Apr 1st, 8:00 AM

The NASA - IITRI Manufacturing Applications Team; Solving Manufacturing Problems Through Aerospace Technology

E. R. Bangs
Assistant Director NASA Mfg. Technology, IIT Research Institute

THE NASA/IITRI MANUFACTURING APPLICATIONS TEAM; SOLVING MANUFACTURING PROBLEMS THROUGH AEROSPACE TECHNOLOGY

BY
E. R. BANGS
Assistant Director NASA Mfg. Technology
IIT Research Institute
10 West 35 St.
Chicago, Illinois 60616

The objective of the MATeam is to successfully transfer aerospace technology to solve key problems in the manufacturing sector of the economy. The underlying purpose for the team is to increase the return on the nation's investment in aerospace research by fostering wide implementation and use of NASA technology and expertise. The function of the team in accomplishing this objective is to provide an important intermediary role between technology sources and technology users in order to: improve the communication process; assist in the movement of new technology across organizational and disciplinary boundaries; and shorten the time between technological development and its broad and effective implementation.

NASA's decision to sponsor an applications team to effect technology transfer in manufacturing was both timely and appropriate. The United States, while still ahead of other industrialized nations in terms of overall manufacturing capabilities, productivity and state of technology, is finding its leadership position diminishing. The problem is becoming increasingly severe because of the continual rise in the cost of energy, raw material and labor and the need to maintain our competitive position in the world market. Clearly, a way to combat this growing national problem and maintain our competitive advantage is to capitalize upon and speed up adaptation of new manufacturing technologies and equipment into the industrial sector. The appropriateness of NASA's decision is underscored by the fact that the areas of science and technology in which they have been actively advancing the state-of-the-art correspond closely to those needed by the industrial sector of the economy to improve manufacturing productivity.

Achieving significant technology transfer, widespread implementation, usage of new products, and processes is not something that occurs quickly. To bring about successful technology transfer, industry problem areas, or market needs, must be matched with solutions that are both technically sound and economically feasible. This matching of needs with solutions does not, however, guarantee technology transfer; it is also necessary to establish effective means for commercializing the new product or process. Thus the MATeam's task is somewhat analogous to that of identifying and implementing new business opportunities and carries with it the many pitfalls normally associated with new venture development groups.

The approach used by the MATeam is structured to insure that the team's efforts are focused on bringing about successful technology transfer and that common pitfalls are avoided.

Effective communication channels between the team, industry associations, individual companies, NASA personnel and other government agencies is necessary to coordinate the teams efforts throughout all phases of the technology transfer process, from identification of technology opportunities to commercialization and implementation of new processes and equipment. The MATeam provides this interaction through numerous presentations to industry groups, visits to companies for in-plant discussions of problems and potential solutions, and extensive consultation by phone and mail. To help foster this type of interaction, there is no fee charged to industry for the team's services.

As an added means of increasing the team's effectiveness, it is concentrating on four target industries. In this way, the team can develop a close working relationship with the target industries and not dilute its efforts by trying to cover all industry types. This does not mean, however, that the team has not or will not work with companies outside the target categories if it appears that meaningful technology transfer can be achieved. The four target industries are:

- Machine tool builders
- Light fabrication and assembly
- Heavy equipment manufacturers
- Electronics assembly

There are two basic approaches which can be used to effect technology transfer: 1) to use the technology available as a basis for initiating the transfer process and then seek out applications for that technology, or 2) to begin the transfer process by identifying the technology needs of the target industry sector and then determine if relevant technology is available to satisfy those needs. The latter approach is the one used by the MATeam.

Starting the technology transfer process with

identification of industry needs rather then the aerospace technology available provides several distinct advantages. First, it helps insure that the team is responsive to the needs of industry. Second, it provides a ready market for the aerospace technology if it can be found, thus helping to insure rapid commercialization and implementation. Additionally, by documenting the technology opportunities and circulating them to appropriate NASA personnel, the effectiveness of the search for relevant technology is increased and, in some cases, may even result in innovative solutions to problems because of the unique technical expertise of NASA personnel. Last, starting with industry problems rather than the available technology helps insure that the team's efforts are spent on areas of greatest need and payback and not in trying to bring about solutions for which there is no real problem.

An overview of the MATeam technology transfer process is shown in Figure 1. It represents a logical sequence of steps, beginning with the identification and documentation of industry technology opportunities, or problem areas, and ending in successful technology transfer.

The MATeam identifies manufacturing problems, or technology opportunities, by working with professional societies, industry associations, various government agencies and individual companies. Once identified, problems are documented in the form of problem statements, which are used by the MATeam throughout the technology transfer process. Problem statements play a key role in the MATeam's activities. They serve as a means of communicating information about the problem so that team members can:

- Seek out potential solutions
- Evaluate the likelihood of successfully solving a problem and implementing a solution, and
- Compare problems and concentrate on those which have the highest likelihood of solution and potential benefit.

