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ADVANCED MATERIALS

FRG Research Society Intensifies Research on Ion, Plasma Surface Technology

3698m272 Bonn TECHNOLOGIE
NACHRICHTEN-MANAGEMENT
INFORMATIONEN in German No 474, 29 Feb 88 p 9

[Text] The senate of the FRG Research Society (DFG) has approved the establishment of a priority program on "Ion and Plasma Surface Technology." The objective of this program is, by means of new ion and plasma supported surface coating processes as well as outer film conversion, to reveal links existing between the multiparametric influencing variables of film production and the properties of outer surfaces and composite materials, and subsequently to reveal the effects of the condition of the outer films on the functional behavior of components, or as the case may be, component matching under mechanical, mechanical-chemical, and tribological stresses.

The priority program is to be limited to the following new processes:

- Plasma supported heat treatment processes;
- Ion and plasma supported coating processes;
- Ion beam processes.

The objectives of the priority program should be achieved by further development, use, and testing of single and multi-layer, single and multi-phase coating systems, surface treatment processes, as well as evaluating films and surface conditions under mechanical, mechanical-chemical, and tribological stresses in replacement systems as well as in original components or component couplings. As reaching low process temperatures is considered a primary objective of the priority program, this limits the choice of processes: the temperature range is planned to go from room temperature to 500 degrees C. In particular, projects that satisfy the following conditions are to be funded:

- Maximum process temperature up to about 500 degrees C for plasma supported coating; no reduction of process temperatures is foreseen for plasma heat treatment;
- Expansion of the application field of hitherto known (and tried) processes and coatings in technical fields, or
- Development of new processes, films, and coating systems, or
- Development of new test procedures for thin films.

08702

New Materials Research Center Established in Aachen

3698m273 Bonn TECHNOLOGIE
NACHRICHTEN-MANAGEMENT
INFORMATIONEN No 473, 18 Feb 88 p 8

[Text] Materials research under microgravity conditions satisfies high requirements which cannot be met by research departments of private industry alone. Successful experiments in space and an overview of available possibilities require besides broadbased technical know-how, experimental and theoretical experience of research under microgravity conditions as well as organizational information. The Aachen Center for Solidification under Microgravity, ACCESS, was recently founded as a result of such considerations.

ACCESS' task is to enable potential users to enter industrial space research. In order to guarantee small and medium-sized enterprises in North Rhine-Westfalia an innovative and productive participation in astronautics research projects, further concrete opportunities for involvement in this field will be offered together with the Chambers of Industry and Commerce's multi-faceted offers to negotiate for the latest technological know-how. To this end the Economics, Mid-size Company, and Technology Ministry is funding a joint venture of firms interested in aerospace. This joint venture will be coordinated by ACCESS. The project leader is Professor Sahm, scientific project leader of the D1 mission.

This project should exploit the D1 mission's direct connection to space research and its experience in order to give small and medium-sized enterprises practical, clear examples of where their flexible potential for developing highly specialized products and processes is needed. For this reason, ACCESS is planning an open seminar for March 1988, with the support of the Dornier System corporation. This will be used to evaluate the experience acquired during the last space mission, to analyze the technological problems that cropped up, and to involve the participating firms in further concrete developments and thus plan a new generation of furnaces. The seminar results should be used by the participating companies to check whether their potential is suitable for producing and developing special products for such a furnace.

Interested companies may contact the Chamber's Industry Department, telephone 0231/5417-255 or contact ACCESS directly, Mr Guntlin, Intzestr. 5, 5100 Aachen, Tel. 0241/806721.

08702

AEROSPACE, CIVIL AVIATION

European Remote Sensing Satellite To Be Launched in 1990

3698m274 Bonn *TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN* in German No 473, 18 Feb 88 p 10

[Text] The European Space Agency will launch its first remote sensing satellite in early 1990. The satellite is named ERS-1 and is expected to have a 2-year working life.

After the first American earth reconnaissance satellite in the Landsat series was launched in 1972 and the French satellite SPOT was launched in 1986, ERS-1 will be the first Earth reconnaissance satellite with an active microwave instrument (AMI). The AMI combines the functions of both a wave and wind scatterometer and a synthetic aperture radar (SAR). This radar enables the satellite to "look sideways" and monitor a 100-km wide band. This radar enables the satellite to "look sideways" and monitor a band 100 km wide.

ERS-1 will also carry a radar altimeter for measuring wave heights and wind speeds as well as the satellite's distance from the surface of the sea level and ice surfaces.

One of the great advantages of the microwave instruments is that they can "see through" clouds and be run day and night. Radar beams penetrate even through the atmospheric water vapor that absorbs ordinary light and infrared rays. Part of the ERS-1 data will be transmitted to the Earth in real time and processed and disseminated within 3 hours, a process that takes 2-3 weeks for other remote sensing satellites. Wind direction and speed, as well as the height and direction of sea waves can be read from the high definition photographs of sea and coastal areas that are obtained from the data collected by the ERS satellite's image sensors. This way, damages resulting from natural catastrophes such as floods, landslides, and tornadoes can be assessed.

The reflected microwave signals also make it possible to monitor the spread of oil slicks and the movement of ice floes, to recognize the effects of acid rain in forests and seas, to measure erosion and desertification of arable land, and to acquire important information about geological faults for earthquake prediction.

Ore deposits can be located on land and at a certain depth under the sea with the aid of radar data. Such data can indicate turbulence in the sea, which is often associated with great abundance of fish, thus making fishing estimates possible.

ERS-1 will be the forerunner of another satellite system due to come into service in the nineties and to play an important role in scientific exploration of oceans and landmasses. This will include observing oceanographic

processes—sea currents, temperature, and condition of the sea surface—the topography of the sea bed, monitoring coastal areas, detecting significant environmental changes on land, geodetic and geodynamic investigations, as well as developing practical applications in these fields.

