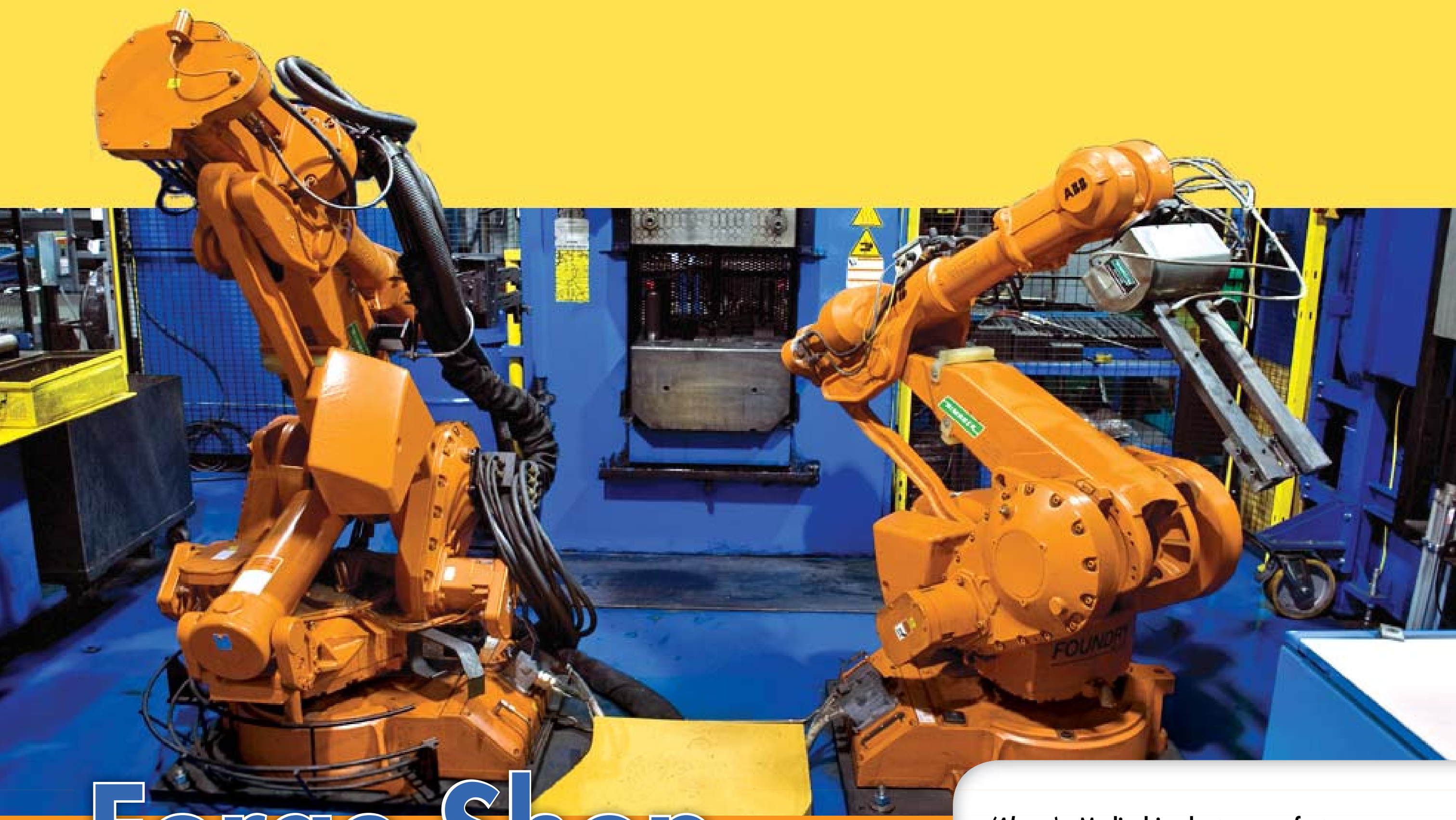

Forge Shop Automation Part two

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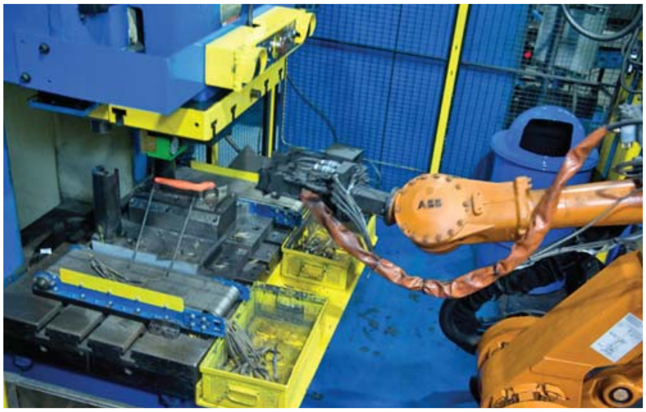
This is the second of two articles designed to help forgers realize the potential of robotic automation in the forge shop. It presents an overview of technical and commercial criteria that will facilitate the management decision to invest in flexible robot-based automation in hot forge production.

