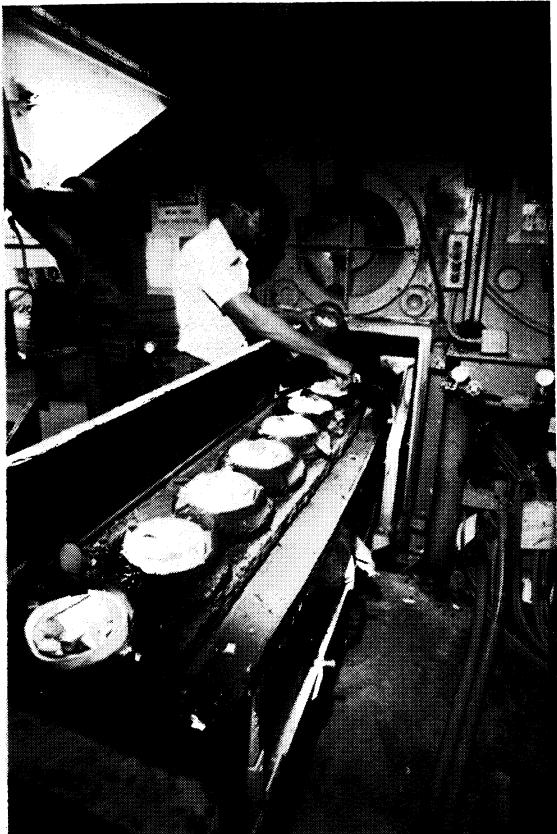


Echo's Legacy

Space-spurred expansion of metallized products manufacture exemplifies the breadth and economic value of aerospace spinoff



Launched 20 years ago, Echo 1 was NASA's first experiment in satellite communications. The satellite was simply a very large balloon, its diameter roughly equivalent to the height of a 10-story building, which served as a space relay station for reflecting communications signals from one point on Earth to another.

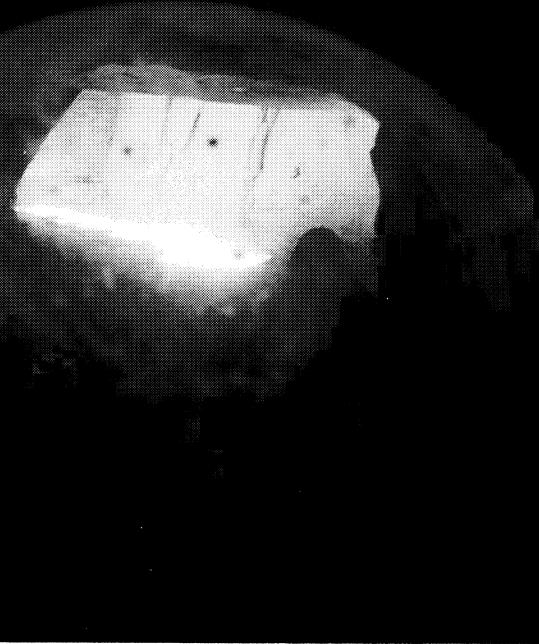
In developing Echo 1, NASA needed a special material for the balloon's skin. For "bouncing" signals, the material had to be highly reflective. It also had to be lightweight and exceptionally thin so that it could be folded into a beach ball-size canister for delivery to orbit, where the balloon would automatically inflate. The material selected was mylar polyester coated with a reflective layer of tiny aluminum particles so fine that Echo's skin had a thickness about half that of the cellophane on a cigarette package.

Metallization—the process of coating plastics or other materials with a superfine mist of vacuum-vaporized metal to create a foil-like effect—was not an exotic space-age development. In fact, it originated in the 19th century, but the technology and its applications developed slowly. By the late 1950s, when Echo was in design status, there was little that could be called a metallization industry; metallized plastics were being produced commercially, largely for decorative purposes, but the market was slim and production was of very limited order.

Echo 1 became the catalyst that transformed a small-scale operation into a flourishing industry. Echo requirements triggered extensive research and development of metallization techniques for the special

considerations of space use. This led to further space applications, mostly for thermal radiation insulation; metallized film was used on virtually every U.S. spacecraft from early satellites of Echo's vintage through the manned Apollo and Skylab programs. The impetus thus provided spurred new Earth applications and resulted in development of a broad, still-growing line of commercial metallized products.

The original Echo contractor was acquired by another company, which in turn was sold to the current inheritor of the NASA-sponsored technology—Metallized Products Division of King-Seeley Thermos Company (KST), Winchester, Massachusetts. KST has significantly improved the technology of vacuum metallizing plastic films and expanded the process to include a number of metals other than aluminum, among them gold, silver, copper and zinc; the range of applications for industrial and consumer use has similarly expanded. KST markets some products itself, in other cases supplies metallized rolled sheet materials for use in products manufactured by other firms. The total product line embraces scores of items from insulated outdoor garments to packaging materials for frozen foods, from wall coverings to aircraft covers, bedwarmers to window shades, labels to candy wrappings, reflective blankets to photographic reflectors. Examples of the products are shown on the next two pages and in the Home and Recreation chapter, page 124.