08702

Rapid Approval for Creation of Space Agency Given by Italian Senate

3698m296 Milan *ITALIA OGGI* in Italian
24 Feb 88 p 8

[Article by Giano Accame: "Senate Takes First Step for Space Agency"]

[Text] Rome—"The Senate has approved the bill for the creation of an Italian space agency in record time. When we came to the Senate on 3 February last, it took only 35 minutes to pass the bill because almost all of us were in agreement. We did not want to create a bureaucratic organization but the most streamlined system available, that of an agency structure."

This is how the president of the Senate industrial committee, Robert Cassola, describes the first important legislative step for the Italian Space Agency. He organized a meeting on Italian industry and space yesterday to celebrate the event.

The Made in Italy Association was responsible for the initiative. This time, it was able to broaden the scope from the production sectors most widely advertised and accepted abroad—fashion and design—to that of advanced technologies, an area in which foreigners are usually more reluctant to acknowledge our achievements.

Communist Senator Vito Consoli also favored the creation of the space agency. He signed the bill along with Ennio Baiardi (Italian Communist Party), Glicerio Vettori (Christian Democrat), Gianfrance Aliverti (CD), and Tommaso Mancina (Italian Socialist Party). Consoli added: "It may not be as simple to pass this bill in the House. This is a streamlined instrument, not a bureaucratic bandwagon. I can feel an undercurrent of resistance, a sort of weakness at the center."

The director of the National Space Plan, Luciano Guerriero, pointed out that: "The problem now facing us is the transition phase to management of the agency. We need to define how it is to be implemented or activity will be paralyzed."

"We will have to pay particular attention to new activities that are being opened up in the south: SNIA is considering an installation for space activities at Gioia Tauro and Alitalia has some initiatives in Naples." These themes were picked up by the minister of scientific and technological research, Antonio Ruberti, who

announced that there will soon be the presentation of a bill for the activities of the Italian Aerospace Research Center (CIRA), which will be located in Campania.

The renowned physicist Eduardo Amaldi, who has acted as chairman of the Space Science Advisory Committee of ESA [European Space Agency], acknowledged that: "First rate construction capabilities have recently become a reality," and strongly suggested that attention be focused on original programs to ensure the best possibilities for success.

The top names in the space sector in Italy had been called upon for the "Made in Italy in Space" meeting: from Francesco Carassa, former rector of the Milan Polytechnic and currently director of the electronics department, to Franco Bardelli, president of the Galileo factories, to the managing directors of FIAR (Silvano Casini), Aeritalia (Fausto Cerenti), LABEN (Marco Gerevini), Telespazio (Raffaele Minicucci), SNIA BPD (Marco Pittaluga), and Selena Spazio (Andrea Pucci).

08801

COMPUTERS

CNRS of France To Boost Computer R&D
36980272c Paris ELECTRONIQUE ACTUALITES in French 8 Apr 88 p 3

[Article by R. Font: "The CNRS [National Center for Scientific Research] Increases its Data-Processing Research Efforts"]

[Text] Bordeaux—The CNRS will increase its data-processing research efforts. Meeting the press on 28-29 March in several laboratories of the Bordeaux area belonging to his CNRS department, Mr Jean-Claude Charpentier, head of the SPI (Physical Sciences for the Engineer) department of the CNRS, announced that he would soon launch a project designed, in his own words, "to give muscle" to the major data-processing research poles of the CNRS.

This project, which should require a total financial contribution of some Fr10 million for this year, will regroup teams from five large cities, Paris, Grenoble, Toulouse, Nancy and Rennes; it will cover themes such as robotics, the neurosciences, mainframe networks, software engineering and artificial intelligence.

Mr Charpentier indicated that the project would extend over several years.

The laboratories in question, he pointed out, are not always perfectly well organized. The head of the SPI explained that he wanted to "put them in order" so as to strengthen what already exists.

In Grenoble, the activities contemplated will involve mostly the neurosciences and software engineering. In Paris, efforts will focus on robotics and software engineering. As far as artificial intelligence is concerned, the two cities benefiting from the project would be Nancy and Toulouse (in particular the LAAS [Laboratory for Automation and Systems Analysis]).

Still on the subject of data processing, the SPI department also announced the creation of an "industrial host structure" in the context of its GRECO on programming.

Created 8 years ago, this GRECO (coordinated research group) comprises about 250 researchers distributed among about 30 teams, some of which belong to the CNRS while others do not (e.g., CGE [General Electricity Company] Marcoussis, the CNET [National Center for Telecommunications Studies], the INRIA [National Institute for Research on Data Processing and Automation] and IBM). The research done by the GRECO on programming involves in particular languages and machines for artificial intelligence, and software engineering and programming environments.

The new structure that was just set up will offer various services to businesses, in particular for training, technological watch and researcher recruiting. Named RIS (Research-Industry-Services), it will be based in Bordeaux, where the GRECO has its headquarters. The SPI department expects the new structure to help multiply contacts between the GRECO teams and the world of industry, and to intensify research implementation efforts. The RIS structure is aimed not only at manufacturers proper (Bull and IBM, for instance, have already joined it) but also at SSIs [data-processing services and engineering companies] and large users.

Generally speaking, the leaders of the GRECO on programming stress that they are "very desirous" to develop and expand their collaboration with professional circles.

Finally, still in the field of data processing, we should mention that the SPI department will soon receive a new data-processing laboratory, together with the status of research unit associated to the CNRS. Located in the Bordeaux area, this laboratory will house two research teams: one which until now was part of the Mathematics and Data-Processing UER [Teaching and Research Unit] of the Bordeaux-1 University; the other, smaller and more recent, which used to depend on the ENSERB [National Advanced School for Electronics and Radio Engineering, Bordeaux]. This will represent a total of about 50 researchers.

The new laboratory, scheduled to move into new premises in the fall of 1989, will engage, among other things, in research on graphic data processing, image synthesis and distributed data processing.