(Above) Medical-implant manufacturer Symmetry Medical Jet in Lansing, Mich., uses two robots to move parts from conveyor to furnace to forging press to trim removal to exit chute. One of the arms also applies die lubricant to the press.

The integration of robotic automation with forging processes is a potentially important step in maximizing a forge shop's production and its productivity. For this article we will, by way of example, illustrate the process by which the decision is made to automate a forging line. In the example that follows, the task will be to add a robotic arm to an existing forge press. As a starting point, the project engineer assigned to this task must compile certain baseline information. Realistic technical and commercial information is essential to planning an automation project, regardless of whether the system development is done in-house or by a qualified, robot systems integrator. At this early stage, three parameters must be considered in detail: the part(s), the level of investment and plant engineering information.

The Part

To begin with, the project engineer must identify specific parts, or family of very similar parts that the automation system will handle as well as the related production goals. Meeting or exceeding these goals with automation will serve as the final acceptance performance criteria. This is the "goal line" that, once crossed, signals to all parties that the project is successfully completed. The ideal part candidate will be a high-volume part that is adaptable to a single forging press. The required part information must include:



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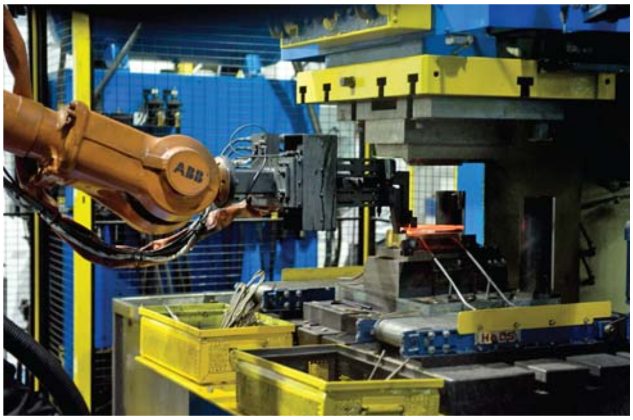

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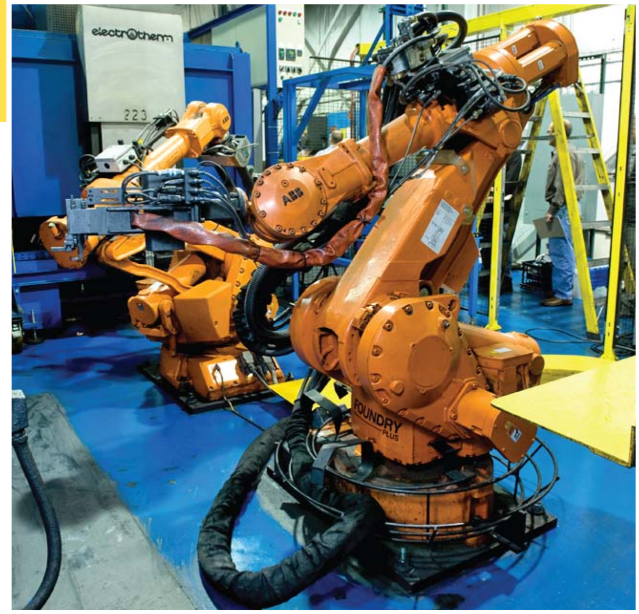

An investment budget to provide a realistic and acceptable return on investment for the company must be developed by the project engineer.

- Part drawings and ID number(s)
- Part weight
- Tooling drawings
- Billet size and shape
- Intermediate and finished size and shape
- Current production rate (volume/time)
- Current process description, including detailed production steps and verifiable cycle times
- Any pertinent quality issues that must be adhered to during production process
- Full understanding of upstream and downstream processes and the affects automation may have on them, if any
- Flash considerations
- Actual parts of each step in the process

The Investment

After selecting a part or family of parts the project engineer must determine the economic feasibility of automating the production process. He or she will develop an investment budget to provide a realistic and acceptable return on investment (ROI) for the company. The budget will outline current costs/benefits versus future cost/benefits and will forecast the period in which the company can expect to recoup the cost of implementing the automation. Although this is probably the most overlooked aspect of a potential automation project, it also is usually the defining factor that will enable it. This step is where good business sense and technology meet, and the engineer will save time by sidestepping poor economic choices that have little hope of approval. The engineer should be willing to discuss most of this information with prospective system integrators but should not publish it. The required ROI information must include:

- Management's ROI requirements
- Current and future fully burdened labor cost/hour
- Current labor usage/hour
- Future labor usage/hour provided by automation
- Current production volume/hour
- Future production volume/hour
- Potential production increase/hr provided by automation
- Potential quality increase provided by automation, if any
- Current/future technical resources needed to maintain the automation
- Future corporate sales goals

Plant Engineering Information

Once the engineer has determined that the part(s) the system will handle is (are) economically feasible, it is time to examine the hard engineering facts of the project. At this point, up-to-date and accurate information is vital to providing a comprehensive platform on which to build the automation system. As such, the engineer will check key field dimensions and verify all documentation that relates to integrating the automation system with existing equipment. The required plant engineering information must include:

