

# Space Technology for Crop Drying

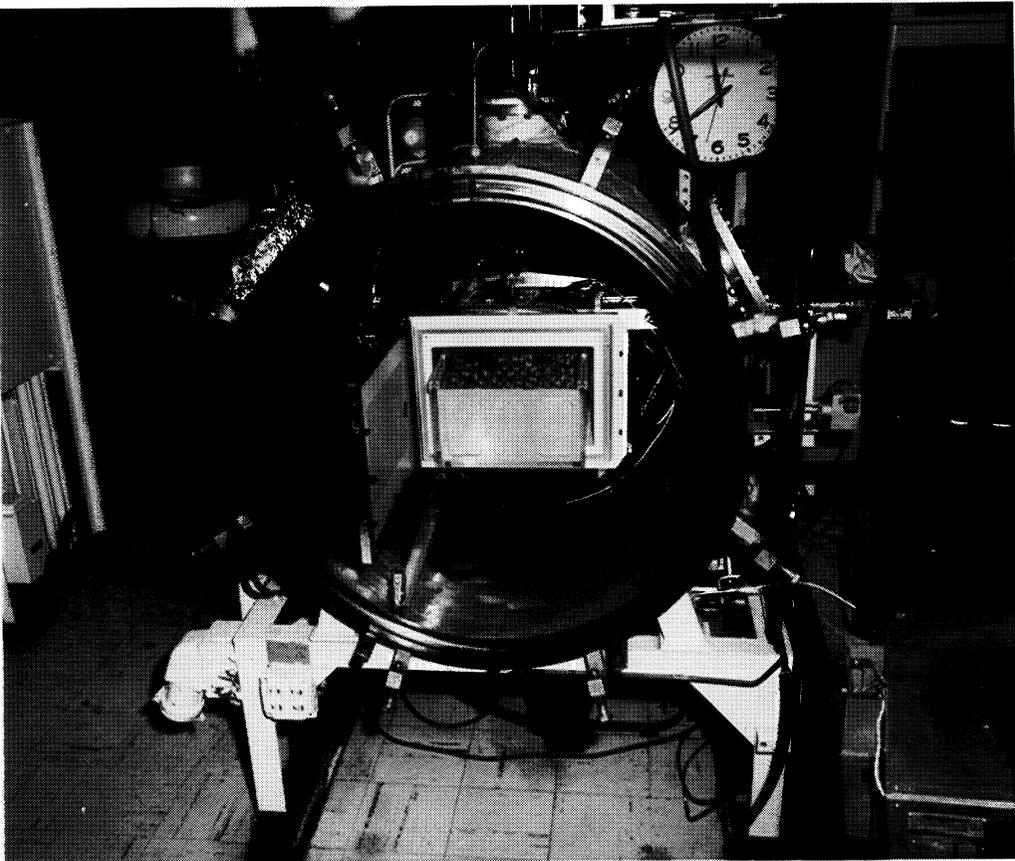
*A new system for drying farm produce, derived from the space simulator, leads a sampling of food and agriculture spinoffs*

NASA's major contractors operate vacuum chambers for testing spacecraft and components under the airless conditions they will encounter in space. Such systems, designed for research in an environment totally unlike Earth's, would seemingly have little utility beyond their original purpose. Yet they have proved surprisingly useful in secondary applications.

Drying documents, for example. Important, sometimes irreplaceable documents often get water-soaked by floods, storms, fire-fighting activities or pipe ruptures. Drying them by conventional methods is time-consuming and extremely expensive. But, since moisture evaporates rapidly in the near vacuum of the space simulator, the vacuum chamber serves as a highly effective, relatively inexpensive dryout tank. For several years, aerospace companies have been using their chambers to provide this unique spinoff service. A company with extensive experience in document drying—McDonnell Douglas Corporation, St. Louis, Missouri—went a step further and came up with a spinoff from the spinoff: a rapid, energy-conserving method of drying agricultural crops by means of a new system derived from vacuum chamber technology. Called MIVAC—a compression of Microwave Vacuum Drying System—it is in experimental operation at the Department of Agriculture's Coastal Plains Station, Tifton, Georgia.