As Mr Franois Dress, vice-president of the Bordeaux-1 University, pointed out, the Aquitaine area lags behind other French regions as far as data-processing research is concerned. And the people of Bordeaux see the development of the new laboratory as a "snowball project" which, they hope, will enable them to catch up with the leading pack in French data-processing research.

9294

March 1988 Status of France's Artificial Intelligence R&D Program

36980272b Paris ZERO UN INFORMATIQUE in French 4 Apr 88 p 18

[Article by J. P.: "Turning Point for PRC-IA [Joint Research Program on Artificial Intelligence]"]

[Text] Nearly 3 years have passed since the creation of the joint research program on artificial intelligence, the PRC-IA. The research undertaken is far from being completed, but the industry is already interested.

French AI [artificial intelligence] research is in full expansion, with respect to the number of students, the number of research theses presented, and national contributions to international conferences or to large programs such as ESPRIT [European Strategic Programs for Research and Development in Information Technology], Eureka or Brain. To a large extent, this was made possible by the joint research program on artificial intelligence (PRC-IA) launched in July 1985, which is administered by a coordinated research group of the CNRS [National Center for Scientific Research] but is dependent on two supervising government bodies for its budget.

The AI joint research program now comprises 23 university and university-related teams which are especially active in the field of artificial intelligence; they are located in Brittany, in Caen, Chambry, Grenoble, Marseilles, Montpellier, Nancy, in the Paris area and in Toulouse. Research areas such as man-machine communications and advanced programming, as well as research on software tools for artificial intelligence, are also coordinated through joint research programs. In 1987, the AI joint research program received Fr7.5 million in subsidies, most of it from the Ministry of Research and Higher Education (MRES), the rest from the CNRS. This amount does not include the salaries of permanently employed personnel nor the facilities of participating laboratories.

Every other year, the teams of the various joint research programs meet to present the progress of their research. The meeting of the AI joint research program which took place in Toulouse on 14-15 March showed the status of the various teams' research and its increasing cohesion, with respect to both the themes chosen and the research methods used.

The AI Joint Research Program, a Scientific Reference Point in the Fields Central to Artificial Intelligence

The general objectives assigned to the joint research programs aim at structuring and strengthening the potential of French public AI research, and at providing a scientific reference point in the fields central to artificial intelligence. The AI joint research program headed by Henri Farreny of the Toulouse University (Languages and Data-Processing Systems Laboratory) is organized around four poles: thought-process and knowledge modeling; learning and analog-process modeling; inference and control analysis; and applications methodology; teams may participate in one or two poles.

In addition, in order to strengthen the cohesion of the teams as a whole, a unifying theme was defined; it is entitled "developing and monitoring the implementation of plans in independent and intelligent multi-agent spaces." According to its leader, Malik Ghallab (Laboratory for Automation and Systems Analysis of the CNRS, Toulouse): "The unifying theme does not have its own financing. The teams are financed from their own budgets, but additional coordination was implemented. To avoid problems resulting from geographic distances, two sub-themes were adopted: computer-aided teaching, at the universities of Paris-VI and Paris-South; and activity planning, which will be studied more particularly in Toulouse. This second theme is consistent with research currently carried out under the European Prometheus project, and the results obtained could be applied to traffic problems or to the layout of multi-robot workshops."

About 500 people attended the Toulouse scientific meeting; a significant percentage—nearly one fourth—were people from the industry who are closely following AI research. The subjects discussed were evidence of a high level of expertise and of considerable progress in unifying the themes, vocabularies and approaches of the various teams, whether in the study of non-standard thought-processes and non-traditional logic, or in the learning of symbols or connections, or in the generation of expert systems, or again in the modeling of imprecise and uncertain knowledge.

The comparison of non-standard logics made by nine researchers from eight different teams demonstrated accurately, through a comparative table of the characteristics of the various logics, what is to be gained or lost when one chooses to reason according to a given logic. This type of research is extremely important, as it will eventually breathe new life into the development of expert systems. Non-standard logics offer much richer inferential capacities and they free expert systems from the shackles of traditional logic, which is suited only to certain types of reasoning.

AI Joint Research Program Dependent on Scientific Research Policy

The study of knowledge-base coherence, or the development of a scheme, in the form of a very detailed questionnaire, to describe and assess expert systems and

development tools, offer results which reflect the immediate concerns of the industry and which are useful when one wants to compare the many expert system generators available either directly on the market or through university laboratories.

Although the joint research program relies on public research, its leaders are still very much concerned with the dissemination of its results and applications in the industry. The attending representatives of the industry—heads of scientific and technical departments rather than managers looking for accessible popularized knowledge (this is something new in meetings of this type)—showed “unfailing interest,” H. Farreny pointed out, adding that “the joint research program wishes to develop its collaboration with manufacturers, in particular those who are sufficiently advanced to devote themselves to research without any immediate applications. Under certain conditions, manufacturers could even become members of the joint research program.”

Despite the success of this conference, the quality of the research presented there, and its acceptance of new research themes such as connectionism, the joint research program now finds itself at a turning point and its future is uncertain. This rather light and non-bureaucratic structure, managed by researchers themselves, is dependent on the research policy implemented in the scientific field. According to H. Farreny, “thanks to the joint research program, the progress of research was accelerated through the implementation of structures and financing which, for example, made a start possible as far as equipment is concerned. I wish to go on with this structure, in which the scientific community plays a responsible part and in which control is exerted a posteriori rather than a priori; and I wish that researchers be given time, i.e. 3-year or 4-year contracts. It appears highly desirable to persevere in the same direction and to provide public research with the continuity and stability which it needs.”

Indeed, when granted for a 2-year period, financing is very constraining and hardly makes it possible to start any thorough research. Besides, the coordination already implemented appears to have fulfilled its function, and researchers do not wish to see it modified in the near future.

