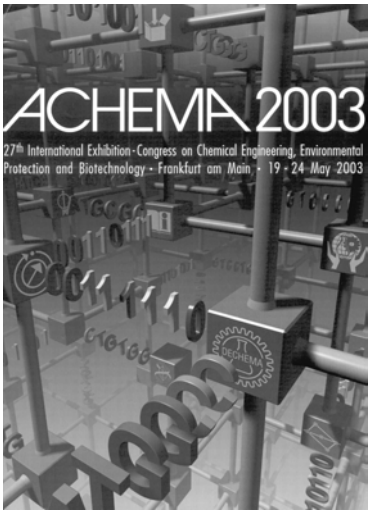


ACHEMA 2003
19–24 May 2003
Frankfurt am Main/Germany

The opening ceremony of the 27th ACHEMA was performed in the Congress Center at the Frankfurt Exhibitions Grounds. From Monday, May 19 2003 the gates to the world's biggest chemical engineering Exhibition/Congress and International Meeting on Chemical Engineering Environmental Protection and Biotechnology were opened to the public for 6 days.
The special technical and trend reports of ACHEMA 2003 exhibition were prepared for publication and realesed by internet as press informationby authorities from DECHEMA. Trend reports covering present and future state of research and development in the field of Supercritical Fluids, Pharmaceutical Engineering and Biotechnology and Bioprocessing, as well as those refering to Catalysis, Nanotechnology, Process Safety Management and Microreactor Technologies were presented in the last two issues of Hemijska industrija (Chemical Industry Journal, No 4 and 5, respectively). Tis issue give some key information on the Large–Scale Engineering Projects and Measurement, Control and Process Control Engineering.

LARGE–SCALE ENGINEERING PROJECTS

The 58,000 employees in the German engineering industry are standing their ground. The large–scale engineering working group at the German Engineering Federation reported that order volumes at member companies increased by 4% to 16.8 billion Euro in 2001. Strong foreign demand was a key factor in this positive trend, and this was a remarkable achievement given the intense price competition in foreign markets. German engineering firms were presented at ACHEMA 2003 their presence in the global market.

Two current examples underline the industry's ongoing success in the international marketplace. Lurgi has received an order from the Turkish Petroleum Corporation (Türkiye Petrolleria A. O., TPAO) in Ankara to construct engineering facilities at an underground gas storage complex in Turkey. Lurgi will have total responsibility for detail engineering at the site as well as for supply of turbines and compressors. The contract includes surface equipment required to store and retrieve the gas. Operations at the facility are planned to commence in August 2004.

Linde was recently awarded a 380 million Euro contract in Norway. This is an important accomplishment in the market for natural gas liquefaction equipment, which holds significant future potential. The company will construct Europe's largest natural gas facility for the international Snhvit group (Statoil ASA, Norsk Hydro, TotalFinaElf S.A.) on the Norwegian island of Melkya near Hammerfest, which is north of the Arctic Circle. The contract includes facilities for storage of natural gas at temperatures reaching –162^{o}C as well as equipment for loading liquefied gas into tankers. It also covers project management, engineering and acquisition and construction supervision at the facility. By 2006 at the latest, the facility will go into operation with an annual production capacity of 4.3 million tons of liquefied gas. Global demand for liquefied natural gas, which will be an important source of energy in the future, is expected to increase by around eight percent per annum.

Although both of these projects will be carried out on this side of the Atlantic, the US continues to be the most important customer market for German engineering firms. China and South Korea dominate Southeast Asian business. There is also good news in the Middle East and Central Asia, where business is growing.

Industrial power generation plants (40.7% share) and chemical facilities (14.3%) make up the largest portion (55%) of orders received by the German engineering industry. Other key segments are steel production and rolling mills (12.7%), electrical technology (10.3%) and the paper and textile industries (2.8%).

Is a German Engineering AG on the cards?

Despite good prospects for the German engineering industry even in a time of crisis, observers see a need for consolidation, because the industry is relatively fragmented. Consideration has been given to the consolidation of domestic and foreign facilities and optimization of marketing and sales operations. The goal is to leverage synergy effects leading to cost reduction.

