

## Technology Screening, Analysis and Management

Eric W. Brooman, Ph.D, AESF Fellow

**Previous articles in this continuing series on Emerging Technologies have discussed several new processes that will impact the metal finishing industries, as well as how to promote the benefits of these improvements to potential clients. This article focuses on the procedures to identify new technologies, evaluate their potential, and select candidates for consideration to solve particular manufacturing problems, meet specified needs, or provide opportunities for expanding products and/or services. Here, questions are answered by Dr. Eric W. Brooman, co-chair of the AESF Emerging Technologies Committee.**

**AESF:** *Why is managing the identification, selection, and application of new technology important to the metal finishing industry?*

**EWB:** It was tempting to maintain the status quo in the past for a number of reasons. Equipment was relatively uncomplicated to operate, inexpensive to purchase, had been amortized, surface treatments and coatings were well established, product requirements did not change much, and the customer base was large enough to sustain a reasonable profit margin. However, in recent years, the demand for improved surface finishing processes has escalated; OEMs have passed the responsibility (and expense) for more of the surface finishing developments and improvements down to the plating and surface finishing shops; and because of the globalization of technologies, in-house improvements or innovations may not be the best solutions for particular applications. These factors have lead to the industry becoming much more competitive and have facilitated the outsourcing of jobs. From the industry point of view, if accommodation to these factors is not made, there is a net loss in sales and/or profitability with an adverse effect on business. For those that have more efficient

processes, or can offer new technology at a price the markets can bear, the business scenario is much more positive.

Consequently, staying abreast of new developments, identifying new technologies to meet new or more demanding customer specifications, then evaluating their potential in order to make a business decision about whether or not to make changes, becomes extremely important. Managing these activities is just as important as managing all the other aspects of a successful company.

**AESF:** *What is technology identification, selection, and application? How can smaller companies do this if it is so important?*

**EWB:** The process itself is simple, but should be an ongoing activity (*i.e.*, as part of a lean and/or continuous improvement program. As a result, it does require resources to implement. The few remaining OEM R&D laboratories and captive job shops may have the staff and resources in-house to perform this activity. However, the choices for the smaller businesses are more limited, and include:

1. Performing a limited activity in-house to meet specific one time needs
2. Using available outside resources to meet specific one time needs
3. Hiring an individual consultant or consulting firm to meet specific one-time needs
4. Performing an ongoing, but limited activity in-house to meet long term needs
5. Hiring an individual consultant or consulting firm to continuously provide recommendations and solutions to ongoing and future needs.

The first option tends to be reactive rather than proactive (*i.e.*, option 4) because of the priority in getting quality products out

the door. It is also dependent on the person assigned having the appropriate knowledge and resources available. The second option has been successfully used by several small companies, and involves access to subject matter experts available through state and/or Federal Programs. Examples of these are the Manufacturing Extension Partnership (MEP) Program Centers in each state, the NASA Technology Transfer Centers, and the local small business and technical assistance centers. In addition, there are specialized centers that can provide information on selected topics, such as the Edison Materials Center in Ohio, and the Massachusetts Toxics Use Reduction Institute/Metal Finishing Forum.

The third and fifth options require not only financial resources, but a commitment in-house to define the type of assistance needed and then to supervise the consulting contract and the deliverables. However, these two approaches do free up personnel in the metal and surface finishing shops to follow other high priority business activities, such as administration, marketing, and production. Consultants and consulting firms can be found listed in trade publications (*e.g.*, *Plating & Surface Finishing* and *Metal Finishing*) and through professional societies and organizations.

**AESF:** *What sort of technology identification, selection, and application activities are there?*

**EWB:** The types of activity depend mostly on the company's requirement(s) and must be tailored to their need(s). In general, these activities try to answer one or more of the following questions:

1. Can my existing process be improved?
2. Can my existing process be replaced?
3. What is the best available technology to replace my existing process?
4. What might be the business impact of my choice(s)?

5. What intellectual property (IP) constraints may impact my business?
6. What are the technology trends that could impact my business?

Performing the first two activities will result in answers consisting of general descriptions of candidate improvements and alternative technologies, along with their apparent advantages and disadvantages. The company then is left to make a choice and decide if they want to implement a change in their shop. Some of the candidates may be taken from other industries, but may be relevant by analogy, or may provide some synergistic benefit. Consequently, when defining the scope of these activities, it should not be too narrow, but a trade off made based on the resources and time available.

