DEVELOPMENT OF A SYNTACTIC-BASED SANDWICH COMPOSITE FOR BLAST-RESISTANCE MODULAR BUILDINGS

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Since the inception of the blast resistant modular (BRM) construction industry in the early 1990s, the favored material of construction has been steel. Steel is well suited for this application as the mechanical response is favorable for mitigating the overpressure from a blast event thus protecting the inhabitant and equipment inside the structure. The main drawbacks to using steel-based construction are the high weight, high maintenance cost because of corrosion and the large amounts of welding needed to manufacture such a structure. Each of these drawbacks has a direct and significant impact on increasing the life cycle cost. Incorporating composite materials can address each of these drawbacks. Drawing analogies from the evolution of commercial aircraft, we use similar light-weighting strategies to replace and reduce part-count of metal components with multifunctional, lightweight composite-based solutions. We focus on polymer-based sandwich composites with the core made from syntactic foam. We fully characterize the mechanical and physical properties of the syntactic core and sandwich panel. In addition, we present the response of a panel and the BRM structure when exposed to an eight psi, 200 milliseconds overpressure event, simulating and blast event. Finally, we will conclude with a cost-benefit analysis showing that, as seen in the aircraft industry, replacing metals with composite materials have higher initial raw material costs but will reduce the overall lifecycle costs.