The idea of forming a "German Engineering AG" through the merger of several German engineering firms into a large corporation is still lurking in many (analysts') minds. This concept implies that an Italia S.p.A., a France SA or a United States Corp. would also make sense. But is the argument that the international engineering community needs a large, powerful corporation really compelling? There is reason for skepticism, and there are many indications that small, highly maneuverable units perform better than supertankers that are difficult to steer.

Flexibility and the willingness to go down new paths are generally more important than sheer size. To cite a practical example, the Dutch engineering firm Fluor Daniel won the "International Project Management Award" in June 2002 for a large petrochemical project. Within a short space of time, the company was able to

convert refineries belonging to the Veba subsidiary "Ruhröl" to handle the production of fuels that conform to new EU regulations. By using efficient project management techniques, the firm completed the project ahead of schedule, and this resulted in considerable cost savings. Working to a tight framework of deadlines, budgets and quality requirements, a 20–member core team completed the refinery conversion by the middle of 2001. Instead of filling binders with contracts, the team reduced the volume of documents to only 35 pages and a few annexes, which is undoubtedly a rarity in the world of large–scale engineering. Possible areas of conflict were identified up front and solved jointly, so that the project goal could be achieved. There was no superfluous hierarchy, and open communications were encouraged.

Project management was the hub of activity

Communication primarily means exchanging data, particularly where concurrent engineering comes into play. The reason for this is that in the global marketplace, alliances and cooperative efforts are often the preferred business model. This results in an increasing need for simultaneous development of processes and equipment. Basic engineering is performed in Germany, for example, and detailed engineering is provided by cost efficient subsidiaries in Eastern Europe. Because the facilities will be constructed in China, a local engineering firm is responsible for the steel structure. An insider has graphically described this as "turning the world into a large network."

Complex, intelligent software is indispensable for a large project such as the pharmaceutical active ingredient facility at Boehringer Ingelheim, which contains about 900 pieces of equipment and 4,500 conduits. Acting as the general contractor, Lurgi Life Science used professional CAD planning tools, ranging from 2D planning applications for the approximately 300 PIDs to applications for equipment modeling, piping, frame work and electrical raceway. Some modifications to the software were made to represent the extensive architectural aspects, and new tools were created for 3D equipment planning, including new macros to generate equipment or new features to handle electrical, measurement and control equipment planning.

Project management becomes significantly more important in this environment. If you base your project on distributed engineering, you must clearly define the specific interfaces between work segments, and this cannot be done without a well–functioning project management team. High–performance software products can provide valuable project control support. Practitioners recommend EDM systems with integrated engineering workflow together with 3D CAD software offering a modern database architecture. Solutions of this type will be presented at ACHEMA 2003 in Frankfurt/M, and the visitor will have the opportunity to review the products first hand to see whether the concept fits his/her specific needs.

Improving efficiency in administration

Efficiency and productivity in indirect activities, particularly in administration, is a good place to start if you want to achieve improvement and cost savings in your engineering projects. Especially the well–established companies in the large–scale engineering project sector still have a high percentage of employees who are not directly involved in the value add process. Moreover, studies have shown that around 70 percent of all quality problems have their source in the administrative area. An insider has calculated that "production normally only takes 15 percent of the time that elapses between receipt of order and delivery. The rest of the time is taken up by administration". On top of that, practitioners believe that 20% of engineering effort involves non–creative work. This time is mainly lost through manual administration of documents. The objective then should be to increase administrative efficiency. This reduces cost, increases quality and reduces throughput time. It is an area that contains significant cost–saving potential.

Taking document management as an example, automated document management systems are useful aids at all stages of the engineering planning process. Engineer productivity clearly improves, as does the quality of engineering planning activities. Users claim that they can now save up to half of the document management costs that they used to incur in the past. There are various changes (in national and international law, FDA validation requirements, etc.) that have a significant impact on business processes in the chemical industry and the pharmaceutical industry in particular. These changes also impact on the quality of project documentation, especially document workflow. Documents must be provided in a quick and timely manner, and the process must leave room for local flexibility. GMP or FDA requirements in the chemical and pharmaceutical industries affect far more than mere document storage. They also require controlled release and collection of documents, which must be kept for accountability purposes.

