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THE SPACE BRICK FLAME RETARDANT EXPANDED POLYPROPYLENE MODULAR ELEMENT FOR SPACE BUILDING

Abstract

1.Introduction Since 2016 Sabelt supply EPP foam parts for the floor/roof/walls of NG Cygnus cargo module. The production process is by mold, where the polypropylene granules are expanded by steam, keeping the internal mold shape. The material tested successfully for mechanical and chemical properties. The lightness of material makes possible a sensible mass reduction, increasing the payload capacity. It has been certified in Europe (ESA) and US (NASA). Sabelt realized that the cost of mold construction was an issue for the utilization of the material. Different molds are needed to change shape and they are expensive.

2.Solution Different approach was needed to solve the issue, making the material more affordable reducing the missions cost. For this Sabelt invented modular EPP elements able to be joined in three different dimension to build larger parts, adding or removing pieces gives the flexibility of building larger, longer or thicker elements. The junction is mechanical, resistant, easy, applicable for any dimension. We produced a prototype mold and modular elements samples to demonstrate the efficiency of the system. We are able to generate desk/decks, boxes, shelves, device protections, bags protections, walls, partition parts, panels.

3.Advantages The material is space qualified and approved for flight. The certified minimum weight achieved today is 35 g/l, making components exrtremely light. For logistic operations is possible to store the brick and build the boxes of needed dimensions, avoiding the massive storage of many different packaging. And when the payload is delivered, the box can be disassembled to create another one with different dimensions, or a completely different object. Re-using "used bricks" already available the mission would be able to create what is needed. EPP foam is a wonderful impact absorber, a great thermal isolator and a good acoustic isolator. All these performances can be increased simply increasing the material density. It is possible to insert the material (for screw) or create different mechanical junction. Quite important: the printed surface is very smooth and it does not generate any debris or FOD. 4.Potential The material is potentially applicable for ballistic structures to protect shelter or habitation. In logistic it is useful for payload accomodation: giving flexibility the size/shape and suitable for any kind of cargo parts. The production process involve these components: polypropilene granules, aluminum mold, electrical energy and steam. This make possible a future on-site production as a contribute for planet human outpost indipendence.