MIVAC's development was sponsored by the Department of Energy because it offers potential for reducing the enormous amounts of energy required for drying harvested crops so they will not rot. Most farmers and warehouse operators now use hot air drying equipment powered by fuel oil, gas or electricity; drying is accomplished by blowing heated air over the produce, a relatively inefficient use of energy.

A distant cousin of the home microwave oven, MIVAC dries by means of electrically-generated microwaves introduced to a crop-containing vacuum chamber. The microwaves remove moisture quickly and the very low pressure atmosphere in the chamber permits effective drying at much lower than customary temperatures. Thus, energy demand is doubly reduced—by the lower heat requirement and by the shorter time electric power is needed.

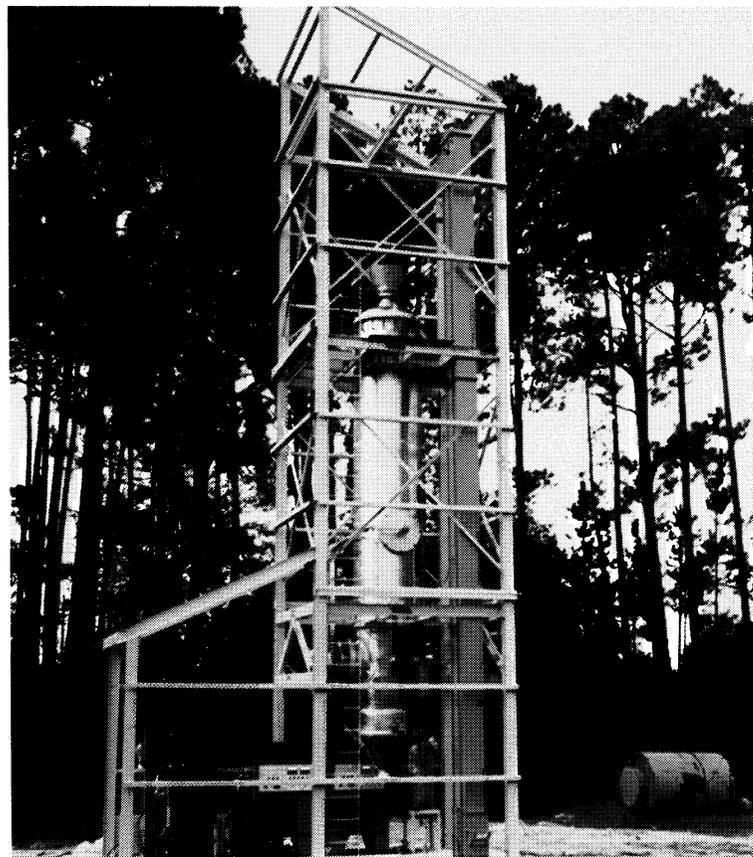
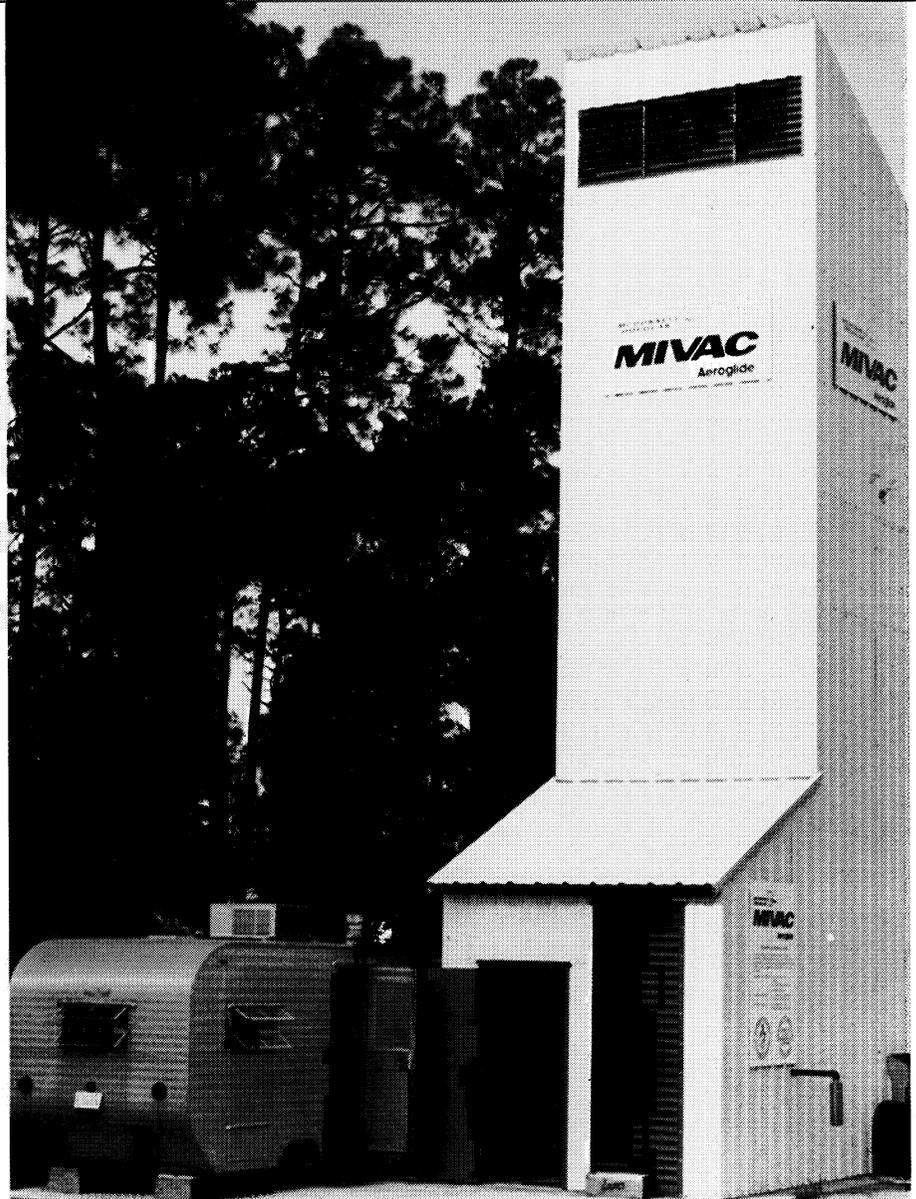