9294

ENERGY

BMFT, Berlin Technical University Subsidize Heat Insulation Projects

[3698m275 Bonn *TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN* in German No 473, 18 Feb 88 p 14

[Text] A highly valuable heat insulation technology developed by the Messerschmitt-Boelkow-Blohm GmbH corporation for use in space has been adapted by Mannesmann Seiffert GmbH for large-scale technical applications in pipe construction, with funding from the FRG Ministry for Research and Technology (BMFT).

Through a follow-up project funded by the BMFT and the Berlin Land, BEWAG intends to participate in a joint project with the Berlin Technical University and Mannesmann Seiffert starting in mid-1988 to test the new technology suitability for long-distance heating systems.

This involves the utilization of vacuum super insulation (VSI) in long-distance heating pipes. The VSI system permits heat losses to be reduced by 20 to 25 percent in comparison with conventional insulation systems. The VSI pipe is constructed in such a way that the pipes can be set directly in the ground just like refrigerating conduits, without any pressurizing or compensation elements. The VSI principle is based on the heat insulation effect of a fine-grained, temperature resistant powder under vacuum pressure introduced by von Smoluchowski in 1910. The dimensionally stable siliceous earth is placed as a support material in the ring-shaped space between the medium and the outer pipe. The outer steel pipe is the load-bearing element, while the expansions caused by temperature changes in the special thin steel inner pipe are taken up by ring-shaped special steel membranes of the external surfaces.

08702

Italy: CNR's Computer Applications in Biomedicine

36980265c Milan *SISTEMI E AUTOMAZIONE* in Italian Dec 87 p 1249

[Article: “Provision for Expert Systems in CNR's Strategic Plans”]

[Excerpts] The CNR [National Research Council] has given the green light to a Strategic Project on the topic “Data Processing Systems in Biomedicine,” which is being coordinated by Engr Fabrizio Ricci, and which, among the lines of research it supports, provides amply for work on expert systems and their use in biomedical applications.

This choice, besides marking application of artificial intelligence to medicine as a research sector in continual expansion, represents the proposed solution of the need to group under a single project all the research topics specifically related to biomedicine, so as to create a forum for the exchange of information on methods and applications having a particular connection to this discipline.

Reflected in this choice is the faith and optimism the public health sector puts into these technologies, despite their lack of a consolidated tradition such as that which characterizes the traditional data processing technologies.

In fact, the aspects of the information processing systems on which the Strategic Project is to operate are strictly those connected with the static and dynamic aspects of the data and knowledge that characterize the biomedical sector.

It is to be borne in mind that the cultural plan under which the Project was launched seeks to give widespread distribution to the problems related to data processing technologies as applied to biomedicine, with a view to furthering the distribution and transfer of the results obtained. This would also achieve the medium- to long-term objective of transferring within the CNR and the universities, as well as to the industrial sector and the National Public Health Service, not only results that can be put to immediate use, but also a more far-reaching scientific culture that will facilitate a sound instituting of productive strategies in the technology transfers sector as a whole.

9238

FACTORY AUTOMATION, ROBOTICS

Officials From Siemens, MBB on Quality-Control Programs

36980261a Munich *INDUSTRIEMAGAZIN* in German
Apr 88 pp 148-156

[Article: "Ninety-Nine Percent is Not Enough"]

[Excerpts] Manufacturing Automation/Quality Management. New production techniques, which are as precise as they are flexible, are forcing a change of course in the area of quality assurance: Prevent defects at the source rather than eliminate them later; co-responsibility and communication rather than monitoring.

For Dr Juergen Schaedel there is only a small gap between good and bad—the difference between 99 and 99.9 percent. This small difference is significant; it means the difference between market success and flop, between profit and loss.

Schaedel, head of quality assurance at Siemens AG's integrated circuits plant, made a quick calculation. The one-megabit chip produced in Regensburg must undergo approximately 400 individual process steps from insertion of the virgin wafer, i.e., the bare high-grade silicon disk, to delivery.

If each step produces a flawless product only 99 percent of the time—multiplied out on a pocket calculator—only a miserable 1.8 percent of the completed chips are of deliverable quality. At 99.9 percent per production step, on the other hand, a significant 67 percent meet the class of service objective.

Schaedel is not satisfied with that: "Reliability in operation is crucial." When a minuscule, highly integrated part in a telephone exchange, a computer or a machine

control unit malfunctions, the cost is many times the value of the part. And the risk of malfunction increases with the number of ICs built into an electronic device.

Also "much more widespread than many think is the misunderstanding"—nurtured by the usual organizational separation—"that quality is only produced in the quality assurance department," complains Hartmut Fromme, head of quality assurance at Dr Johannes Heidenhain GmbH in Traunreut in Bavaria, a manufacturer of testing and control equipment. "In the final analysis each employee is co-responsible in his work for the quality of the products"—an idea which is also not lacking in the basic quality principles of high-tech companies such as Siemens and Messerschmitt-Boelkow-Blohm (MBB).

Programs on the subject of "modern quality management" are very popular; established consulting firms and expert industrialists anticipate a consulting business with good future prospects.

Justifiably so. While the quality demands of customers increase—not least of all those placed on the suppliers of raw stock and components—and product liability is stressed, modern microcircuitry in the areas of electronics and optics, biotechnology and new materials, as well as in more advanced, highly automated flexible manufacturing systems, require an extremely high degree of processing expertise. Process reliability and product quality—be it an automobile, a chip or a genetically engineered medicine that is involved—must go hand in hand in terms of planning and control. At the same time automated aids can also be useful—from simulation of the product's technical properties or manufacturing processes on a computer terminal to in-line, computer-controlled test systems and test robots and to computer-aided quality assurance (CAQ) which provides for clarity of the data.

The German capital goods industry wants to improve future quality using this type of hardware and software in particular. This statement is based on a survey by the Roland Berger & Partner Gesellschaft fuer Strategische Planung mbH in Munich regarding the "status of development trends in the area of quality with respect to CAQ."

