

*A musical derivative of aerospace technology accents the breadth and economic value of spinoff*

## An Instrumental Innovation

Think of guitars and you think of rock and country music, or the vigorous rhythms of the gypsy flamenco, or perhaps the classical strumming of a Segovia. About the last thing you would associate with guitars is aerospace technology.

Yet there is a connection. A whole family of quality guitars is an outgrowth of helicopter rotor research conducted for



*Ovation guitars were created by Charles H. Kaman, president and founder of Ovation's parent firm, Kaman Corporation. In photo, Kaman swaps notes with entertainer Glen Campbell, one of a lengthy list of top-flight performers who use and endorse the spinoff guitars. Feedback from Campbell and others has resulted in a number of improvements to the Ovation line and on one occasion produced an entirely new model.*

the military services and NASA by an aerospace contractor. These musical spinoffs, commercially available and rapidly gaining in popularity, are the Ovation guitar line, manufactured by Ovation Instruments, Inc., Bloomfield, Connecticut.

Ovation Instruments is a subsidiary of Kaman Corporation, a diversified company originally formed to develop and build helicopters. A helicopter's rotor system, with thousands of moving parts, is highly susceptible to vibration. For rotor efficiency, vibration must be "dampened," or reduced. Like other helicopter builders, Kaman Corporation spent years of research toward that end. The technology thus developed, together with the availability of staff experts in vibration engineering, sparked an idea in the mind of the company's president and founder, Charles H. Kaman. A guitarist of professional caliber, Kaman reasoned that vibration-dampening technology could be turned around to *enhance* vibration and thereby produce a guitar with superior sound.

Kaman researched the guitar field and found that, although the instrument had been in use since the 16th century, not much was known about the physics of the guitar with respect to its complex vibrations and their influence on sound quality. Kaman put the quest for sound excellence on a scientific basis, using special vibration analysis equipment patterned on aerospace technology. What began as a basement hobby project grew to the point where Kaman organized Ovation Instruments to manufacture and sell the guitars.

From two years of vibration analysis emerged an innovative bowl-like guitar design that Ovation researchers considered the ideal shape for full, rich and constant tones throughout the instrument's range. But it would be difficult, if not impossible, to shape traditional wood to the new design. So the Ovation team delved again into aerospace lore, investigating a number of strong, lightweight materials used in aircraft and helicopter construction. Initially, they came up with bonded fiberglass; more recently they added carbon graphite, originally developed for supersonic planes. These materials offer a number of advantages in shaping, strength, sound and producibility.

For manufacturing the guitars, Ovation made still another trip to the aerospace technology well to develop special jigs and fixtures characteristic of aerospace production techniques. This assured effective quality and cost control in the manufacturing process and reduced labor requirements; although considerable hand work is still necessary, company officials estimate that man-hours needed to produce an Ovation guitar are about one-fifth of those required to produce competitive instruments of similar quality.

Initially, Ovation produced guitars for the top of the market, mostly professional entertainers. More recently, the cost advantages of aerospace-derived production, unique in the industry, enabled the company to enter the lower cost field. Ovation is producing several hundred guitars monthly; sales, in the multimillions annually, are increasing each year.

The Ovation story is an excellent example of spinoff because it illustrates a number of points with regard to technology re-use. It shows, for instance, the universality of spinoff, its reach into virtually every avenue of everyday existence. Frequently, as is the case here, the secondary application is surprisingly remote from the original technology.

The guitar example also points up the fact that, in many instances, multiple aerospace technologies are employed in the development and manufacture of a single product. The reverse is also true: often a single technology finds multiple secondary applications, each different from the other.

Most importantly, the Ovation case underlines the economic potential of spinoff. As happens frequently, a whole new company was formed to manufacture and sell a spinoff product, with eminently successful results that contribute to the Gross National Product and to job creation.

There are many other examples of aerospace spinoff that compare in scope and economic benefit with the guitar application, technology transfers with values running into millions of dollars. Many others offer only moderate economic gain but provide significant public benefit in other ways, ranging from simple conveniences to important developments in medical technology.

For the past 16 years, under its Technology Utilization Program, NASA has been actively engaged in



50  
Photo shows three of more than a score of guitar models that make up the Ovation line, which traces its origin to helicopter rotor research. Ovation Instruments, Inc. also uses aerospace-developed materials and aerospace production techniques in the manufacture of the instruments. Ovation Instruments is a "spinoff company," one formed to merchandise an aerospace technology transfer. The firm turns out several hundred guitars monthly and sales are in the multimillions annually, underlining the economic value to the nation of major spinoffs.

promoting the secondary application of aerospace technology. The results have been impressive; thousands of 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.