The answer to the third question is more definitive because of the narrower objective. The result ("deliverable", often a report) will be a recommendation for a course of action to implement a specific alternative. The selected improvement or new technology will have resulted from a survey of the alternatives and a down-selection against a list of screening criteria, *mutually agreed upon in advance* by the company and the consultant or consulting company. This approach requires that the person or consultant company hired has sufficient experience to be able to compare technologies and assess their advantages and limitations based on their knowledge and published information that may not always be complete.

Answering the fourth question provides useful information for making a business decision about implementing a new or improved technology. For example, information can be collected, collated, and analyzed to show what the competition is locally, nationally, and even internationally. Data on what technologies the competition is using or planning to implement, how markets are shifting, trends in OEM requirements for its suppliers, and perhaps even pricing may be available or projected from vendor information and market surveys. All these data can influence if and when a decision is warranted. A business case analysis can then be used to justify making the change.

IP issues have been discussed in other columns, but their relevance here is twofold. Part of making a decision about implementing an improved or new technology, of necessity, involves assessing how its use can be protected in the market place and the marketing edge it may provide. The cost involved with licensing the technology has to be considered, because this will impact a company's pricing strategy. The

scope of the license also is important. For example, is the license restricted to a geographic area, a particular industry, or specific product? If the use is too narrow, the opportunity exists for competitors also to purchase a license and obtain market share. Conversely, if the use of the technology is unique, then this could provide product differentiation in the market place, or allow the company to make unique claims about its products or services. Some companies offer software for "data mining" the patent literature that can provide helpful information about patent activity in specific industries or areas of technology. The results of data mining also can be used to identify the interest of specific companies in certain technologies, technologies that are beginning to be implemented in industry, as well as voids in technology and/or applications.

The final question is different in that it addresses a longer term issue and plays a part in strategic planning activities. While predicting the future is always difficult, projecting what may happen in particular industries can be useful. Some professional societies and trade associations provide trends or publish technology roadmaps. And from time to time, the government may publish the results of analyses to find alternative materials and processes, such as alternatives to chromium or cadmium coatings, which could find use in general industry, as well as the defense industrial base.

Finding synergy between processes used in different industries also can be fun and profitable. One example is the electroforming of copper foil and the making of flexible printed circuits. Traditionally, copper foil was produced by electroforming on cylindrical steel mandrels. This foil was sold and die stamped into circuit traces then laminated. By incorporating temporary or permanent masks on the mandrels the circuits could be directly formed then automatically transferred to the laminating material in one facility, thereby benefiting from the expertise of both the plating and flexible printed circuit industries! Extension of this technology led to plating directly into molds then injection molding a polymer, bringing in expertise from the injection molding and polymer production industries. The result is a part with a circuit trace embedded in it or a metal coated surface that requires no further treatment. This technology has been used to make items ranging from lamp reflector housings to cell phone covers.

**AESF:** So, in summary, technology assessment and management seems to be very important.

**EWB:** I hope that is the message I have tried to convey. Unfortunately, in such a brief article only an overview can be provided with few details. However, most of what I have discussed is common sense, and with easy access to the Internet and the World Wide Web, numerous resources are now available, and many are free of charge. Otherwise, there are a number of metal finishing consultants and consulting companies that can provide the services described for a fee.



### About the Author

*Dr. Eric Brooman is the Director of Technology at Materials & Processes Professional Services (M&PPS), a small business in Dublin, OH providing consulting to the metal/surface finishing industry. He specializes in technology assessment and implementation, with an emphasis on environmentally acceptable solutions to client needs. As such, he is supporting the Pollution Prevention R&D Team in the Materials and Manufacturing Directorate, at the Air Force Research Laboratory, near Dayton, OH. Prior to establishing M&PPS, he was Technology Director at METSS Corporation, Principal Technical Director at Concurrent Technologies Corporation, a consultant on special programs to the Ohio Department of Development, and Business Area Manager in the Metals and Ceramics Department at Battelle's Columbus Division.*

*Dr. Brooman was educated in the UK, obtaining his graduate degree in materials science and doctoral degree in Metallurgy (Electrochemistry) from Cambridge University. He is a Fellow and Past Secretary of the Electrochemical Society, and a Fellow of the American Electroplaters & Surface Finishers Society. In the latter, he is currently a member of the Research Board and Co-chairman of the Emerging Technologies Committee. He also serves on the Nanomaterials Sub-committee, which he helped to establish a few years ago.*