In practice the flow of information is still frequently impeded by technical interface problems between test equipment, decentralized CAQ systems and central commercial EDP systems. At Heidenhain and at the MBB plant in Nabern, which manufactures high-precision components for military and aerospace applications, the computer gap between quality assurance and commercial EDP is about to be bridged.

Three quarters of those surveyed by Roland Berger & Partner—mostly medium-sized and large companies with more than 250 employees—are also investing in

quality-related education and training of their employees. Lack of personnel, qualified personnel in particular, is considered by them to be the main obstacle standing in the way of outstanding success in terms of quality. Deficiencies in leadership, organization and design are only blamed secondarily—a self-assessment which appears somewhat optimistic and dangerous to those familiar with the scene.

"Over 90 percent of the life cycle costs are already determined when new systems are conceived and defined," explains Dr Paul Wilhelm Schmidt, head of the central quality assurance department at MBB. "Incorrect decisions regarding the basic definition of the technical problem, and thus the quality, cannot be corrected later on at all or can only be corrected at disproportionately greater expense." At MBB, therefore, the quality risks are evaluated and quality analyses are performed during the initial study phase.

Siemens Example: Testing the Design Engineers

"Siemens' overall experience," according to IC quality manager Schaedel is that 70 percent of the subsequent manufacturing costs are fixed during development, "with integrated circuits, easily more than that."

The importance of quality assurance as early as the design phase, when no testable prototype yet exists, is shown by an example of computer development at Siemens: Eliminating a defect in the prototype phase of the X3 central processing unit in the 1970's cost approximately DM500 and took about a half a day. With the complex central processing units of today it would be about 100 times as expensive and take approximately two months.

Design engineers and quality assurance personnel therefore take up the battle against tricky problems earlier and earlier—with success. The defect ratio is declining. Among other things, EDP-aided design systems, which simulate the behavior of chips and computers in advance and pay heed to meeting certain design requirements, are helping to prevent defects as early as this stage.

The quality battle even begins as early as the planning stage. "In the past quality assurance was always between a rock and a hard place. The project manager labored under uncertainty for three years, then we threatened to use the guillotine, and he begged for mercy because he had to deliver," recalls Siemens' Schaedel. "But an IC project is a one-time procedure just like the construction of freeway overpass. You don't start in on it just like that." As a matter of fact the development of a basic process for IC manufacture is also in a similar price range: normally around DM100 million.

The three obstacles to approval, which have been stipulated at the Siemens IC sector for process development, begin with the design review. The design engineer must take the process steps "which do not yet exist and make

them plausible" to the quality assurance people, explains Schaedel. "We test his knowledge, ask him for justifications and alternatives, and point out to him where deficiencies and risks still exist."

The top priority is a robust process which is relatively insensitive to changes in its diverse requirements and influencing variables. According to Schaedel, the principle of making the leap to the next generation "as large as necessary but as small as possible in order to make use of the manufacturing expertise already won," and thus to shorten the testing time and the production run, becomes second nature to the design engineers.

In the case of the megachip, the company's component sector knowingly broke this rule: Siemens went over from the standard five-inch wafer to a six-inch-diameter wafer in order to make faster progress than with successive steps. The electronics giant had to accept some startup delays, in addition to having to begin production in the completely new Regensburg factory with a largely new crew. However, by suddenly changing over to the more advanced mega-process of the Japanese electronics company Toshiba, Siemens is now among the few companies in the world which produce megachips in series.

The mega-process experts took on obstacle number two, approval of prototype production, at the beginning of 1987. In addition, Schaedel and his team take a critical look at whether the installed production system "appears manageable." To date the quality assurance group has been on target with its approval 90 percent of the time.

During the subsequent pilot phase, a limited number of chips are produced, tested and, with appropriate markings, even supplied to customers. At this time quality assurance takes wafers from all possible process steps and subjects them to a detailed design analysis using a scanning electron microscope; i.e. they "act as if we are not familiar with the chip." Only when the quality detectives are satisfied with everything do they give the go-ahead for series production—at the Regensburg mega-plant this was in December of 1987.

From its tailor-made structure—almost a machine and building all in one—it is clear what all is given prior consideration: For wafer production in the 3860-square-meter clean room almost six times more total area is needed for supplying raw materials and removing wastes. For certain systems, the building vibrations per floor area on which they sit cannot be more than 0.3 to one one-thousandth of a millimeter. Specially selected plants were used for the landscaping around the building because flower pollen can disrupt production.

Dr Karl Thomae GmbH in Biberach/Riss, a German pharmaceutical center belonging to the Boehringer-Ingelheim group, had to take similar measures with its

new biotechnology factory. Since the fall of 1986, genetically engineered hamster cells there are producing the protein t-PA, which helps to dissolve blood clots. Biberach t-PA has been market approved since October of last year.

12552

Asea Brown Boveri Chief on Future Strategy
36980254 Duesseldorf *HANDELSBLATT* in German
12 Apr 88 p 18

[Article by hch: "The Risk of Merger Leading to Incapacity to Act Has Mostly Been Overcome Already"]

[Text] Stockholm—"The large risk factor in other major mergers of a lengthy merging process, accompanied by uncertainty and paralysis of action, now seems largely to have been overcome," writes Percy Barnevik, head of ABB Asea Brown Boveri, in Asea's annual report for 1987.

The merger was agreed to in August of last year and approved in November by the general stockholder meetings of the two companies. Even before the merger became legal at the end of the year, primarily in the FRG and Switzerland structural programs with a "high pace and significant rationalization measures" got under way, which Barnevik broke down into the following points:

- Reduction of the central staffs, decentralization into profit and loss units and a transition to a "more level" organization;
- Merger of individual enterprises, overlapping productions and marketing channels;
- Exchange of products between manufacturing units, as well as specialization in research and development;
- Liquidation of losing units, as far as it appeared impossible to bring about acceptable profitability;
- Rationalization of capital for both financial and physical assets, as well as release of real property for other purposes within the entire ABB group.

