



NASA Food Technology: *Incredible Edibles From Space*

Dining in space takes culinary art to new heights in orbit and on Earth. With the zest of space technology, astronauts today are able to take in a variety of tastes and textures that please their palates and satisfy their stomachs while orbiting hundreds of miles from home.

Space food has come a long way! Mercury, Gemini and Apollo crews squeezed their meals from tubes and popped freeze-dried snacks. Now, crews on the International Space Station enjoy warmed pouches of savory shrimp cocktail and apples with black currant juice.

A spinoff is an item designed for NASA use that later becomes a commercial product that benefits the American public. Food technology spinoffs benefit dining rooms throughout the world. NASA licenses dozens of space-age technologies and connects with the private sector through business-to-business partnerships to create products that improve lives here on Earth.

Advancements in food packaging, preservation, preparation and nutrition to meet the challenges of space resulted in many commercial products. Below are some of the products that Americans enjoy today.

It's a wrap

Materials and food packaging techniques used to protect space food are now used to protect foods on grocery shelves.

Space food serves the elderly

Combining the freeze-drying process with a unique packaging technique, NASA helped develop shelf-stable foods specifically designed for homebound senior adults. Responding to a request from the Texas Governor's Committee on Aging, NASA used its experience in producing spacecraft food and food systems to develop a food system for home preparation with minimum effort. This food system prompted companies to manufacture the compressed and freeze-dried foods developed by NASA for campers and as compact emergency food rations. **Spinoff 1976**

No refrigeration required

As a spinoff of Meal Systems for the Elderly, various commercial food processing firms began producing astronaut-type meals for public



distribution. Modeling the NASA meal system, Sky-Lab Foods, Inc., began offering the public a variety of freeze-dried foods that are reconstituted by adding water. Other meals were produced and packaged in retort pouches, an innovative flexible package that combines the advantages of the metal can and the boil-in-bag. Such packaging blocks moisture and oxygen, both enemies of food preservation, giving foods longer shelf life with no refrigeration required. **Spinoff 1980**

Reflective and protective

A metallic film first used as a signal-bouncing reflective coating for the Echo 1 communications satellite made way for packaging and protecting food while reducing packaging manufacturers' costs. The insulation barrier of aluminum-like material placed over a core of Mylar has also insulated and protected components of a number of other spacecraft.

Today, the metallic material, sandwiched between layers of plastic, has found its way into a wide variety of food packaging on Earth. Its reflective properties offer insulation and product protection for long periods, and it is less expensive and more easily machined than aluminum foil. **Spinoff 1988**

NASAfacts

Heat and eat

Astronauts' needing to prepare food easily and safely soon led to Earth-bound innovations in food preparation.



Cooking with air

Specialized fast-cooking equipment conceptualized for the International Space Station has pioneered a new generation of commercial and residential ovens. NASA sought help to create a compact oven for cooking that could offer flight crews variety, quantity and speed for meals in orbit.

The need for low-weight equipment that operates on little electrical energy and is easy to clean and repair spawned the development of air impingement technology. The concept uses jets of hot air at the top and bottom of the oven, heating food directly. An oven for the space station is now being used in the food service marketplace. The air impingement technology has applications in equipment for food processing plants and restaurants as well as vending and home applications. **Spinoff 1998**

Hot plates for hospitals

A development for meal service aboard Apollo spacecraft is now serving hot plates to patients in hospitals. Under contract to NASA, 3M developed a unique, electrically heated insulated dish that



served as both plate and oven when slipped into a control module. A commercial version of the food system was later developed for use in hospitals.

Improving on the system, 3M employed the technology of integral heating, also called cook/chill technology, to better serve the demands of hospital food preparation. The new system allows food to be prepared in advance, assembled in 3M Thermalization Carts and stored in refrigeration until mealtime. The trays, like their Apollo predecessors, convert electrical energy to heat with sensors that monitor and control the heat to an ideal serving temperature. **Spinoff 1992**

Safe and Wholesome

NASA's search for ways to provide not only tasty but safe and wholesome foods for astronauts living in space has led to food safety systems and new nutritional products here on Earth.

A recipe for food safety

Planning for crewed space missions, NASA sought help in its space food program to solve two principal problems: crumbs and disease-producing bacteria and toxins. The Pillsbury Company came to NASA's aid, producing the first astronaut meals for the Mercury, Gemini and Apollo crewed spaceflight programs. Bite-sized foods coated with a material that would prevent crumbs quickly solved one problem.



Quality control to prevent food poisoning required more intensive studies, which led to what is known today as the Hazard Analysis and Critical Control Point (HACCP) system. HACCP engages a process of testing not only the end product, but also the raw materials and the entire process in the food chain. The Pillsbury-manufactured food that went aboard Apollo spacecraft was produced under the HACCP system. The HACCP system, recommended by the National Advisory Committee on Microbiological Criteria for Foods, is now also employed by canned foods, meat, poultry and seafood inspection operations. **Spinoff 1991**

Food research fit for babies

As a part of NASA's ongoing research to fulfill astronauts' unique dietary needs while living in



space, an agency-sponsored study explored algae-based food products for long-duration space travel. As a result, Martek Biosciences Corporation developed an algae-based vegetable-like oil that contains two essential

polyunsaturated fatty acids, believed to aid in mental and visual development, called Formulaid. These two vital acids are found in human milk, but not in infant formulas. Martek incorporated the algae-based food product in infant formula as a healthy dietary supplement for bottle-fed babies. The algae-based formula has since been licensed to the Mead Johnson Division of Bristol-Myers Squibb, American Home Products and others.

Spinoff 1996

For more information about NASA's spinoffs, visit: <http://www.sti.nasa.gov/tto/spinoff.html>

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