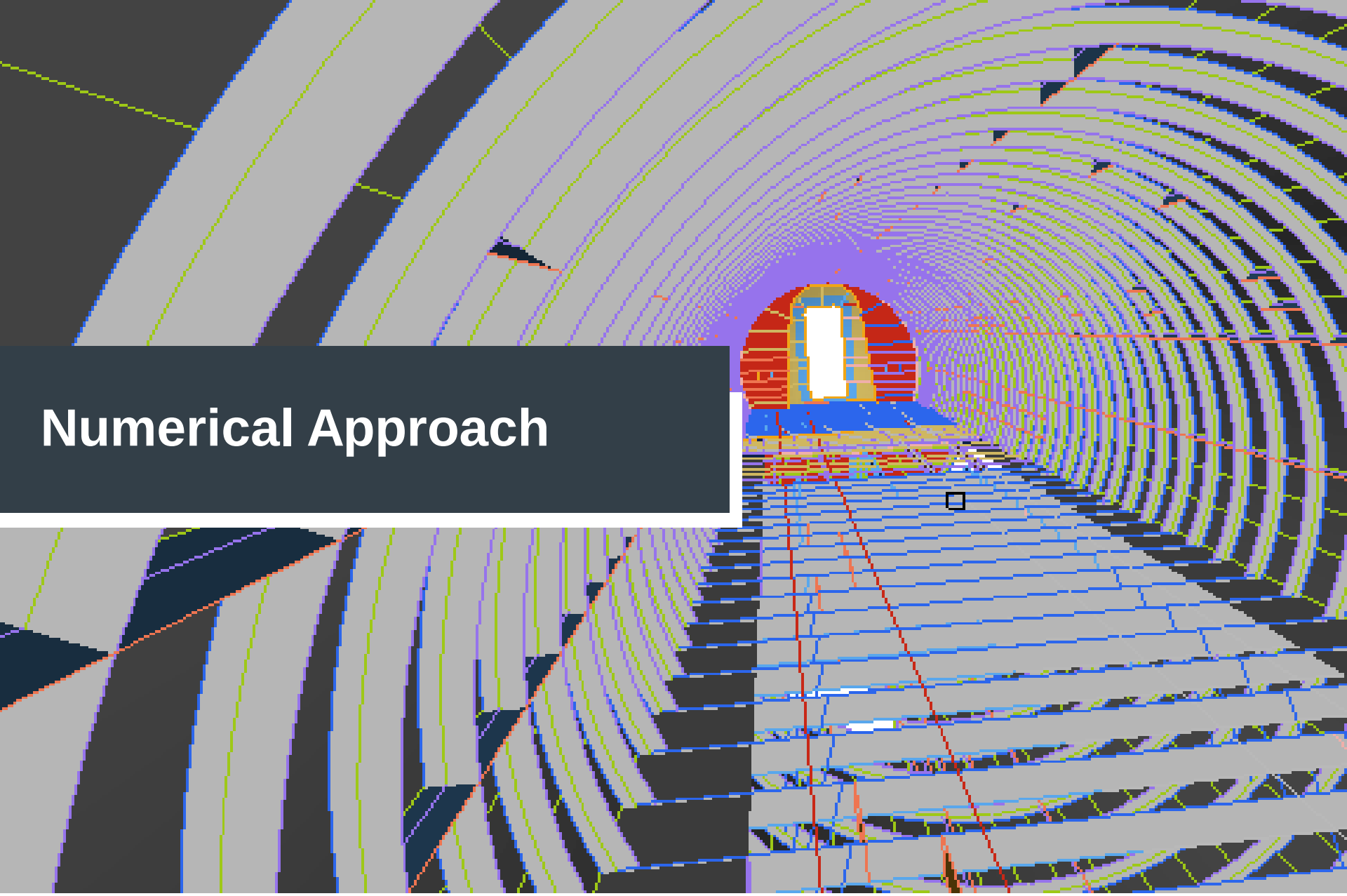


Least Risk Bomb Location (LRBL)

