

Gordon L. Nelson, Ph.D.
Principal
Gordon Nelson and Associates
Melbourne, Florida 32902

Small Business Innovation in America's Space Program – From a NASA STTR Experience

I appreciate this opportunity to provide comments on “The Role of Small Business Innovation in America's Space Program.” My comments are based upon my experience on a NASA STTR which began in 2012 focusing on “New Flexible FR Polyurethane Foams for Energy Absorption Applications.” That STTR has progressed through Phase I (one year), Phase II (two years) and Phase IIE (one year), and is now in Phase III (in its third year). Polyurethane foams can be items such as seat cushions, mattresses, of which you are very familiar. However, significant flame retardancy is required in high hazard seating, Navy mattresses and many other applications.

This STTR project represents the development of a unique family of highly flame retardant, environmentally friendly, flexible polyurethane foams. The flame retardant package is non-halogen and chemically bound-in, meaning it is non-migrating, with low VOC (volatile organic carbons), resolving key concerns for environmental stakeholders. The goal was to exceed the flame retardancy of BX265 NASA SOFI (Spray on Foam Insulation) (354 Peak Rate of Heat Release by one Calorimetry at 50 kW/m² external flux, 1-inch thickness). Project foams perform down to 148 PHRR (less than one-half that of SOFI) (over 90% reduction versus 1670 for base foam). Foams meet Cal 133, BS5852 standards for seating, 16CFR1633, Cal 129 and NFPA 267 (Navy Modification) for mattresses, and the FAA oil burner test for commercial aviation seating, without additional fire barriers. All foams of course meet NASA 6001 Method 1. Some foams meet the US Air Force dynamic cushioning test for packaging. Foams can be made to any needed static stress performance, useful for energy absorption foams in automotive or aerospace applications. Some members of the family show enhanced cryogenic insulating performance versus SOFI at soft vacuum. Foams down to 1.8 pcf density are available. Thus there is a broad family of potential performance.

Part of the NASA vision was flexible insulating foam which could be used for cryo line repair, yet serve a variety of other applications during a mission. Indeed, project foams provide cost effective flexible polyurethane foams for cryogenic insulation, packaging, energy absorption materials, and flame resistant materials. Also, some 15 priority applications were identified by the project Commercialization Panel, including high hazard seating and mattresses, energy absorbing foams (automotive, aerospace), packaging foam (US Air Force), and anechoic chamber materials (electronic industry/airports).

NASA likes applications beyond NASA mission materials. During Phase III working with several leading companies we have focused on foams for prison mattresses, rail car seating, automotive headliners, and anechoic chamber materials. Using the automotive headliner materials as an example, currently the headliner composite (fabric, foam, and polyethylene film barrier) must meet the flammability requirement (MVSS302) utilizing a flame retardant fabric. As one goes to autonomous vehicles, a more pleasing environment will be needed versus the few

colors currently available for headliners. Flame retardancy will no longer be met by the fabric, but MVSS302 performance will need to be provided by the 3 to 4 mm of foam. Project foams at the required 1.8 pcf density can provide that performance.

The project has been very productive. I have the following comments based on my 7 year STTR experience:

The project had a Commercialization Panel using three internationally recognized consultants with polyurethane formulation, application, and standards/regulation experience. Several times at NASA briefings the question was raised why Commercialization Panels were not required. Perhaps they should be.

I served as the Small Business Concern (SBC) for the project. Florida Institute of Technology served as the Research Institute (RI) for the project. STTR requirements allowed the RI 40% of project funds and the SBC 60% (up to half for consultants and at least half spent directly by the SBC or 30%). This allowed me as a sole-proprietorship to function effectively. However, some STTRs and SBIRs require the SBC to have at least 50% of project direct expenditure which effectively excludes sole-proprietorships. We had that issue on an Army SBIR project. That is my first concern.

STTRs many times involve universities. The RI, in this case Florida Institute of Technology, involved 14 students (6 MS and 8 undergraduate students) in the project. Five of the 6 MS students were women and three of those were Hispanic. All but one of the 14 were from Chemical Engineering. Students have commented that they appreciated the exposure to real industrial applications as part of their project work, having the responsibility to meet real project goals and timelines. One should not forget that STTRs offer a great opportunity for student experience and exposure. Indeed, the lead MS student, Caitlin McKinnon, has had great exposure in managing a project group.

During Phase I (\$125k) the SBC needed to front \$60-70k since expenses are billed after the fact by quarter. That is difficult for sole-proprietorships, and would be particularly so for younger entrepreneurs. A Phase I up front initial payment would be useful and encourage new innovation. That is a recommendation.

I was approached on several occasions by individuals at other institutions about being the SBC on their projects. Their issue was the time necessary to complete the System for Award Management (SAM) registration process. Hearing about a potential award topic and being able to respond with the required documentation limits some people with clear specific expertise to respond. In my case I had been doing work at Kennedy Space Center for a good number of years. Projects were normally available only to small businesses, thus over the years I had built up experience in maintaining the necessary registrations, accounts, billing practices, etc. But, someone starting fresh would find it difficult to accomplish registration in the time and context of a specific project submittal deadline. That clearly limits fresh innovations.

I hope these comments are helpful. The STTR project over the last 7 years has been fun to work on. Thank you for your attention.