- Existing forging equipment information such as make, model, serial numbers and tonnage capacity
- Press drawings showing elevations, window openings and plan view of the die space
- Any existing equipment that may, or may not, be replaced by the automation
- Pictures and/or plant drawings of the floor space around the existing forging equipment showing the locations of all other equipment, pits, and other process and maintenance equipment
- Complete controls-package documentation on the existing forging equipment, including up-to-date controls drawings, PLC programs, operating instruction and HMI screens, if any
- Full understanding of maintenance needs around the existing forging equipment, especially for tooling
- Full understanding of upstream and downstream processing equipment
- Probable installation time frame, Christmas shutdown, annual summer shutdown, etc.
- Plant specifications

System Integration

Having compiled and organized all the key project information, it is time to determine who will design, build, install, start-up and warrant the automation system. The majority of forge shops do not have the qualified resources to commit hundreds, or even thousands, of engineering hours to developing a complete automation system.

Forge Shop Automation Part two

The project engineer must then focus on using the services of a qualified robotic system integrator (SI).

The RFQ – The engineer should produce a formal request for quote (RFQ) in order to communicate the compiled information effectively to any prospective SI. The RFQ is a single document that contains all part and plant engineering information (as mentioned previously) and will serve as the document to which all prospective SIs will quote. The engineer will send the RFQ to all prospective SIs and respond to any questions asked by potential bidders. It is important to note that a complete RFQ document will help shorten quote lead time, improve the accuracy of the quote and significantly improve the probability of a successful project.

The RFQ also must contain specific documents that will serve as points of reference throughout the life of the project. The more thought given to this, the more benefit to customer and supplier alike. This additional information should include:

- **Final acceptance criteria** – This is the set of performance criteria that the selected SI will meet in order to consider the project complete. The business-savvy engineer will tie the achievement of those criteria to the final payment of the project.
- **Preliminary master schedule** – This will generally show only the intended installation period. The engineer should consider realistic lead times and system delivery times in this plan, which could take as much as six months. Pressuring an SI for rapid delivery of either of these items, whether because of improper planning or any other reason, may lead to increased costs and the possibility of missing important issues.
- **Commercial terms** – These are the terms that your company will establish on any capital expenditure. They can include payment schedules, delivery requirements, trucking companies and freight charges, cancellation charges and many other items. Some flexibility here will help keep costs down, as smaller SIs often cannot finance one-sided commercial terms.
- **Key items** – These include certain items that do not fit into the technical or commercial realm. They could include application-specific management concerns, installation contractors, work permits, operating instructions, special training requirements or any other special requests that will facilitate the overall project.

SI Selection Process – The project engineer should consider the reputation, financial stability and basic business qualities of each prospective SI that will receive the RFQ. A visit to their facility is a good idea. Beyond good business judgment, the following are some basic technical guidelines the engineer should consider in the selection process. Listed in order of importance, these guidelines include:

- **Strong project management skills** – This is of paramount importance to the project engineer's review efforts. A good project manager will provide open and reliable communications and will prevent conflict by continuous advanced planning.

- **Pre-delivery acceptance run-off demonstration** – This step will show the basic functionality of the system before it leaves the SI's floor. Every good SI is eager to provide a pre-delivery demonstration of the working system at their facility, mostly because correcting problems at home is significantly more cost effective than fixing them in the field. This demonstration should include mock-ups of existing equipment, simulation of inter-equipment communications, cycle-time verification and performance evaluation. It is to the benefit of both parties to make this effort as complete as is economically feasible. More effort at this point will save time and money once the equipment is installed.
- **Complete and on-time documentation** – This is generally a good indication of how thorough a SI can be. Good documentation may not save a project, but poor documentation can ruin one. This is one of the best qualities to look for in the review effort, and good SIs are always proud to show it off.
- **Experience in integrating the preferred robot brand** – This is purely an economic decision usually made by the SI. Most SIs will focus on one or two robot brands to integrate because of experience and their comfort level. Asking a good SI to integrate a robot brand with which they have no experience could increase their cost, increase your cost or jeopardize the project's success.
- **Prior experience in forging automation applications** – This is important but not necessarily required. What *is* important is that the SI fully understands the working environment in which the system will operate. This includes the physical environment as well as the cultural environment.
- **Geographic location** – This can be a swing factor in the decision process because of the availability of local support. Local support can provide some amount of uptime insurance should issues develop post start-up.

Looking Ahead

The engineer is now ready to apply sound project-management techniques to produce an automation project that is effective operationally and financially. While every nuance of defining an automation project is beyond this article's scope, the information provided should help the engineer complete a successful project. It is inevitable that the SI will require additional information as the project unfolds, and a good SI partner will help define those requirements before they become an issue.

Author Jan Hutson was senior robotics systems specialist for forging and foundry applications. Reader inquiries about this article should be directed to: Greg Gernert, vp and general manager at 614-471-5926 or sales@rimrockcorp.com; or Mark Riekart at 614-509-4278 or mwriekart@rimrockcorp.com