

production

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ASSEMBLY:

Putting It All Together
How To Do It—and When Not To

TEAMS:

Getting Organized for Success
Tips from the Pros to Improve Your Operations

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“THE BEST ASSEMBLY IS

Those are the words of Sandy Munro, president of Munro & Associates, a design for assembly/manufacturing consultancy. Munro is nothing if not provocative or blood-pressure raising, depending on your point of view.

By **GARY S. VASILASH**, Editor-In-Chief

WHERE TO START?

“Where there’s arrogance, there’s opportunity,” says Sandy Munro, president of Munro & Associates, Inc. (Troy, MI), an organization that has helped in the design for assembly/manufacturing efforts of clients including Bose, Caterpillar, Ford, General Motors, John Deere, Mercury Marine, Motorola . . . (Need we indicate more?)

Munro and his colleagues conduct workshops that are attended by people organized into cross-functional teams of from five to seven individuals. Each team, Munro maintains, needs to include an assembly worker, a manufacturing engineer, an industrial engineer, and a design engineer, in addition to a selection of some of the other usual suspects (i.e., marketing, design, purchasing, finance).

Munro has a shop-floor orientation (he’s spent a lot of time there, so when he goes into the offices where people aren’t wearing oil-stained shirts and steel-toed shoes, he’s able to articulate the realities of the day-to-day production environment with knowledge, not just rhetoric). His specialization is going after products that pose assembly problems or carry high warranty costs or which, ideally, are still early in the design (or redesign) phase. He goes after them with a certain pugnacious zeal. He’s a guy who obviously believes in what he’s doing—and believes that it’s important.

About that quote concerning arrogance: Munro frequently meets with people that think they know it all, period, *end of story, now what were you here to talk to me about?* They refuse to entertain any notions of change. *We’ve been there, tried it, done it, it doesn’t work, now let’s go have lunch.* The good news is that manufacturing people, according to Munro, tend not to be so . . . stubborn. Their paradigms may need a bit of coaxing or shoving. They don’t require dynamite. Unfortunately, some of those persons who are less inclined to listen have authority over whether changes will be made—or not.

Munro’s experience tells him that in places where people are absolutely, positively certain that they have a lock on The One and Only Way there are undoubtedly money-saving opportunities galore in the design/manufacturing nexus waiting to be explored.

PRIMITIVE MODERNS

People have been assembling things pretty much in the same way since the early days of the Industrial Revolution. Yet Munro thinks there might be some changes due—perhaps overdue—despite the long experience, which some confuse with mastery.

“People lived in caves for a long time, too,” he notes.

Doing something for a long time doesn’t necessarily mean it is the right thing to do.

IMPRESSING THE JAPANESE

“One of the things we tend to do well in North America is fix things,” Munro says. “We’re great fixers.”

Or, to use a popular metaphor: People in many North American companies are world-class fire fighters. Day after day, blaze after blaze.

He says that when he was with Ford Motor Co. he had the opportunity to read some reports, translated, written by Japanese engineers who had toured U.S. factories. “They were impressed at how fast we could pounce on a problem and get the job done.”

Unfortunately, this fix-it approach is pretty much like gluing together broken dinnerware and other ceramic pieces. It might be more advantageous to figure out how to keep the bull out of the China shop in the first place.

HE KNOWS ABOUT TOOLS—NOT THAT THEY’RE NECESSARILY THE ANSWER

In addition to working for Ford (as manufacturing engineer, senior automation specialist, and corporate

NO ASSEMBLY”

Sandy Munro: “I was a toolmaker at one time. When I visited the people in design I was sometimes horrified at what I saw.”

coordination—design for assembly), Munro had a stint working with many machine tool companies, such as Lamb, Snyder and Cross (for those of you who don't know them or have forgotten, these are/were companies that specialized in automotive-sized machining and assembly systems).

Munro is not particularly impressed with technologies of late developed to enhance assembly: “There hasn't been a whole lot of major innovation since they started using walking beams and shuttles to accurately move and locate parts.” (He is more impressed with developments in machining that, he explains, can be beneficial to assembly from the standpoint that metal removal can actually eliminate the need for assembly. See: “No Assembly Required (or Very Little)”)

He is not anti-machinery, not some sort of contemporary Luddite. But he thinks that people ought to pay closer attention to the process—the total process—and less to machinery. No machinery for the sake of machinery.

Munro isn't particularly taken with flexible automation, in the guise of robots, either. Not that there is anything wrong with them per se. But it is that some engineers at some companies use them to automate assembly tasks in instances when, he argues, the whole task can be eliminated—but (and here's the rub) only in the design stage.