The photo sequence illustrates the process whereby multipurpose metallized plastic film is manufactured by the Metallized Products Division of King-Seeley Thermos Company. At far left, a technician is preparing aluminum for a vacuum metallizing run. The view through the port of the vacuum chamber (above) shows the aluminum being vaporized at temperatures of more than 2,000 degrees Fahrenheit. As the aluminum vapor rises, it is deposited evenly on rapidly-moving plastic film. At right, an employee inspects the finished product; in the background is the vacuum metallizing chamber.



The metallization story is an excellent example of the aerospace spinoff process. This instance involves a technology that existed before the NASA application, but space use prompted far greater commercial applicability. There are many similar examples, where adaptation of an existing technology to an aerospace requirement resulted in expanded markets for the technology, to the benefit of the U.S. economy. More often, spinoffs stem from technology specifically developed for aerospace purposes and later adapted to Earth needs and conveniences.

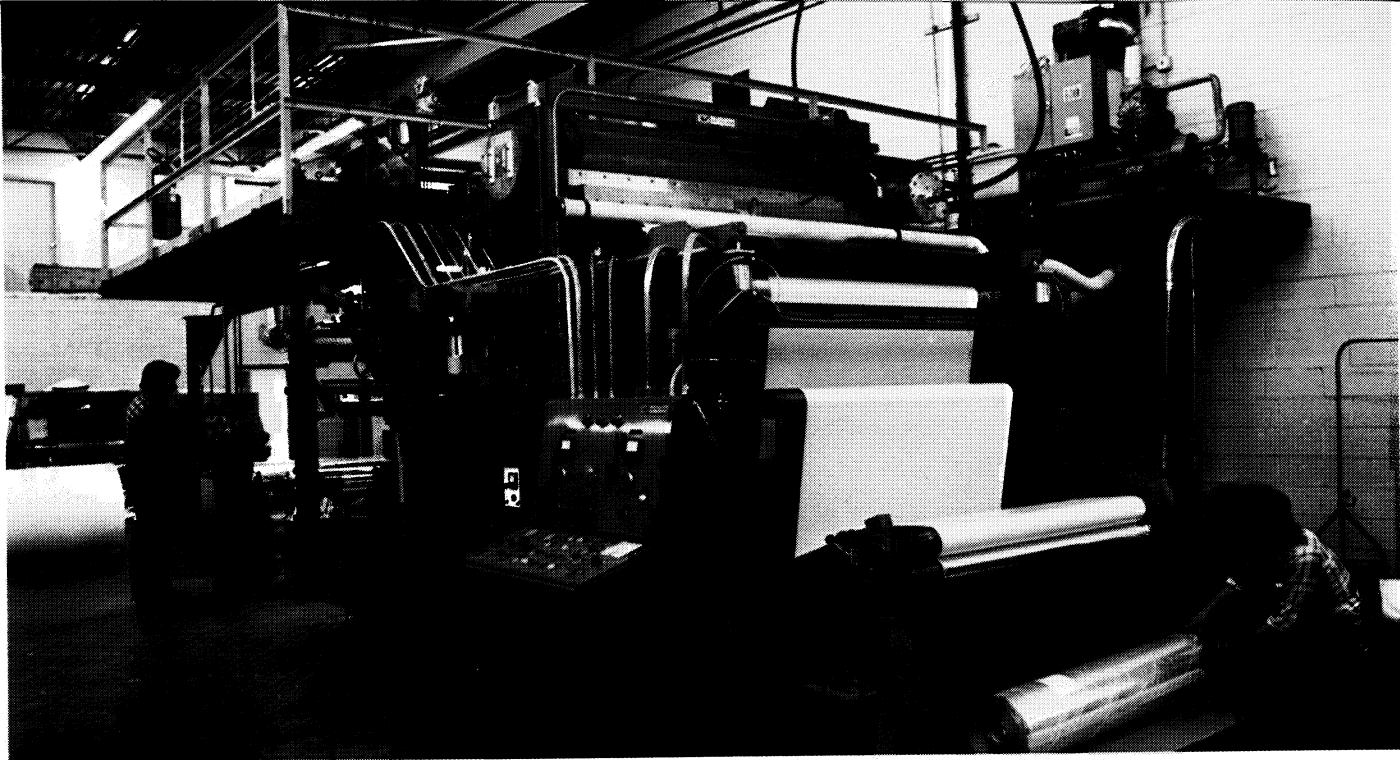
Metallization is a case wherein a single technology found multiple new applications. At times the reverse is true: multiple aerospace technologies are sometimes employed in development and manufacture of a single secondary application. The instrument of technology transfer may be an

entrepreneur who recognizes the potential of technology available for transfer and invests in its further development; it may be an aerospace contractor seeking product line diversification; or it may be an individual aerospace worker who moves to another industry, bringing with him aerospace-acquired skills and know-how applicable to non-aerospace use. NASA also serves as a transfer catalyst, by means of a number of mechanisms which are detailed in Section III of this volume.

