General Plastics supplies aerospace and defense manufacturers with build-to-print flexible foam products and aerospace-grade rigid foam core materials.

WHERE GREAT IDEAS TAKE SHAPE

Established in 1941, General Plastics has been supplying the global aerospace industry for over 60 years. Among its capabilities:

- Sheet stock, machined parts and complex laminates
- Finished parts/build-to-print
- On-site R&D, chemists and scale-up engineers
- On-site analytical/testing capability
- ITAR compliant
KEY TAKE-AWAYS

COMPOSITE MATERIALS
  Overview
  Industry Trends

FST/OSU
  Testing Process
  Requirements

FR–3800 FST FOAM
  Features and Benefits
  Applications
COMPOSITE MATERIAL

Benefits of Composite Core Materials

- Reduced weight
- Environmental impact
- Increased design capabilities
45 Years of Composites Evolution (Commercial Transports)

Source: www.compositesworld.com
PASSENGER JET OPERATING EXPENSES

Fuel

Source: U.S. Energy Information Administration

U.S. Gulf Coast Kerosene – Type Jet Fuel Spot Price FOB
TRENDS IN THE AEROSPACE INDUSTRY:

- FAA specifications
- Weight considerations
- Drive down costs
- Other requirements
FST/OSU SPECIFICATION

Fire
Smoke density
Toxicity
Ohio State University
-Heat Release Method

FAA FST/OSU requirements:
65/65/200
FST/OSU SPECIFICATION

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FAA FST/OSU requirements:
65/65/200
<table>
<thead>
<tr>
<th>FAA Regulation</th>
<th>FAR Paragraph No.</th>
<th>Airbus</th>
<th>British Aerospace</th>
<th>Boeing</th>
<th>Douglas</th>
<th>Shanghai Aircraft Research Institute</th>
<th>ASTM</th>
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<tr>
<td>Burn Test Description:</td>
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<td>Piping/hose assemblies</td>
<td>25.1183 (a)</td>
<td>ISO/DIS 2685</td>
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<td>Fire zone wire</td>
<td>25.1359 (b)</td>
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<td>MIL-C-25038</td>
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<td>Wire insulation</td>
<td>25.1359 (d)</td>
<td>ABD0031/AITM 2.0005 (2)</td>
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<td>60-second vertical</td>
<td>25.853 (a)</td>
<td>ABD0031/AITM 2.0002A(2)</td>
<td>BACM 1551A</td>
<td>BSS 7230 F1</td>
<td>DMS 1510</td>
<td>ASTM F 501</td>
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<td>OSU heat release</td>
<td>25.853 (a-1)</td>
<td>ABD0031/AITM 2.0006 (2)</td>
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<td>BSS 7322</td>
<td>DMS 2277</td>
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<td>12-second vertical</td>
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<td>BSS 7230 F2</td>
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<td>2.5-in/min horizontal</td>
<td>25.853 (b-2)</td>
<td>ABD0031/AITM 2.0003 (2)</td>
<td>BACM 1555A</td>
<td>BSS 7230 F3</td>
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<td>4-in/min horizontal</td>
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<td>Oil burner seats</td>
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<td>BSS 7303</td>
<td>DMS 2274</td>
<td>HB 7263</td>
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<td>DMS 1513</td>
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<td>30 second, 45 degree</td>
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<td>BSS 7230 F5</td>
<td>DMS 1508</td>
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<td>Oil burner, cargo liner</td>
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<td>ABD0031/AITM 2.0010 (2)</td>
<td>BAEP 4508</td>
<td>BSS 7323</td>
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<td>Radiant heat test</td>
<td>TSO-C69a, Appendix 2</td>
<td>TSO</td>
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<td>BSS 7315</td>
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<td>Other NBS smoke</td>
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<td>Toxicity</td>
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<td>Lot</td>
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<td>ASTMD 2863</td>
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*ASTM test method being written by subcommittee F7.06.
HOW TO CHOOSE AEROSPACE MATERIALS

Things to Consider:

- Processing limitations associated with materials
- Strength-to-weight ratio
- Cost Performance
- Safety Requirements
LAST-A-FOAM® FR-3800 FST

- PU-based core material
- Halogen-free
- Passes FST OSU 65/65/200 specification
- Physical properties congruent with other PU-based core materials
  - 18, 20 pcf densities meet BMS8–133

https://www.generalplastics.com/fst-3800.html

www.generalplastics.com
<table>
<thead>
<tr>
<th></th>
<th>LAST-A-FOAM® FR-3806 FST</th>
<th>PESU</th>
<th>PMI</th>
<th>PEI</th>
<th>End-Grain Balsa</th>
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<tbody>
<tr>
<td>Nominal Density (lb/ft³)</td>
<td>6</td>
<td>5.6</td>
<td>4.7</td>
<td>4.7</td>
<td>6.5</td>
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<td>C/S (psi)</td>
<td>144</td>
<td>174</td>
<td>217</td>
<td>160</td>
<td>980</td>
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<td>C/M (psi)</td>
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<td>11188</td>
<td>NA</td>
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<td>Shear Strength (psi)</td>
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<td>203</td>
<td>188</td>
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<td>Shear Modulus (psi)</td>
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<td>Tensile Strength (psi)</td>
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<td>Smoke Density</td>
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<td>Total HR</td>
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<td>Peak HR</td>
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<td>Fail</td>
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<tr>
<td>Tg (F)</td>
<td>310</td>
<td>425</td>
<td>350</td>
<td>190</td>
<td>&gt;350</td>
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<td>FR-3800 FST FOAM OFFERS</td>
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<tr>
<td>▶ Passes Fire/Smoke/Toxicity (FST) requirements</td>
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<tr>
<td>▶ Meets OSU 65/65 heat release standards</td>
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<tr>
<td>▶ Alternative to thermoplastics and honeycomb in FST applications</td>
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<tr>
<td>▶ Withstands process temperatures up to 310°F</td>
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<tr>
<td>▶ Range of densities: 3 - 40 pcf</td>
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<tr>
<td>▶ High strength-to-weight ratio from crosslinked structure</td>
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<tr>
<td>▶ Bonds well with composite skins</td>
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<tr>
<td>▶ Resistant to most chemicals and solvents</td>
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<tr>
<td>▶ Will not support fungal growth</td>
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<tr>
<td>▶ No edge-closing or filling needed</td>
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</tbody>
</table>
OPTIONS FOR USE
THERMOFORMABLE

- Easy processing
- Drape / mold forming
- Can form all densities
SANDWICH PANEL LAYUPS

- Process using standard vacuum bag layup techniques
- Processing temperatures above 275°F
POUR IN PLACE PARTS

- High levels of detail
- Complex shapes without machining
- Smooth or textured skin
HIGH MACHINABILITY

- Smooth surface finish
- Minimal dust
Conclusion

COMPOSITE MATERIALS
Weight reduction
Enhanced Performance
Overall cost reduction

FST/OSU
FAR flammability specs
Materials testing

FR-3800 FST FOAM
High strength to weight ratio
Low cost material
Versatile processing
Q & A

G. Joel Meyer, Ph.D.
Chemistry Laboratory Manager
General Plastics Manufacturing Co.
joel_meyer@generalplastics.com