In addition to its internal use, the MATeam circulates edited copies of the problem statements to technical personnel in the NASA field centers and laboratories. This helps insure that every effort is made to identify appropriate technology if it exists. The problem statements are edited prior to circulation to NASA personnel to reserve the name of the problem originator and any information of a proprietary nature.

Copies of the problem statement are not circulated outside of NASA or the MATeam until a potential solution has been identified. If a potential solution has been identified, other organizations may be contacted to assess the magnitude of the problem and the suitability of the potential solution. Unedited problem statements are not circulated under any circumstances.

Problems which the MATeam will work on must meet three criteria:

- The problem must be manufacturing related.
- The problem must apply to more than one company.
- Solutions to problems must be based on NASA technology.

The problem statements are screened at several stages during the technology transfer process. The questions asked during the screening are:

- Do satisfactory commercial solutions already exist for this problem?
- What is the likelihood of identifying relevant NASA technology?
- What is the magnitude of the benefits to be gained by solving the problem?
- Can the problem be solved technically?
- Can a solution be implemented?

The answers to these questions are used to select those problems which the MATeam can most effectively solve. In those instances where a problem statement does not pass the screening process, the problem originator is notified and is informed of the reason for the decision.

Those problem statements which survive the preliminary screening (i.e., are deemed suitable for the team) then enter the next phase of the technology transfer process: identification of relevant NASA technology which could provide wholly or in part, a solution. This is accomplished through data and literature searches utilizing NASA's Scientific and Technical Information Facility, annual STAR indices, review of NASA Tech Briefs and by contacting individual NASA personnel with the necessary expertise for further discussions of the technology involved.

Following the identification of relevant NASA technology, each potential solution is given a more in-depth analysis. The solutions are assessed in terms of impact of solving the problem, likelihood of successful solution and implementation, resources required to effect commercialization and organizations which should be involved.

If the solution still appears valid after this assessment, the team then develops an implementation strategy to bring about commercialization. Such factors as applications engineering and implementation costs and the proper time phasing of the implementation are taken into consideration when developing the implementation strategies. Inputs from the problem originator and NASA personnel are solicited in devising these strategies. The particular implementation strategy that is developed will depend on the individual case in point, but in general, the strategy will be one of the following types:

- Direct transfer of the solution information and immediate implementation by the user.
- Applications engineering followed by test and implementation totally funded by the user or someone in a position to commercialize the process or product.

- Applications engineering jointly funded by the user/commercializer and NASA with subsequent test and implementation by the user/commercializer.

Once an implementation strategy is agreed upon between the MATeam, NASA, the problem originator and a commercializer, implementation is initiated. It should be pointed out that successful technology transfer and implementation takes varying amounts of time to come to fruition, depending on the specific case. Some can occur fairly rapidly, while others will take more time because of applications engineering and the type of industry and technology involved.

In order to achieve the maximum possible implementation, the team widely disseminates data pertaining to successful technology transfers. This dissemination of information is accomplished through press releases and articles in appropriate trade journals, magazines, etc., and presentations at conferences and other meetings.

Responsibility for the MATeam resides in the Technology Transfer and Market Research Section at IITRI. The team organization is shown in Figure 2. The team members possess a unique mix of capabilities and experience in manufacturing technology and technology transfer for a variety of industries. In addition to the individuals listed in Figure 2, the team also relies extensively on staff members within other IITRI research divisions for their expertise in specialized areas relating to manufacturing processes and equipment.

The MATeam program has been well received by industry. During the past year, the team members have had contact with over 450 companies, industry associations and other government agencies. Thirteen presentations on the MATeam have been given at various conferences and meetings. The presentations to the National Machine Tool Builders Association and the Industrial Perforators Association were particularly noteworthy in that these organizations are considering the formation of committees to interface with the team on a regular basis.

To date 150 manufacturing problems on technology opportunities have been identified and documented. Thirteen of these problems have been screened and 20 potential technology transfers have been identified.

Most notable of the potential transfers include, An A-C Motor Power Factor Control that reduces the energy required to operate small motors; a Computerized Tracking and Torch Manipulation Welding System (Weld Skate); Computer Aided Design of Sand Casting Molds; Automatic Laser Inspection of Printed Circuit Boards; and Tool Wear Sensing Using Vibrational Analysis. Although none of the technology transfers have been completed (e.g., commercialized and implemented), several are entering the applications engineering phase and should reach completion during the next year or two.

In summary, the MATeam has been well received by the industry; strong communications channels have been established between the team, NASA, individual companies, industry associations and other government agencies.