Finally, the metallization example underlines the economic potential of aerospace spinoff. Many of the individual items within the broad metallized product line are sold in volumes reaching multimillions of dollars annually. Technology transfers

of that scope occur frequently. In other instances, spinoffs offer only moderate economic gain but provide public benefit in other ways, ranging from simple conveniences to significant developments in medical and industrial technology.

For the past 18 years, under its Technology Utilization Program, NASA has been actively engaged in promoting the secondary application of aerospace technology. The results have been impressive; thousands of aerospace-spurred or aerospace-originated innovations have found their way into everyday use. They are contributing to lifestyle improvement, helping solve major problems of public concern, and supporting the national economy by increasing industrial efficiency, stimulating productivity and creating new jobs. In the aggregate, they represent a substantial return on the aerospace investment.



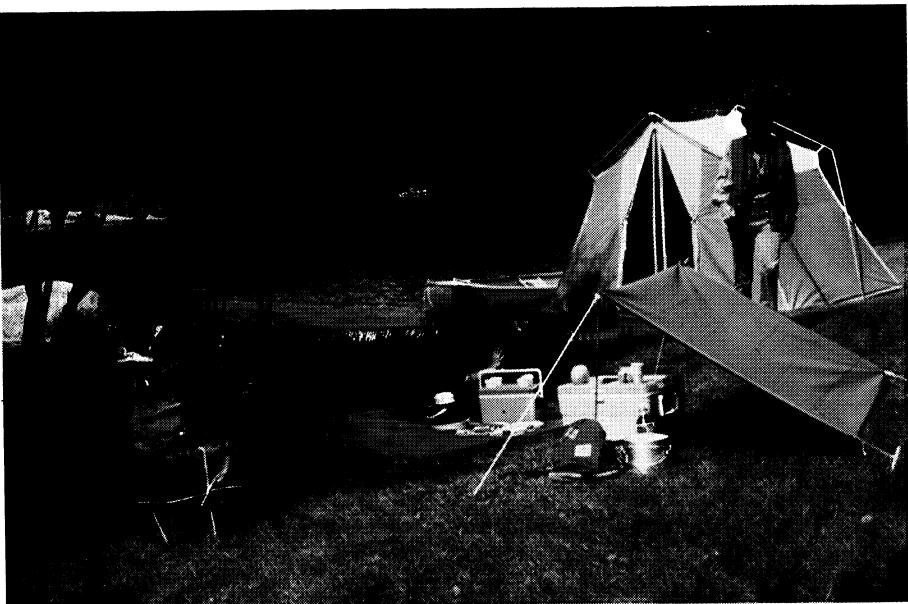
This sophisticated King-Seeley equipment is employed in a new electron beam processing technique for curing—instantly drying—solid coatings; the coatings are exposed to streams of electrons and cured in five-thousandths of a second. The machine also laminates sheets of material for greater strength and quick-cures the laminating adhesive.