"In many areas of its initial phase, this program leads to a reduction in personnel with very painful effects locally," Barnevik states, but expresses his own conviction that the improved competitive ability resulting from these measures must lead to the next step of a sales expansion in Europe as well as overseas. Reiterates Barnevik: "The ABB merger is an offensive union, with the goal of increasing profits and turnover."

That requires setting some strategic switches, for the electrical technology industry, according to Barnevik, "has reached its maturation all over the world with only weak growth, and in some areas there are considerable overcapacities." On the other hand, the head of the group pinpoints some regions, above all the developing countries, with greatly increasing demand, and, consequently, there are also "global niches." In these regions the ABB is now making efforts, as Asea has been doing so

far throughout the 1980's, to establish overrepresentation through acquisition of market shares. That is the objective of the reconstruction program.

Said to be particularly promising are the areas of power plants, power transmission and power distribution, which in 1987 represented not quite 30 percent of the turnover at Asea, but brought in nearly half of the revenue. In the new ABB group the turnover is more than 40 percent in these areas, and Barnevik now endeavors to "raise the joint earnings level to that of Asea."

Barnevik regards ABB as a "federation of national European enterprises," by which a concentration of strengths and thus reinforced competitive power vis-à-vis the competitors in Japan and the United States has been created in a previously fragmented industry.

Expansion Opportunities Primarily in Southern Europe

The initial position in the markets varies. In northern Europe improvements in earnings can be achieved principally from the cost benefit of the now larger production volume and from the exchange of products between the units in the group. The situation is similar in the FRG, whereby Barnevik again refers to the "room for profit improvements" in the former Brown Boveri & Cie. units. He envisions actual expansion opportunities in southern Europe, above all in Italy.

In the developing countries, mainly in Asia, ABB wants to grow "from within," combined with project exports from Europe. North America represents 30 percent of world demand, but only 10 percent of ABB's turnover, and will thus be given priority in setting up new business. In so doing ABB wants to retain the profile of concentrating on electrical technology and directly related fields and avoid unconnected diversification. "So ABB is swimming against the current, compared with most of the competitors," Barnevik remarks.

The 1987 result for Asea shows a 12.2 percent increase in turnover to 52,271 billion Swedish kronor (DM 14,787 billion) and a profit gain before extraordinary items, reserve funds and taxes of 12.3 percent to 2,724 billion Swedish kronor (DM 771 million). The dividend will be raised from 7 kronor to 8 kronor per 50-kronor share.

In the power plant sector, profits fell short of expectations. The fact that the delivery of two nuclear reactors in Sweden had raised profits in the last two years is reflected there. The demand for new reactors continues to be weak after Chernobyl, the annual report states, but also notes that after a growth of 21 units in 1987, 416 installations using nuclear technology now operate worldwide and an additional circa 150 are under construction. This expands the market for fuel and maintenance, according to the report.

Asea rejoices in the "market breakthrough" for the environmentally safe and resource-saving technology of high-pressure fluidized-bed combustion. In 1987 an order was received for a combined power and district heating plant of this model near Stockholm. Now, a new generation is being developed for the end of the 1990's.

Despite international market slumps, Asea recorded considerable improvements in profit in the areas of power transmission and power distribution, whereby technical problems last year had the effect of depressing profits. Also showing growth is the division for means of transportation (railroad and local traffic systems), which is experiencing particularly strong complementary effects through the merger.

In order to round out ABB in Sweden, Asea now wants to take over all of Flakt AB, of which Asea owned 50.4 percent. First, the companies already have broad areas in common in their production programs, and, second, Flakt subsidiary Gadelius has a strong position in Japan, which can be utilized for ABB.

11949

Overview of FRG Robot Sensor R&D

36980261b Duesseldorf VDI NACHRICHTEN in German 8 Apr 88 p 25

[Article by Michael Pyper: "Sensors: The Euphoria of Earlier Years Has Passed. Still a Long Way to Intelligent Robots. Sensing of Unforeseen Geometries Confused"]

[Excerpts] Bad Nauheim, 8 Apr (VDI-N)—The "intelligence" of a robot depends on its ability to sense its environment and act accordingly. Its performance therefore depends greatly on its sensors. This is why robotics sensors were also a focal point of the "Sensors—Technology and Applications" conference held by the VDI [Association of German Engineers] and the VDE [Association of German Electronics Engineers] in Bad Nauheim from March 14 through 16.

"We are in a phase of technological consolidation," is how Dr K. Bethe, the scientific conference chairman in Bad Nauheim, described the state of the art of sensor technology.

Only a Few Robots Equipped With Sensors

Substantial progress in robotics depends on sensors which help the robot to sense his environment and take appropriate systematic action. Dr R.D. Schraft, acting director of the Fraunhofer Institute for Production and Automation Engineering in Stuttgart, provided the more than 500 sensor experts with an overview of the current state of robot technology.

Surprisingly, only a very few robots in the FRG today are equipped with sensors. Essentially, says Prof Schraft, there are four reasons for this fact: Potential users

frequently are not aware of the capabilities of sensor systems; these systems are still reputed to be very expensive; there are too few system suppliers in a position to provide complete systems; and finally, interface problems between robots and sensors are still being dealt with.

The future most important area, however, is likely to be automation of assembly. Considerable interest was generated in particular by the development of the inexpensive Scara robots in Japan. In the future growing awareness of viewing robot installations as total systems may lead to overall planning efforts extending even to design.

It is primarily the colleges and universities which are currently still involved with the possible applications of sensors in robot technology. G. Kegel from the Institute for Control Engineering at the Technical University of Darmstadt was thus able to present several types of sensors developed there. In his opinion the ability to detect altered manipulation parameters and to react to them can be efficiently implemented directly at the end effector.