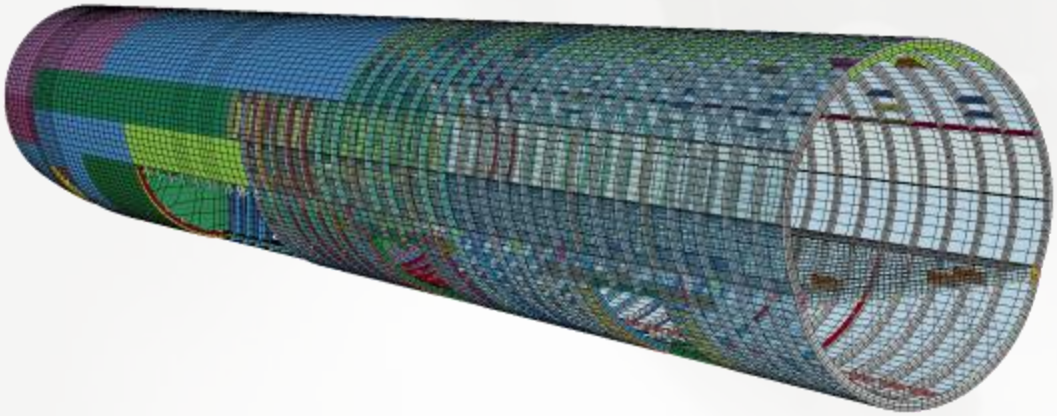
Cabin Blast Containment Unit

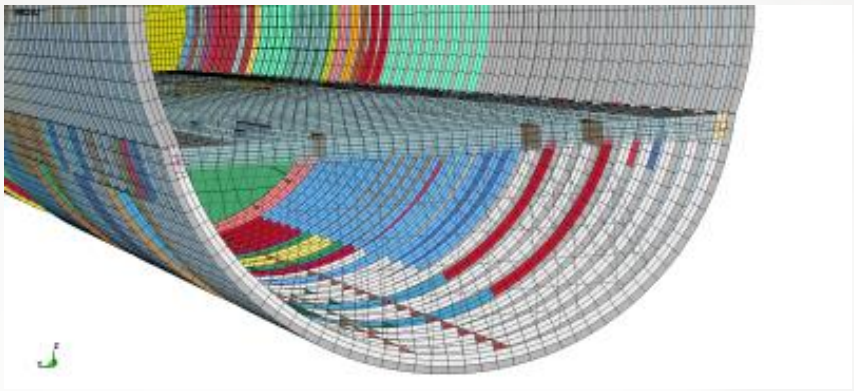


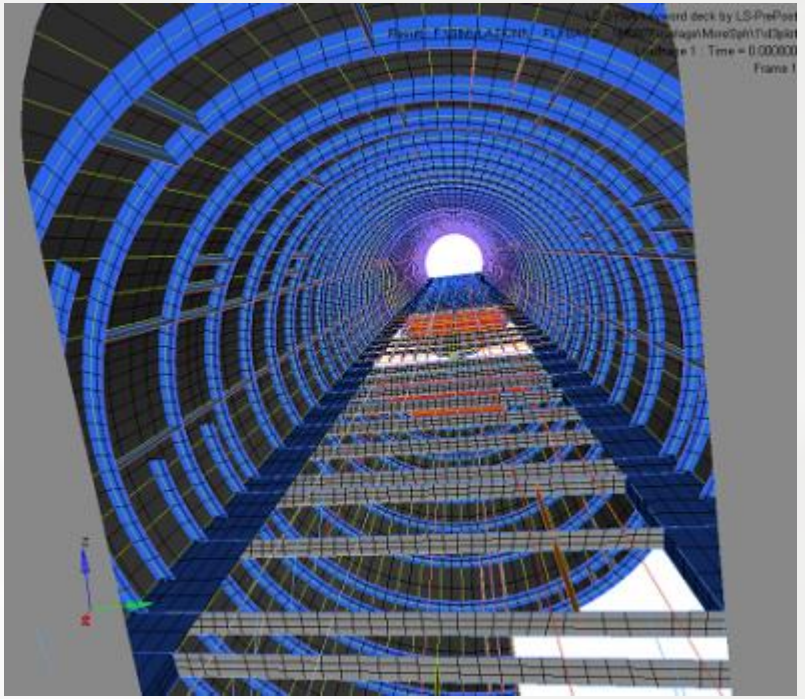
Numerical Approach



FE Model of the MD80-87 Fuselage





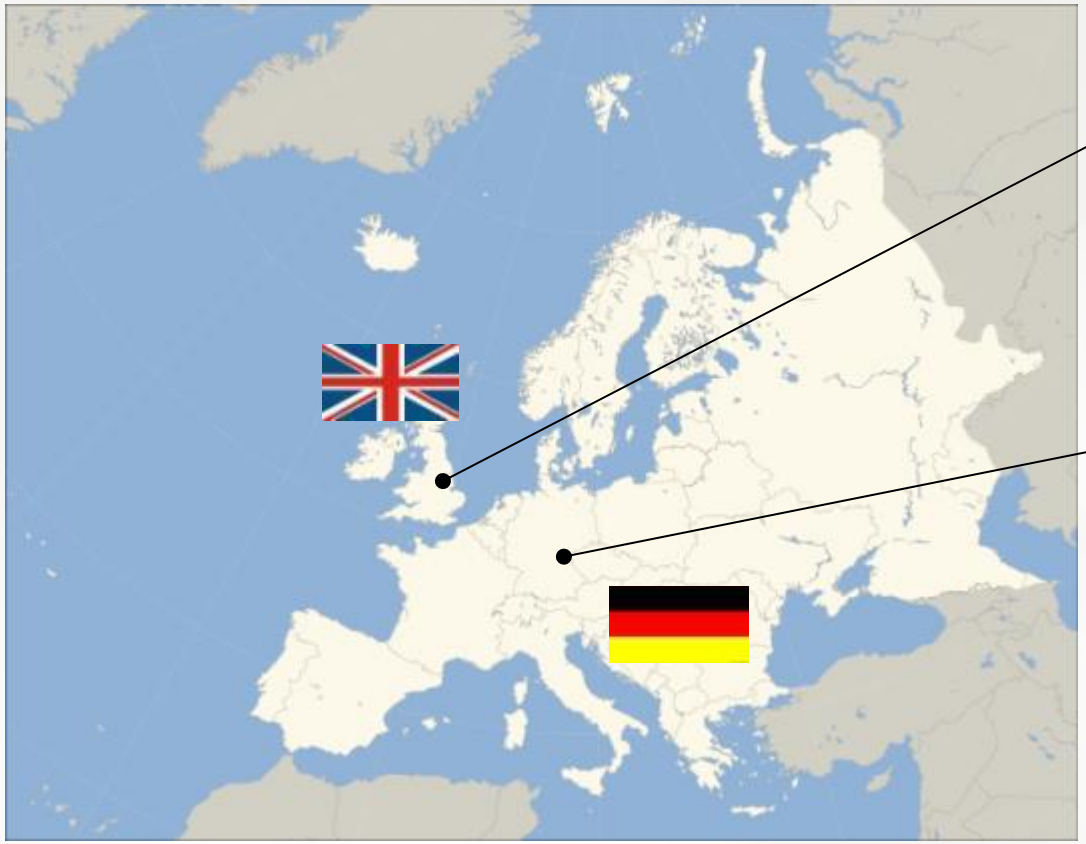


Blast tests

Full Blast Tests

- Illustrate efficacy of bag in a wide and narrow body aircraft
- Determine structural interactions between hold bag / cabin bag and aircraft
- Measure any physiological effects on passengers caused by event in hold / cabin contained within bag

Full scale blast tests



UK, Cotswold Airport
Wide body aircraft - (Boeing 747)

Germany, Berlin - Narrow body aircraft (MD80-87)

Contact

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