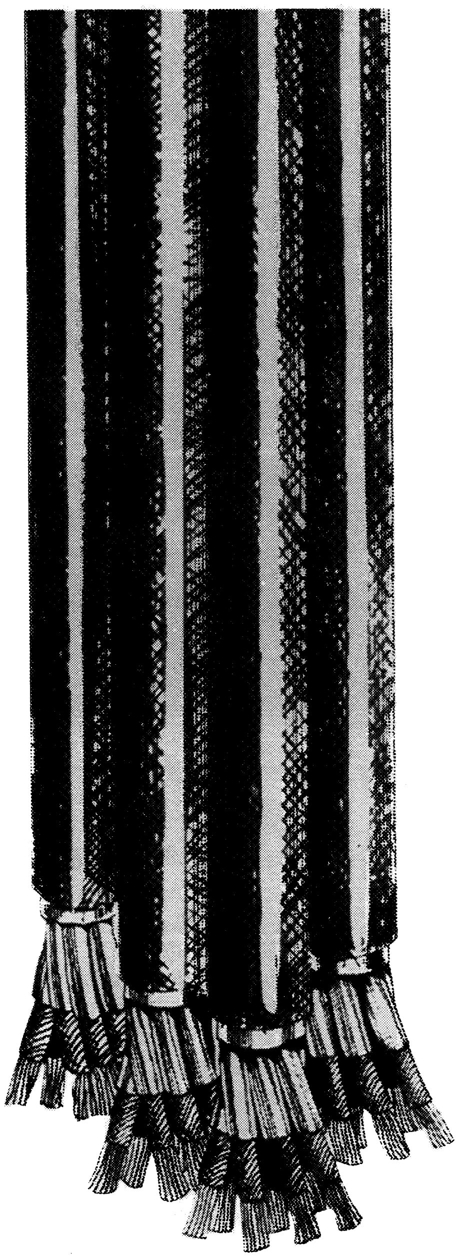
Technology for Transportation Safety

Fire-resistant materials for passenger-carrying vehicles lead a selection of spinoffs in public safety

Long concerned about fire and smoke hazards, the public transportation industry is constantly seeking improved passenger safety through development of materials more resistant to fire for use in vehicle interiors. Two new materials that originated in aerospace research represent steps in that direction.

In prototype service on cars of the Bay Area Rapid Transit system is a major development in public transportation safety, a new polyimide foam material with greater flame resistance than other materials currently employed in transit car interiors.



NASA technology was incorporated in development of a safety enhancing insulating material for Lo-Smoke cable assemblies used in rapid transit systems.

For several years, Johnson Space Center (JSC) has been conducting research on advanced flame-resistant materials toward minimizing fire hazard in the Space Shuttle and other flight vehicles. From that program has emerged a polyimide foam material that resists ignition better than any materials earlier used. It is applicable not only to flight vehicles, but also to surface transportation systems such as rapid transit cars, trains, buses and ships.

Known commercially as Solimide®, the material was developed under JSC contract by Solar Turbines International, San Diego, California, a subsidiary of International Harvester. The polyimide foam's broad safety potential stems from the fact that it does not ignite when exposed to open flames, it only chars and decomposes. Since the material does not "outgas" until it begins to char, it is also safer than current materials with respect to toxic fume generation. The polyimide can be made in two forms: a "resilient" foam for such soft components as seat cushions, and a rigid foam for door, wall, floor and ceiling panels.

A polyimide foam is in prototype service on the San Francisco/Oakland Bay Area Rapid Transit (BART) system whose officials were looking for a better interior material after a 1979 fire that caused one fatality. NASA's SRI International Technology Application Team, Menlo Park, California arranged for engineers from BART and the California Public Utilities Commission to witness full-scale polyimide fire tests at Johnson Space Center. SRI later provided samples of the material for independent BART testing. As a result of those tests, BART is using rigid polyimide foam as the core of car-end doors.

Resilient polyimide foam is being suggested as a replacement for polyurethane in airliner seat cushions, which represent the largest amount of flammable material in commercial transport interiors. In addition to reducing in-flight fire risks, polyimide offers bonus advantages. In a ground emergency, the material's flame resistance could lengthen—from two minutes to five minutes—the time needed for passenger evacuation. And since the foam is about 50 percent lighter than current materials, it could also help reduce airline fuel consumption by trimming aircraft weight. In a cooperative NASA/Federal Aviation Administration (FAA) program, polyimide seats will be evaluated in test fires at the FAA's Technical Center, Atlantic City, New Jersey.

NASA technology also contributed to development of a new type of smokeless wire and cable insulation. Because of several subway fires in which burning wire and cable insulation propagated the flames and created much smoke, the rapid transit industry placed high priority on a search for an affordable smokeless insulation material. To see if NASA research offered a solution, the SRI Technology Application Team circulated a statement describing the problem among NASA centers.

Jet Propulsion Laboratory (JPL) responded with a possible approach borrowed from solid rocket propellant technology: a technique known as bimodal distribution in which a binder—insulating material—is loaded with inorganic filler, thereby reducing the portion of the material that will burn and smoke. After extensive research, JPL produced a candidate formulation which minimizes smoke and flammability yet provides requisite mechanical strength.

Seeking to arrange commercialization of this technology, the SRI team interested Boston Insulated Wire & Cable (BIW) Company, Boston, Massachusetts. BIW expanded the bimodal distribution concept to include a number of additional formulations. The JPL work served as a departure point for BIW's development of an advanced wire and cable jacketing material with superior flame resistance and smoke retardation characteristics. The material is incorporated in the company's line of Lo-Smoke® cable assemblies, which are being supplied to mass transit systems in the United States and abroad.

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® Lo-Smoke is a registered trademark of Boston Insulated Wire & Cable Company.