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EDITORIAL

Developments in Advanced Handling Systems

The movement and storage of materials, and increasingly the associated capture of information to track each transaction, are fundamental to all manufacturing systems. Over the past twenty years there has developed a much greater recognition that handling and storage are important activities in material flow systems, perhaps equally important as the material transformation processes. This has come about during a period in which enormous changes have taken place in the management of manufacturing and in the technology involved. In terms of management there has been the revolution in thinking brought about largely by the Japanese approach, and in technology the rapid development of computer-aided systems. Such concepts as the "systems approach", emphasis on flexibility and integration, leading to computer-integrated manufacture, have come to the fore. In the area of handling and storage much more complex systems are now considered, comprising mechanical equipment together with associated computer hardware and software for control and management information purposes–the advanced handling system (AHS).

The need for an AHS is driven by market forces–to be more competitive, to give better service to the customer, to reduce costs and increase productivity, to improve quality, to give enhanced management control, etc. To maximise these gains demands a thorough knowledge of the business, its strategic objectives, its products, the market place, the needs of customers and the role of technology. An AHS must be used only to assist in achieving the strategic objectives, not as an end in itself.

In spite of general improvements in throughput efficiency, it is still true that material often spends a small proportion of the total manufacturing cycle being processed, part of the remainder being handling and storage time. The less the material is handled, the better the handling methods and the less time spent in storage (implying lower stocks and increased turnover), the more cost–effective the overall process will be. This faster flow rate brings with it the need to track the material closely through manufacture, since searching and identification activities waste a significant amount of time and give rise to error. These principles apply not only to material which becomes part of the finished product, but also to tooling, fixtures, process materials, swarf, etc, which does not. Thus, handling and storage have to be integrated into the design of the whole manufacturing system.

A most important aspect of any handling and storage system is its ability to control inter-operation movements, particularly as material flow rates increase and reductions in work-in-progress become imperative. In small volume production, machines served by an automated guided vehicle (AGV) may be appropriate. One approach in medium volume production has been that of cellular manufacture, with families of components produced on groups of machines. This simplifies the flow structure and reduces handling and storage requirements. In high volume production, however, the choice is either to use a transfer line with its inherent lack of flexibility, or to employ individual machines linked directly to an automatic handling and storage system. Control of inter-operation movements is equally important in assembly. Traditionally, this has been done using conveyors, often now the power and free type to remove operator pacing. Alternatively, AGV work platforms can be used. Again, it may be necessary to link the assembly process to an automatic handling and storage system which has the ability to maintain control over operation sequences and buffer storage.

The concept of an AHS involves automation, but not without careful thought about the reasons for it. However, the concept does not necessarily imply full automation; it is sensible to automate only to the degree which is both practical and economic. Even where conventional methods are retained, the use of up-to-date control systems can provide the means to gain better utilisation of equipment and labour–a point of considerable importance to the smaller company which may not be able to afford the major capital cost of a complete AHS. Hence equipment suppliers are developing "bolt on" systems which can be retrofitted to conventional equipment to achieve a low cost automation facility.

As far as computer hardware and software are concerned, the changes that have taken place have been dramatic, with regard to both the scope of the systems and their reliability. It is now common for there to be a control hierarchy and, increasingly, AHS systems are being interfaced to other machine and management systems as progress is made towards computer-integrated manufacture. The key element in the whole system is the software. Because software engineering is a relatively new discipline and not always well understood, it is often given inadequate attention, even at the functional specification stage. It is only later, when changes in the control system are required, that it is realised there exist major constraints imposed by the design of the software. Therefore, identification of the various functions to be performed, the speed of response needed, the analysis of data flow and file structure must be done thoroughly. The provision of quality software which is flexible, adaptable and easily maintained, is vital.

Automatic identification is closely related to AHS, linking the physical identity of material with the processing of information for planning and control. Some of the technology has been used for a considerable time, but other forms are now becoming available which further extend the application of the basic principles. In manufacturing, the principal benefit of automatic identification is the ability to track accurately every transaction from receipt to despatch. This should provide reduced stocks and lead times, better control of quality and rework, less plant downtime waiting for materials, improved information for monitoring operations, etc. Time and attendance recording, control of access to secure areas or to information sources are other industrial applications.

The design of handling and storage systems has relied heavily on the experience of the analyst and system design tools are often fairly rudimentary with little formal modelling. During the design phase various options will be considered, some of which will be eliminated as infeasible, leaving a few which are worthy of detailed analysis. Comparison may first be made on the basis of capital and operating costs and any obvious difference in the more intangible benefits, such as flexibility, expansion capability, ease of control, etc. . More sophisticated modelling may well be needed, particularly using computer simulation now that powerful graphic displays and interactive systems are readily available. However, the technique needs to be used carefully to focus on those aspects of the total system where performance is unpredictable, rather than attempting comprehensive model development. Perhaps the skill of the system designer will be captured in a series of expert or decision-support systems in the future, although little has yet been done apart from some computer-aided design packages used by a number of suppliers mainly as marketing tools.

AHS projects range from relatively simple improvement schemes to full-scale design of a completely new facility. The methodology involved across the range is not fundamentally different, but the emphasis on the various stages of the project will vary. In all cases there needs to be a clear statement of objectives, time for an adequate feasibility study and thorough system design, a full specification of the design and a well-managed project team to carry through the implementation. Much has been learned about these aspects of AHS project management over the past few years from bitter experience, but mistakes continue to be made.

There are many facets of the overall project management process that require further study. Such investigation is of interest both to equipment suppliers, who claim that many companies do not understand AHS and thus find themselves involved in much unpaid initial design work, and to company users who do not have the internal expertise and must rely too heavily on consultants or suppliers. For example, the whole question of economic justification for AHS is a matter of concern, since there is often difficulty in measuring the intangible benefits as input to traditional methods for evaluating capital expenditure and assessing sensitivity. Frequently the major intangible benefits only appear when a series of investments have been made and a degree of system integration has been achieved, making management cautious in their initial willingness to accept that such benefits will be forthcoming.

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