Much Demanded of Sensors for End Effectors

The sensors in end effectors equipped with multiple sensors, says Kegel, must satisfy various requirements. Whenever possible they should be implemented within the end effector itself. Tactile sensors integrated into the fingers must be built small, may not weigh much and may not overlap non-tactile sensors located behind them. They should have a standardized and, whenever possible, digital interface, and the mechanical connections should permit an automated change of fingers.

A matrix-addressable optical sensor for sensing silhouettes and profiles was developed at the Institute for Network and System Theory of the University of Stuttgart. This sensor detects the silhouette or profile of an illuminated object using a matrix comprising 32 x 32 picture elements each of which contains a photoconductor and a thin-film transistor. The object lying on the matrix is illuminated and covers up individual picture elements. This information is scanned line by line and converted into voltages which can then be further processed.

Also inexpensive is a fluorescence sensor developed at the Institute for Electronics at the University of Bochum in the Ruhr area which is also supposed to be able to measure positions optoelectronically. A transparent polyester plate is doped with a fluorescent dye. Photodiodes covering the surface area are optically coupled to the face of the plate. This permits determination of the coordinates of a point generated by a parallel light source over the plate.

A process using an arc sensor, which was developed by Daimler-Benz, is supposed to work well primarily for sensing workpiece profiles. The non-contact process

works on the basis of arc discharges and is said to represent an alternative to tactile sensors. In Bad Nauheim, H.W. Spaude listed as its particular advantages the nearly punctiform resolution of the object, the sensing speed, the uncomplicated signal processing, the compactness of the sensor head and its insensitivity to interference factors such as temperature or radiation.

The sensor head consists solely of a current-carrying conductor. The spacing characteristic is obtained by evaluating the relative break-through frequency of the reference branch. The measuring frequency is supposed to be able to be increased up to several kilohertz without difficulty. An offline weld joint tracing system on lap welds is currently being tested. To do this the torch holder is replaced by a sensor. This sensor determines the actual joint control pattern and during a tool change, for example, corrects the already stored pattern.

The demands made on sensors used in forming and finishing machines are altogether different. In forming and finishing wood, sheet metal, plastics or even food-stuffs, the amount of resolution required is much less than with machine tools. Therefore, the number of machine axes to be controlled is as a rule much greater than with machine tools.

An intelligent sensor system presented by Dr H. Walcher of Siko GmbH in Buchenbach detects pathways and angles. The critical element is an incremental photoelectric angular stepping transmitter; its signals are counted as a function of the direction of rotation. The unit has a nonvolatile memory to prevent loss of the information. There is an integrated microcontroller which is already capable of further processing the values sensed using various methods. Twelve faults can be detected by the sensor. Data transmission is via an RS-485 bus so that large amounts of data can be transmitted over long distances without extensive wiring.

12552

Netherlands TNO Institute To lead ESPRIT CIM Project

3698a168 *Amsterdam COMPUTABLE in Dutch*
22 Jan 88 pp 8, 12

[Text] The Hague—The TNO [Netherlands Central Organization for Applied Natural Scientific Research] Metal Institute is expected to enter into a major cooperative project in the field of flexible production automation within the framework of ESPRIT II. Mandelli, the Italian machine tool manufacturer, the Turin Technical College, Sema Metra, the French software company, and IPK Berlin have already announced their desire to participate.

The partnership also includes the further development of a control system for batch production which TNO hopes to complete this year. The assistance of Sema Metra, which specializes in technical software, would be particularly useful in this project.

The so-called TNO Supervisory Control System (SCS) allows several production machines to be linked and controlled from one central point. The SCS coordinates activities, handles detailed planning, and controls the manufacturing process. TNO is currently very busy developing a demonstration model which will cost about 4 million guilders. The new control system was developed by TNO's Technical Physical Department.

The SCS software architecture is in theory suited for the real-time control of any Flexible Manufacturing System (FFS) including several machine tools. According to eng W.J. Oudolf, head of TNO's Metal Removal and Automation Department, the control system is unique in that its software is to a certain extent universally applicable to flexible systems. Whereas existing control systems can on average produce 10 to 12 different products, SCS can handle batch production for a very wide range of products (about 80). These possibilities meet the specific needs of the Netherlands metal removing industry, which is characterized by production of relatively small batches. It usually involves the manufacturing of parts with the concurrent use of metal removing techniques. The SCS was designed in such a way that a control system suited to a specific application can be created via relatively small software adaptations. Only minor changes will be needed to increase the production capacity or to add more machines. With this system it should be possible, to a certain extent, to make a production plan for any desired configuration.

Pilot Plant

The development of the demonstration model, which TNO hopes will lead to a commercial product, was not without problems. The completion of this model later this year will have taken at least 20 man-years. The control system is at the heart of an ambitious project which should familiarize Netherlands industry with flexible production automation. In Apeldoorn, a pilot manufacturing system is being finished which should be an example of the "factory of the future."

TNO is looking for ways to further develop this project and possibly the SCS software architecture in a European framework. The pilot plant or so-called "test bed" could prove to be a major asset as none of the other European participants has such a pilot project. TNO aims at a joint European project in the field of flexible manufacturing systems requiring some 22 million guilders. A major aspect of this project will be the development of systems for computer-aided planning of the production process. These are moving in the direction of the so-called generative production preparation.

Engineer Oudolf: "Once the shape of a part has been defined, a computer system can automatically generate the information needed to produce that part. The computer indicates which tools and machines to use and which working method to follow." This technique is not yet widely used, says Oudolf. "Most systems use existing information which can be retrieved systematically. A search is then made for similar parts based on past experience. A generative system, however, uses the shape of a certain part as basic input and then generates logical rules to decide how it should be produced."

