The Advantages of Designing Products of Plastics

By Jeff Spira

It has been nearly 40 years since Mr. McGuire took the recent graduate, Benjamin, aside from the pool party and whispered that one word, plastics. We've come a long ways in knowing what can and can't be made of plastics, and have both wild successes and dismal failures in applying these fascinating new substances to our everyday commercial and industrial products. Savvy engineering skills in applying plastics can make or break a product design.

There was a time when things made of plastics were considered cheap and flimsy. Not so any more. New polymers have greatly expanded the horizons of possibilities. We board a jet to cross the Pacific made mostly of plastics. The frontal armor of an M-1 Abrams battle tank contains plastics, and previously unattainable temperatures and pressures of our power transmission equipment rely on plastics. Even the safety of nuclear power plants is dependent on plastics.

Engineering universities still teach metallurgy, metal fabrication techniques and metals performance in mechanical systems, but few teach plastics outside a cursory introduction to the topic. The plastic polymer manufacturers are the main sources for sound plastic design technology. This means that finding talented design engineers to perform conversions from existing materials to plastics is sometimes not easy.

While it may seem like making a part in plastics is less expensive than in metal, more often than not, the reverse is true. Metal is inexpensive and stamping, forming and machining it is fast, inexpensive and requires minimal investment in tooling. Conversely,

plastic polymers are fairly expensive, especially engineering polymers with the kind of physical properties needed for many commercial and industrial components. In addition, plastic molding requires expensive tooling; even for single cavity prototypes while multi cavity production tooling can produce quite a sticker shock.

So if plastics are more expensive to tool up and run than their metal counterparts, why bother to convert from metals to plastics? Well, the secret to making a less expensive assembly involves integrating a number of components into a single unit. Typically four or five metal components can be integrated into a single plastic replacement part. Such things as pins, retainers, clips, brackets, etc. are often easy to integrate.

Doing this not only saves on tooling up multiple components; it also saves on the costs of purchasing, shipping, inspecting, and inventorying multiple part numbers. It also saves in cost of quality, because often, subassemblies made up of a number of components can get assembled incorrectly. In a steering column subassembly used on one of the big three automaker's most popular automobile, it took redesigning four components into a single plastic assembly to finally get their rejected parts PPM down below the desired 25 PPM zero defect level. The integrated plastic part cost just about exactly the same as the four components it replaced but the savings in reducing the number of parts plus the vastly improved quality level achieved, made it a highly profitable choice.

Integrating several parts together nearly always results in a reduced labor cost in assembling those parts as well. Even in automated equipment, handling one part instead of four is less expensive and almost always less time consuming.

Some other advantages of using plastics over metals include a lighter weight finished assembly. In terms of handling and shipping, this can represent a substantial savings. Plastic parts also don't tarnish or corrode, so do not require plating or coating operations that metal parts usually need.

Intelligent design of plastic components can be a boon for many products currently using metal parts. Often substantial savings can be garnered in parts count, ease of manufacture, labor rates, and the cost of quality. The tidal wave of changeover from metals to plastics is continuing and there is no indication that the trend will not continue or even accelerate as new and better polymers are being developed.

Jeff Spira is a mechanical engineering consultant and runs Spira Engineering at http://www.spiraengineering.com specializing not only in design and engineering, but also in tooling, design, process design and quality system consulting. One of his specialties is in the conversion of materials in product designs.