Requirements related to globalization issues are also becoming more stringent. Many products not only go through an inter–company process, but are also developed in parallel in several countries. As the number of large international projects increases, a smooth flow of information and secure distribution of all required documents between project participants inside and outside the company becomes a crucial factor in the bottom line profitability of the project. It is important to remember that all documents must be available for storage and retrieval under strict revision control. Specialist suppliers of document management systems that meet these requirements will present their latest solutions at ACHEMA 2003.

From turnkey solutions to project business

How important is turnkey business in the international large–scale engineering project sector? Is demand increasing for world–scale plants, or do small, local product facilities perhaps offer greater advantages? Cookbook solutions cannot, of course, provide the answer to this question. However, market observers have noted some interesting developments.

In the European fine chemical industry it appears that customers have little interest in turnkey solutions because – in the words of one of these observers – "the user wants to introduce and retain his/her own know–how." On the other hand, in the international petrochemical business, in nuclear power technology and in the plastics business, there still appears to be a preference for turnkey facilities.

These individual observations can be generalized as follows: if facilities are involved that are used to process high–grade, innovative preliminary and intermediate fine chemical products or active ingredients in the pharmaceutical industry, the user prefers to retain in–house process and production know–how within the company. In this case, the engineering planner/producer designs facilities to exact customer specifications. Siemens Axiva, for example, has built a production facility for Aventis Pharma Germany to manufacture an active ingredient for reducing blood pressure. In only 12 months, the facility was integrated into an existing production operation at the Höchst Industrial Park, and it went into operation in August 2002. Siemens Axiva's Pharmaceutical Business Unit worked closely with the customer to develop the concept and make sure that the project was successfully completed right up through mechanical installation and initial operation. Integrating the facility into an existing production complex and using existing systems, infrastructure, pipelines and electrical, measurement and control equipment presented quite a technical challenge. One special requirement in the overall concept was to provide for gentle product flow to avoid destruction of crystals in the product as much as possible. This precluded the use of pumps. A top–down material flow was designed, which uses gravity to move the product. This provides a gentle means of moving the product, and also reduces investment and maintenance costs. By coordinating the modification and installation work with the operator, Siemens Axiva was able to avoid any degradation of the ongoing production process. Aventis requirements for final processing of active pharmaceutical ingredients were implemented and maintained in the filling area (cleanroom) – a classic example of project business.

However, in mass production environments, where margins can only be maintained through cost reduction, there is a clear trend towards larger and larger plants that can be constructed at a fixed price. The customer is quite willing to buy the process technology as well, and he expects that the large engineering company which provides the process will continually optimize the process to repeatedly squeeze out the last drop of savings on energy and materials. Some suppliers engage in cooperative efforts to meet increased demands in efficiency and environmental protection. The tendency to locate such plants closer to the sources of raw materials – together with the saturation in some national customer markets which has been evident for some years now – suggests that the trend in large–scale engineering projects in Germany over the long term will be rather subdued.

There are naturally those who champion the "small is beautiful" concept. Small, local production facilities are attractive, because they are flexible and less susceptible to risks associated with malfunction and environmental damage (lower volumes of hazardous materials mean less potential emission of contaminants) and also because transport costs are lower. Perhaps this philosophy will become more prevalent in the near future. The process intensification approach could enhance this trend. Multi–purpose use of existing equipment and the use of very efficient technologies significantly reduce facility size.

Knowledge management in large–scale engineering projects

Knowledge management and the transfer of know–how are becoming crucial factors in the engineering business. In the opinion of an international consulting firm, groupware applications, document management and the use of workflow systems are an absolute must in view of the global widespread pooling of skills and cooperation with the customer team, and above all because of the need to retain evidence of a quality management system and project documentation.

In the large–scale engineering sector, a significant amount of knowledge must be built up, but the knowledge also needs to be made available to employees in a useable form. The large–scale engineering working group (AGAB) at the German Engineering Federation (VDMA) addressed this topic for the first time in 1999, and its Project Management study group took a closer look at the subject. One important outcome was the realization that if knowledge management is to produce noticeable improvements in productivity, there needs to be a high–performance IT infrastructure. Also, employees must be required to use and maintain the system, and management must put incentives in place to encourage knowledge sharing. To succeed, however, management must first create and set a good example of knowledge culture.

