A BLAST AND BALLISTIC RESILIENT TEMPORARY SHELTER SYSTEM

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Lightweight temporary shelters are often required by armed forces or civil authorities in areas at risk from enemy action, terrorist attack, or accidental explosions. An extensive program of full-scale blast, fragmentation, and ballistic trials, computational modelling, and component testing has been conducted to develop and validate a novel deployable 'air-beam' shelter having high resilience to blast and ballistic threats. The air-beam shelter has no hard framing or paneling in its construction and is self-supporting by means of large columns of polyester-fabric tubing formed into arches and lightly pressurized; spans to 24m can be enclosed. Such a structural system flexes under blast ultimately taking loads as membrane and tensile stresses for which the materials are inherently strong. The mode, rate, and extent of wall deflection can be largely controlled by special tethering which also mitigates the degree of blast pressure transmitted to the interior. An optional external geotextile curtain-wall supported by flexing masts provides a high degree of ballistic protection and additional blast mitigation for the shelter.

Due to the highly responsive nature of the fabric surfaces, computational simulations require a fully coupled fluid-structure interaction (FSI) approach. Computational modelling using the FE code LS-DYNA coupled to blast CFD code CHINOOK has allowed optimizing of the complex response dynamics; blast simulations show the system should survive blasts as severe as 70kPa x 100ms. Full-scale blast field tests instrumented with manikins have validated the blast resilience and protection to occupants to levels of 40kPa x 36ms. Preliminary fragmentation and ballistic trials show the geotextile curtain-wall will stop fragmentation from 155mm artillery at 5m standoff, exceeding Level V protection under STANAG 3459.