The manufacturing engineers are often simply trying to make the best out of a less-than-ideal situation. He has an example: a small door that is part of a slide projector. He has two of these doors. One has a device that holds the door in a shut position flush with the projector cabinet that includes a small spring that's held in place with a sliding element and a spring. The other has no spring and no screw. Snap fits are used. Munro points out that even if a robot is used to drive the screw in the design with the



OBSERVATIONS FROM SANDY MUNRO

“It is **never to late** to do what's right. But sometimes it certainly is expensive.”

“There are four things that people in a company ought to do. **Look** at the product, **analyze** it. **Redesign** it. **Implement** the redesign. **Celebrate the success**. A lot of people don't do the implementation. Or they just do part of it. And often, when it comes to the celebration of success, the big boss gets a bonus and everyone else gets squat.”

“There are three rules for manufacturing businesses: **Innovate. Innovate. Innovate**. For some reason, three tends to be a magic number.”

“I think of sunk costs like a boat that is sunk. You can't get it back. So **don't worry about it**.”

“Most of the time it is less expensive to bite the bullet and **do something right the first time**.”

multiple elements that must be fixtured just-so in order to get everything to come together in the proper way, it can't be manufactured as efficiently as the snap-fit arrangement. By way of demonstration he challenges me to put the doors together: given that I have a built-in vision system and a fairly fast processor, and two arms with flexible end effectors, it might seem that I have a metaphorical leg up on a robot, yet the task of putting the parts together goes from difficulty to absurdity.

PENNY-WISE, DOLLAR-FOOLISH

Speaking of doing things with springs, Munro tells a story about seeing an assembler of another product pulling a spring out of a box. Actually, she pulled out a bird's nest of springs. Someone in purchasing had gotten a "deal" by buying the springs in bulk. What the purchaser had failed to take into account was the consequent coiling of the springs in the container.

The assembler shook a spring loose from the clump . . . and trashed the remaining mess.

There went the discount on the bulk buy—and then some.

WHAT DESIGNERS DON'T KNOW CAN HURT YOU

"The people who are downstream from the designer—manufacturing, marketing, service, and even the customer—are at the designer's mercy. The designer knows functionality. But he doesn't know a great deal beyond that.

"I was a toolmaker at one time. When I had the opportunity to visit design I was horrified at what I saw. Those guys didn't know which tools could do what.

"Of course, they only have four years to learn all they can. So they know about functionality, ergonomics and even the psychology of design. But they tend to miss something—like processes and assembly systems . . . which is why we have manufacturing engineers.

"But the way things usually work—yes, even today—is that the designers do their work and it goes to manufacturing when it is too late to do much to improve the design for manufacturability."

Here's the bizarre part about all of this: Think of the billions of dollars invested in the tools and equipment necessary to build the products of the designers' work. If manufacturing is brought into play at an earlier stage, it may be that fewer billions of dollars worth of equipment will be needed to build better products. And this cost savings doesn't come at any cost to the company implementing it.

ON WEAK LINKS

Did you ever notice how it sometimes happens that a race car driver—say Michael Andretti—spends the better part

of a race blasting around the track, leaving the other drivers in his exhaust, and then, in the final moments, something trivial breaks and he is left fuming at the side of the track?

Munro points out that most companies are piece-cost oriented. "This is a tragedy," he opines.

For example: "In an engine plant there are wonderfully produced blocks and heads. They get plenty of attention. Then there is the head gasket that has to perform under extreme conditions. It, too, receives attention.

"But the bolts holding the whole thing together may be junk. No one pays any attention to them. They are inexpensive. They are also the weak links in the chain."

Munro recommends that companies pay attention to the trivial things that might be weak links. Although they may not be cost-drivers from the standpoint of what it takes to design and build—compare an engine block with a bolt—but they can have massive negative effects on quality, which not only can drive warranty costs, but drive customers away.

Of course, unless a company has all aspects under control, it is difficult to spend time with the small things. Which means that a systematic approach must be used throughout the entire organization.

NO ASSEMBLY REQUIRED (OR VERY LITTLE)

Munro and his associates did a study for the manufacturer of a transport plane. They determined that it was possible to combine 10,000 parts and operations into one. That is not a typographical error: 10,000 to one.

The piece had been an assembly. But it was determined that by high-speed machining an aluminum workpiece, the redesigned part could be produced at half the cost of the existing one.

Munro notes that it is only because high-speed machining has been developed to a commercially viable state that this is possible. "Fifteen years ago," he says, "it wasn't practical to propose a monolithic structure. It couldn't be done. The spindles weren't there, there was a paradigm of machining everything horizontally, not vertically . . . But we can do it now."

He makes a larger point. It's that when it comes to design and manufacturing, engineers and managers ought to stretch their thinking so that they take into account many more possibilities than their direct experience might lead them to consider. Although he is not a proponent of threaded fasteners, adhesives, hitch pins, and the like, Munro understands that there are still instances where they may be required. But he doesn't think that any of these things should be used in an auto-pilot manner. 🌐