Electronic knowledge databases play an important role. An interesting example in this context is the system of so–called "knowledge filling stations" run by a large engineering firm, which provides an electronic representation of 10 to 12 topic areas. There is an employee responsible for each topic. A management consultant recommends the creation of a virtual team room. The room is a uniform company–wide IT platform which integrates all internal and external persons participating in a project and provides timely

dissemination of relevant information within and between the project phases. The virtual team room creates a network encompassing all project members regardless of their location. To establish such a powerful information and communications platform, there must be Internet–based access to all the information that is relevant to the process (specifications, drawings, customer data, schedules, logs and parts lists). Commercially available engineering and life cycle data management systems, for example, already provide a concrete implementation of the virtual team room. Suppliers of these systems will be represented at ACHEMA 2003.

Prognosis: there will be demand for flexible engineering firms with IT skills

Although technical leadership in the past was so important that German engineering firms were usually able to set their prices at a level that provided a good return, this is no longer the case. Many customers increasingly use the pre–qualification phase to bring the technical offers into line with each other and then let the price decide. This applies in particular to customers who are interested in low–cost complete solutions. Engineering firms are also confronted with a growing number of customers who use their in–depth technical expertise to lay down technical requirements and award the order volume to several (specialist) engineering planning firms.

Pressure arising from contractual terms and prices are on the increase. The industry is witnessing continuous expansion of initial terms and availability requirements, as customers take advantage of the competitive situation in the international marketplace. Customers are also increasingly adding local acceptance requirements for engineering as well as for construction and components to the list of items required for contract award. Customers or politicians often require the supplier to build, finance, own, and operate the facilities. There is a general tendency on the part of customers to tie in the supplier more closely, from quotation right through to acceptance ("partnership contracts").

On the other hand there is less and less scope for the traditional tendency of German engineers to achieve technical perfection for its own sake. There is an increasing emphasis on the practical benefits of the design and production service, so–called value engineering. Efforts on the part of German suppliers in recent years to reduce project cycle times have been beneficial. Suppliers have been able to reduce costs, and they have also increased their chances of obtaining a contract award. The fact that large German engineering firms have pioneered the use of electronic business processes is now paying dividends. ACHEMA 2003 in Frankfurt/M from May 19th through May 24th is the international forum for presenting and evaluating the latest IT developments.

What's happening in the international engineering industry

The process concept is gaining acceptance in contract management

- Changes in the formulation of contracts: tendency on the one hand to turnkey facilities managed by one general contractor (basic materials), and increase of project business (pharmaceuticals and fine chemicals) on the other
- Customers increasingly require the supplier to plan, build, finance and operate the facilities and provide consulting services in other areas (data, communications, plant management, plant financial controls
- Transfer of know–how and knowledge management are becoming a crucial success factor
- Establishment of competence centers focused around topic areas and areas of specialization
- Reduction of production complexity

MEASUREMENT, CONTROL AND PROCESS CONTROL ENGINEERING

Process automation remains a reliable source of moderate growth. Although several projects have been placed on the back burner in Europe in recent years, particularly in the chemical industry, automation in the process engineering sector provides the only way in the medium term of delivering more effective and efficient processes. New developments and trends in the field will be presented at the ACHEMA 2003 exhibition and conference, which will be held May 19–24, 2003 in Frankfurt am Main, Germany.

Whether you are looking at pumps or analytical instruments, process automation or dosing devices, process engineering without electronic components is virtually inconceivable. These components increase efficiency and effectiveness, ensure a high level of quality, and make a significant contribution to safety and environmental protection. This makes it all the more important for process engineers to know what is technically feasible. A large proportion of the exhibitors at ACHEMA 2003 in Frankfurt come from the process engineering industry, and many visitors will be interested in seeing what innovative developments they have to offer. Measurement, control and process control technologies are used at all process–relevant levels, but information and communication technology provides a large part of the input. Although not every new idea needs to be incorporated, it would be most unwise to miss the important trends.

Technology has to be borrowed from other industries to address the challenges faced by the process industry. At the end of the day, most large corporations have imposed strict cost controls at their production facilities. There could be no great success stories without automation or the appropriate measurement and control equipment. The linkages between company management and field devices, between e–business and engineering, between

maintenance and process optimization are becoming increasingly more complex. Many of these areas of endeavor have their own software solutions, which have a large number of interfaces that need to be connected together. It comes as no surprise that although hardware is still sold in the automation industry, it only makes up one third of turnover. Services and software are the main element in the contract awards. There will be a special exhibition at ACHEMA 2003 dedicated to e–services for the process industries.