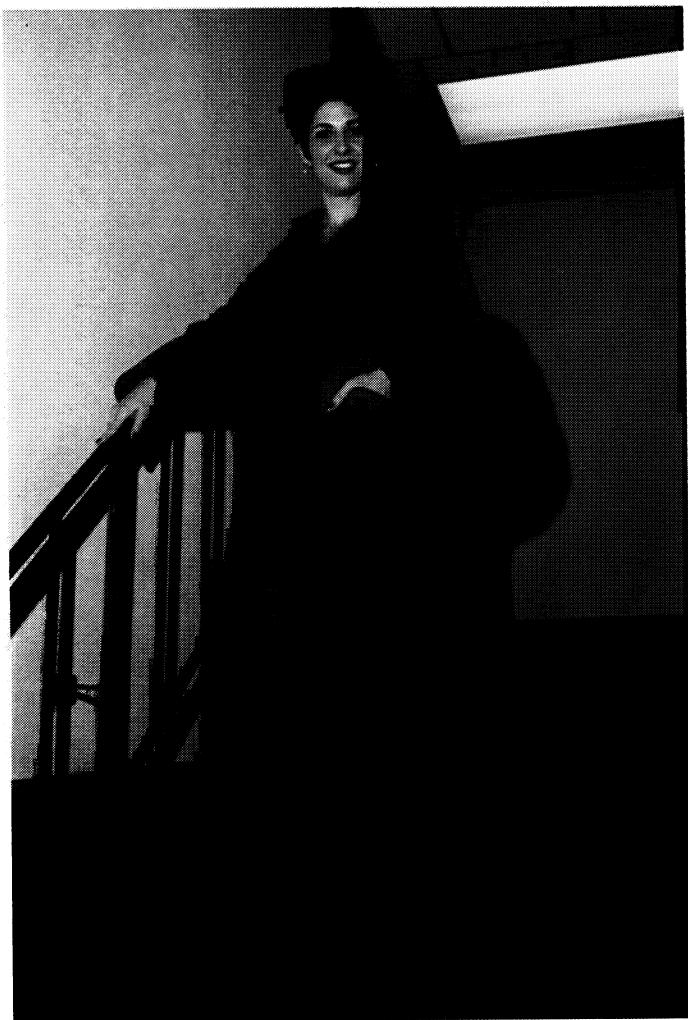


Among the most widely used of the many products made from metallized film is the high-reflectivity Thermos® Blanket, which keeps heat in or blocks heat out, depending on the use. For example, as a stadium blanket (above) it retains 80 percent of the wearer's body heat. For camping (above right), it serves as an insulated packaging

material, picnic spread, tent floor or heat-reflecting canopy for protecting food and beverage. The multipurpose blanket is marketed by King-Seeley's Thermos Division, Norwich, Connecticut.

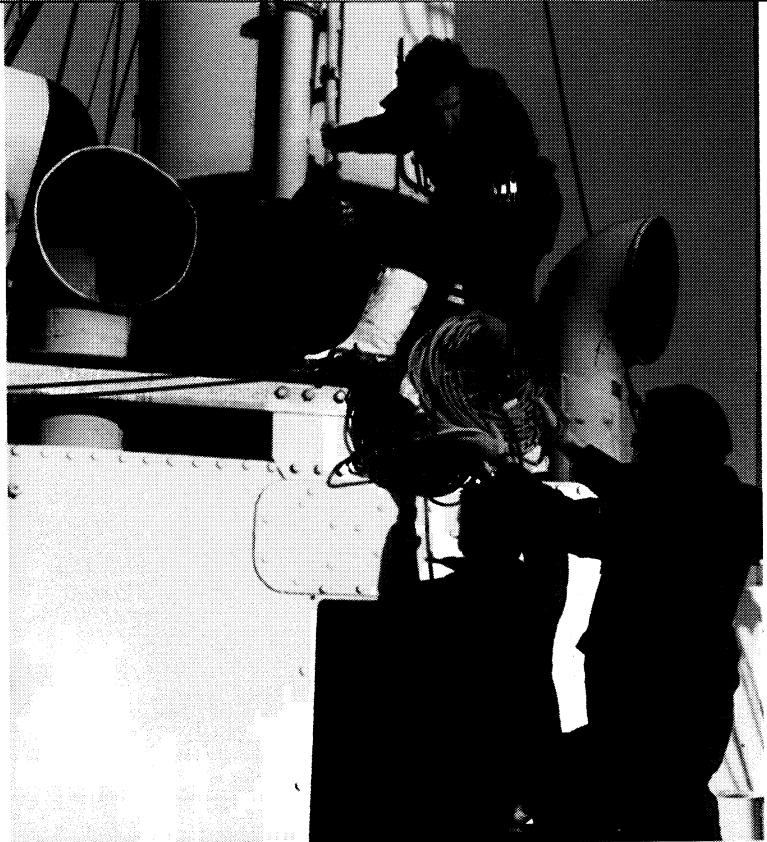
® Thermos is a registered trademark of King-Seeley Thermos Company.





In addition to marketing its own products, King-Seeley supplies a wide range of metallized material for products of other companies. An example is Astrolon® II, a multilayer derivative of astronaut space suit material which has exceptional heat reflection and heat retention characteristics. One of many applications of Astrolon II is the "Spacecoat," marketed by Spacecoat Garments, Ltd., London, England. Shown above, the lightweight Spacecoat is useful for home energy savers who are turning down their thermostats; it is a personal insulator whose reflective layer of vaporized aluminum slows loss of body heat by radiation. The Spacecoat is finding wide acceptance among elderly people living in minimally-heated quarters, as protection against respiratory and circulatory illnesses induced by lowered body temperature.

® Astrolon is a registered trademark of King-Seeley Thermos Company.



A special application of Astrolon II is its use in clothing worn by members of the 1979-82 British Transglobe Expedition, which is attempting the first polar circumnavigation of the world by land, sea and ice. Designed by Spacecoat Garments, Ltd., the lightweight, bulk-free suits pictured will provide protection from extreme cold as the expedition crosses the South and North Poles.

