

A Study in the Utility of Elastic Material in Expandable Containment Units

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Abstract

The idea of containment units that are both rigid and expandable has been of interest in the field of modern technology in recent decades. This concern is caused by the advantages that stretchable materials would bring to containment units with respect to population growth and space exploration. The world population is currently growing at an exponential rate, and as the population grows, the more important it will be to have containment units that can enclose a small volume in its normal state, as well as a larger volume in an expanded state without compromising the integrity of the container. In order to achieve this integrity, a new type of storage container that utilizes the inherent strengths of both flexible and rigid materials will be prototyped and tested in a research study. The purpose of this study is not to find the final answer to the question of "How will we do it?" This study will narrow the range of possible answers for the benefit of future research projects and teams that also want to apply elastic materials to stiff components. The container needs to stand rigid on its own, but also expand in horizontal directions to hold objects larger or more abundant than the container's original volume. Applications include backpacks, mailing packages, shipping containers, and long-term storage units. This study will research the utility of elastic materials in expandable storage devices via an expandable backpack as a scaled-down case study. The backpack will utilize grooved panels made of lightweight, rigid materials such as elm-wood or PVC-plastic; in conjunction, elastic cloth--made of a mix of nylon and spandex--will be applied to the joints of the stiff panels to aid in the creation of the desired containment unit. Male and female contact points will be placed between the individual panels to allow a firm, primary state of the unit, while maintaining structural integrity when in an expanded state afforded by the elastic cloth. The front and back sections of the container will be comprised of two or three panels, but the sides will be comprised of panels numbering between five and ten so that expansion is more likely to occur in multiple directions. This segmentation will lessen the stress on the fabric to increase its longevity. To create this expandable container, multiple samples of fabrics with varying ratios of nylon-to-spandex will be tested, as well as the ratio of rigidity-to-weight of various woods and plastics to find the optimal ratio of flexibility-to-rigidity. Upon deciding the materials, a prototype will be built and tested. To test the backpack, school paraphernalia of varying numbers with differing weights and dimensions will be placed into the study backpack. An experimenter will wear the backpack for varying amounts of time to gauge how the backpack performs under certain rigors that over time. The study will also test the increase of volume afforded by expansion. Any percentage of expansion between five and ten percent in increased volume will determine the study successful.