Long–term growth

The German Electrical and Electronic Manufacturers Association (ZVEI) estimates that the global market for electrical automation technology is 180 billion euros. The German share of global production was 14 percent in 2001, and the European Union share was one third. This clearly places Europe ahead of Japan, which has a 26 percent share. The US continues to have the largest share of global production at 36 percent.

The industry started the year 2001 with significant growth. Over the course of the year, growth continually slowed, and the year ended with a drastic slowdown, particularly in the fourth quarter. At 25.1 billion euros, the automation industry finally grew by 1.5 percent following growth of nearly 12 percent in the preceding year. However, medium and long–term forecasts indicate that the industry will continue to grow.

Differences between expectations and reality

Open designs already offer the customer supplier independence, and networked systems increase flexibility, productivity and efficiency in the process industry. Low–cost, flexible operating and monitoring systems are examples of this technology, which make it easier for users to operate their equipment, thus increasing production reliability. The reality, however, often looks quite different. There are still a lot of insular solutions, which are used for the most diverse tasks within a company. This begins with the planning process. More and more frequently, interfaces need to be taken into account between process optimization solutions, CAE (Computer Aided Engineering) systems, and material management systems. Yet a large portion of the documentation is still paper–based, to say nothing of the numerous special solutions that undoubtedly have existed for years in every company. There is a good reason for having them, but they tend to be unsuitable for maintaining a continuous workflow.

There is a general recognition that information and data about a system and its environment are more valuable than the system itself. Much has been done by equipment manufacturers and system suppliers in the field of asset management since the last ACHEMA. Asset management means enhancing the value of a system by operating the system in the best way possible. Maintenance in the future will no longer be aimed exclusively at maximum or optimum availability of components and systems, but rather at the required level of reliability. Digital measurement instruments provide a valuable source of data and hence information about the actual state of individual components. The question remains, however, of how to process the data in a way that benefits the system operator without simply creating even more work. At the moment, the user is often confronted with a large amount of superfluous, redundant data, to say nothing of the immense scope of the interfaces required. There is good reason why data consistency and data management are among the ongoing hot topics in discussions on requirements in the measurement and automation engineering industry.

Field devices, which have been underestimated for a long time, play a special role in these discussions and create the basis for successful asset management. The prospects are good for fieldbus and control systems, and the long–term future for the various field devices is not looking too bad either. Regardless of the measurement principle used, mechanical devices are losing ground to digital devices, yet mechanical components will certainly not disappear altogether. They have the big advantage that their measurement principle is well known, and they have been working reliably for a long time. Sensors must be reliable as well as accurate. Digital technology delivers fast, high–precision measurement, but electronics are often susceptible to conditions that exist in the harsh everyday process environment. Many devices have also been overloaded with functionality during the course of the digitalization process. This can delay start–up and carries with it the risk of operator error.

Device manufacturers have recognized the challenges and are working on features such as a uniform data format, homogenous interfaces or improved maintenance capability. Once these challenges have been met, information from field devices will facilitate preventive maintenance and successful asset management.

In general, the question of how to integrate the intelligence of field devices into other systems remains open. Because attention is shifting from the individual device to the entire instrumentation package, there is an urgent need for measurement instruments that are compatible with and communicate with each other. It is not unusual for hundreds of field devices from various manufacturers to be installed on a system. Configuration and parameter setting still have to be performed for every device, and the specific device parameters must be recorded and transmitted to the control system. Manufacturers do supply the required tools, but learning how to use them is not a trivial task, and it is necessary to convert large amounts of data. There is still no real continuous flow of data. Instead, users are faced with growing costs for documentation, consistency checking and configuration on a daily basis.

The existence of Ethernet and Fieldbus

The impression was often created in recent years that the important of Fieldbus was declining in favor in Ethernet. This will certainly not be the case, and Fieldbus systems will continue to be indispensable in the future. Ethernet will, however, penetrate further at the field level and will be used for applications such as intelligent field devices. A study conducted by Frost & Sullivan predicts that the European Fieldbus market will grow from $US 170 million in 2001 to $US 420 million in 2008.