*In early trials, McDonnell Douglas Corporation used this space environment simulator to test the feasibility of vacuum-drying farm produce.*

MIVAC, its developers say, offers bonus value in that it does a better job of drying more easily damaged crops—rice, for instance. The hot-air-blowing process often hardens the outer surface of the seed, making it difficult for internal moisture to escape; this may cause cracked grains of reduced quality. Microwaves heat rice—and other products—evenly from the inside out without hardening the outer coating, thereby obviating possible damage to kernels or grains.

At the Tifton pilot plant, MIVAC is being used to dry a number of agricultural products, such as rice, wheat, peanuts, soybeans, corn and pecans. Change of product entails no change of equipment. A small scale experimental facility, the MIVAC unit at Tifton has limited capacity. Corn, for example, is dried at the rate of seven bushels per hour. But it is possible, within existing technology, to scale up the system for a capacity of 1,000 bushels hourly. With anticipated development of advanced technology, capacity could be increased substantially further.

MIVAC is undergoing a two-way evaluation. The Department of Agriculture is examining results from the standpoint of product quality and processing cost. The Department of Energy is determining what energy savings MIVAC affords in comparison with existing systems.



*Successful initial crop drying experiments led to development of the Microwave Vacuum Drying System (MIVAC). At left is an interior view. The long cylinder is the vacuum chamber; wet crops enter through the top funnel and emerge dried through the exit hatch near bottom. At surface level is the microwave generating equipment.*