Self-Containing Breathing Apparatus (SCBA) Composite Cylinder Service Life Assessment

Research and Development Forum

January 17, 2014

Mark Toughiry

PHMSA

Self-Containing Breathing Apparatus (SCBA) Composite Cylinder Service Life Assessment

Objectives :

1. Evaluate Commonly Used SCBA Composite Cylinders For Additional Usage Beyond Their 15 Year Service Life

2. Evaluate Accuracy And Repeatability Of Modal Acoustic Emission Examination (MAE) For Requalification Of These SCBA Composite Cylinders

What is DOT – CFFC Cylinder That is used for SCBA Service?

DOT–CFFC = Carbon-Fiber Fully Wrapped Composite cylinder with Reinforced Aluminum Liner

Made in Accordance with

DOT – CFFC Standard

Typical SCBA, DOT–CFFC Cylinder

- Volume = 6.9 Liter (415 Cu. In.)
- Amount of Breathing Air = 45 Minutes Use
- Service Pressure = 4,500 psi
- Max. Service Life = 15 years
- Liner = Seamless Aluminum
- Shell = Carbon Fiber
- Safety Factor (Burst/Service) = 3.4

Testing Used to Assess Performance of DOT CFFC Cylinders for Additional Service Life (Beyond 15 yr.)

- **Mechanical Testing Used** – Design Qualification Testing on Sample of Cylinders that are Close to End of Service Life.

- **Nondestructive Testing (NDT)** – On Each Cylinder during Mechanical Testing.

Mechanical Testing Includes

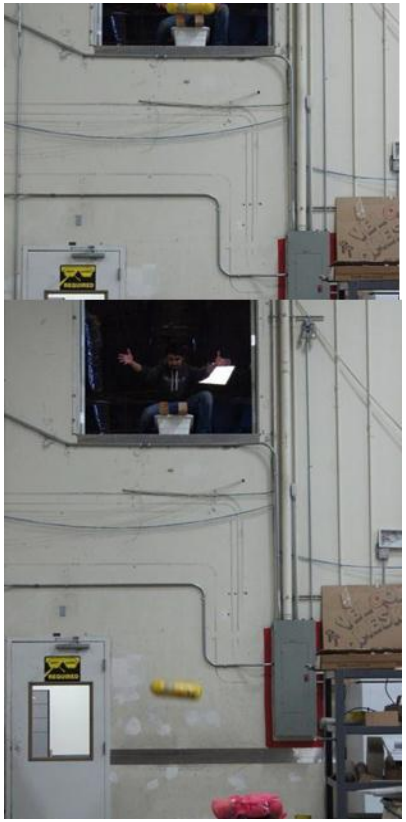
- Burst
- Fatigue Cycling
- Flaw Tolerance
- Drop

Burst Testing

Fatigue Cycling

Flaw Tolerance

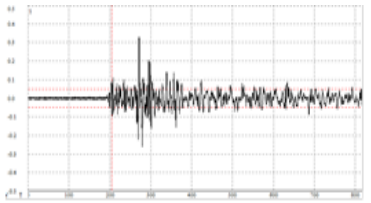
Drop Testing

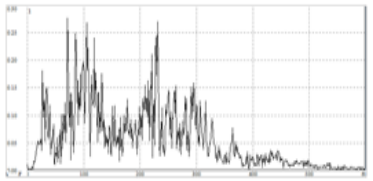


Nondestructive Testing (NDT)

- Strain Gaging

- Modal Acoustic Emission (MAE)



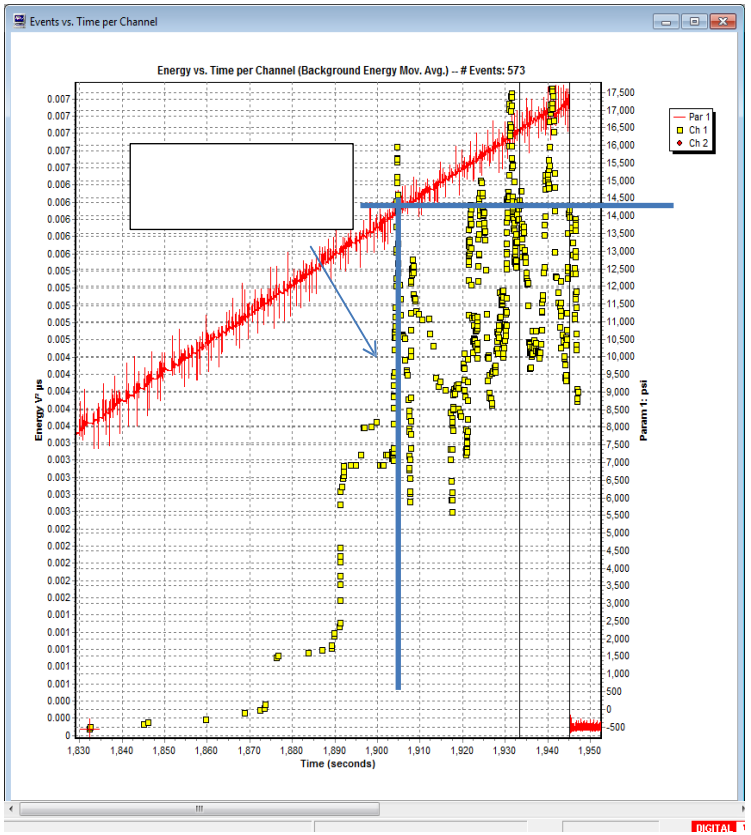


Strain Gaging

What is Modal Acoustic Emission (MAE)?

MAE is a relatively new NDT method. In this project, MAE is Used to Determines the Types of AE Sources in the Composite Cylinder Wall (e.g. Fiber Breakage, Delamination)

MAE Testing Used on Each Cylinder During Mechanical Testing



Conclusion

Following Will be Achieved Upon Completion of This R&D Project:

1. Whether or Not SCBA/DOT CFFC Cylinders Can be Used Beyond Its 15 year Service Life?

2. Whether or Not MAE Testing Can Reliably be Used for Requalification of DOT CFFC Cylinders?

Questions?