High investment costs, a lack of standardization and insufficient compatibility with other equipment act as impediments to a more widespread introduction of Fieldbus systems. The reluctance to make new investments also have a negative impact on Fieldbus. Where Fieldbus has already been installed into new systems, these systems have generated real cost savings. Operators are very satisfied with their systems. Fieldbus systems are indisputably the key technology for asset management. Despite user interest in a common specification independent of any manufacturer, there is still no uniform Fieldbus standard. The pragmatic view is now being taken that there will simply be different bus systems for different applications. It is good news for the user that manufacturers are increasingly trying to produce open systems, and there is increased cooperation with user organizations.

Standards at all levels

The experts agree on one thing: there is a need for standards that apply to field communication protocols, software and Fieldbus devices. The OPC DX interface (OLE for Process Control Data Exchange) brings continuous, uniform data communications in mixed automation solutions one step closer. The intent is to enable cross–manufacturer data exchange between servers from different manufacturers using Ethernet networks. Companies have now announced initial prototypes that offer OPC DX functionality.

FDT/DTM technology (Field Device Tool / Device Type Manager), which was initiated by the German Electrical and Electronic Manufacturers Association, is now gaining wider acceptance as an industry standard. It defines the interface between device–specific software components and the control system manufacturer' engineering system. In using suitable drivers to integrate devices from different manufacturers, FDT/DTM has borrowed concepts from the Office world. More devices that follow this concept will be presented at ACHEMA 2003.

The Internet moves into the automation space

Among the other problems that now confront the industry is the fact that life cycles vary greatly from one product to the another. To cite one example, a control system often runs for 10 or 20 years to the full satisfaction of its operator, but semi–annual release cycles for a software product are not uncommon. Only visionaries could have suspected 15 years ago how important Internet technology would become for automation. Now, however, the Internet language XML (Extension Markup Language) has become the basis for modern data exchange. The challenge in the future will be to create a link between these two worlds.

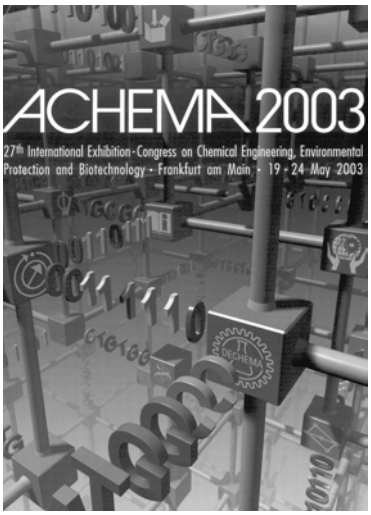
One thing is certain: the impact of Internet technologies will extend into traditional fields of automation engineering. Web technology will open the door to mobile data communications in the world of automation. The current approach to opportunities offered by the Internet remains cautiously optimistic. On the one hand, web technologies are suitable for widespread use, because nearly all the data are available on every PC. There is no need for special application programs, which are often difficult to operate, to perform a simple exchange of information. Diagnosis via the Internet also offers very interesting opportunities, for example the integration of video images. However, it is important to ensure that the information can be transferred reliably on the Internet, and that is not always the case today. Even when there is no need for real–time data transfer, the Internet is currently not a suitable solution.

A slow transition

Whatever form process automation may take in the future, the rational use of information appears to be what is currently needed. There is simply no demand for data at any cost. A mountain of information does not help anyone operating a system. Operators merely need to decide whether they should shut down equipment or not in case an alarm is raised. Service technicians, on the other hand, can make good use of selected information.

Control system manufacturers and device suppliers will face a growing list of tasks to address in the coming years. Because technical complexity continues to increase, maintenance and service will play a dominant role in device technology in the future. Many devices are still a long way away from offering plug & play functionality, despite the fact that simple operation is high up on the user priority list. Today more than ever, very solid know–how is essential to really make use of new functionality and integrate the devices into existing systems. This applies both to the manufacturer and the user.

There must be a realistic timeframe for the transition from the analog to the digital world. Old and new systems will have to coexist, and manufacturers must respond to this reality. They must also take account of the fact that structures in companies will change as a result of mergers and spin–offs. Small companies prefer solutions from a single source, whereas large corporations are familiar with using various versions at different locations. ACHEMA offers the ideal platform to garner information about the different opportunities and solutions.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