Integration

The second part of the program is the integration of computer-aided design (CAD) and computer-aided manufacturing (CAM). In Oudolf's opinion, most CAD systems are basically no more than electronic drawing tables. "The information they often contain is not at all suited for computer-aided production planning. It must be translated, taking into account the techniques used in the workshop. In addition, joint research with European partners should focus on the combination of workshop planning and material requirement planning (MRP). At present people generally determine when a certain part should be produced by a certain machine on the spur of the moment. The development of a more systematic approach is being studied. Finally, TNO hopes to conduct more extensive research into assembly operations planning within the context of ESPRIT II. ESPRIT I for that matter already has a project on this subject.

25023

LASERS, SENSORS, OPTICS

French Firm Develops Commercial Femtosecond Laser

36980269b Paris L'USINE NOUVELLE in French
15 Apr 88 p 56

[Article by Thierry Lucas: "First Commercial Ultra-Fast Laser"]

[Text] Step-by-step research on the behavior of two molecules that have just collided with each other may seem a gratuitous undertaking. Yet, it is precisely for applications of this type that the Photonetics company at Marly-le-Roi (Yvelines) has just completed the development of the first commercial version of an ultrashort-pulse type of laser. Only this technique enables observation of phenomena whose duration is of the order of the femtosecond—that is, one millionth of one billionth of a second!

Photonetics, a PMI [Small- and Medium-Sized Industry] employing 60 persons and specializing in lasers and optic fibers, has developed this product, designated Fem/Tau, jointly with Patrick Georges, a researcher at the Orsay Optics Institute.

Actually, the study of many very fast mechanisms in physics, chemistry and biology is dependent on this technique. This is why some laboratories have already developed their own devices. But generally speaking, these are complex and costly prototypes. "It takes a year to develop a femtosecond laser," says Herve Arditty, president of Photonetics. "Our aim is to make access to femtosecond pulses available to a larger number of laboratories, by offering a product that is less costly (Fr350,000) and quickly operational."

The solution adopted by the Optics Institute consists of a "ring" of six mirrors, which envelops within itself the path of a light ray. The light source, an argon coherent-pulse laser, excites the molecules of a jet of dye which traverses the beam. This jet constitutes the laser amplifier. The light emitted by the dye is then collected by a mirror and revolves within the "ring." At this stage the laser beam continues coherent.

To create pulses, another jet of dye must be interposed which has the property of absorbing light as long as its intensity remains low. However, as soon as the intensity exceeds a certain threshold value, the jet becomes momentarily transparent and allows a pulse to pass. The second dye, which is called a saturable absorber, thus plays the role of an optic switch, controlled by luminous power, and so effectively so, that each successive crossing of the two dyes produces a further shortening of the pulses with each revolution around the ring.

Unfortunately, however, with this device alone, it was found impossible to attain pulse durations of less than 500 femtoseconds, because contrary phenomena owing to the interaction between the laser beam and the materials it encounters (dyes, mirrors,...) tend to lengthen the duration of the pulse.

To obtain a "useful" pulse—that is, a pulse of less than 100 femtoseconds duration—the designers therefore introduced a system of four prisms into the path of the light. Fine adjustment of this system compensates for the above negative effects and enables the obtaining of pulse durations of less than 80 femtoseconds, guaranteed by the manufacturer. "Our work on industrializing it has involved human-factors engineering, and the fineness and stability of the adjustments," says Herve Arditty. "Furthermore, we have defined a simple and accurate procedure for putting it to use."

Today, femtosecond lasers underlie the work of teams of researchers at the AT&T Bell Laboratories, MIT, IBM, and, in France, the Applied Optics Laboratory at Palaiseau in particular. The latter has just equipped its facilities with a laser capable of generating pulses of 13 femtoseconds duration. These laboratories are engaged in a heated race to attain the femtosecond, the lower limit for lasers emitting in the visible spectrum. To attain shorter durations than this, laser sources in the ultraviolet—or even in the X-ray spectrum—will have to be developed.

Research in this regard interests industrialists, since applications already abound in the study of fast semiconductors, such as gallium arsenide. Furthermore, the improvement of these techniques is contributing to the developing of the "optical computers" of the future, whose performance should far exceed that of the most powerful present-day computers.

On the sidelines of this race, Photonetics and the Orsay Optics Institute have channeled their work into putting this technology to practical use. Convinced that ultrashort-pulse generators are fast becoming an indispensable tool for all major chemical laboratories, the goal of these companies is to sell 30 to 40 lasers over the next 5 years.

9238

Optoelectronic R&D in France at Thomson, CNET, CGE

36980274 Paris *L'USINE NOUVELLE (Supplement)* in French 14 Apr 88 pp 36-40

[Excerpts] Work is proceeding at Thomson's Central Research Laboratory, in Corbeville, on laser diodes emitting on a wavelength of 1.55 microns, a value that will increase the distance between two repeaters in optic fibers. The researchers have developed a laser termed a DFB, for "distributed feedback," laser, which emits on an extremely precise wavelength and thus supplants conventional lasers. The latter have a broader spectrum and give rise to wavelengths close to 1.5 microns that do not all travel at the same speed, a flaw that increases the dispersion of the light.

Increased Distance Between Two Repeaters

The CGE Laboratories at Marcoussis, in close cooperation with Alcatel-CIT, another CGE subsidiary—which, moreover, also operates a manufacturing facility at the Marcoussis site—are pursuing the same line of research for high-speed telecommunications links operating at speeds of up to 2 Gbits [gigabits] per second. For the researchers, the objective is a simple one: Attain an ever greater distance between two repeaters. To this end, they have worked hard, as have those at Thomson, on DFB lasers, which are in the process of being transferred to optical heads, specifically as part of the trans-Atlantic fiberoptic cable project. "These studies require an in-depth knowledge of the different electronic, optic and thermal models that govern the operation of lasers. They also require a mastery of specific technologies, such as epitaxy, etching and diffusion, which enable precise and reproducible control of the laser's parameters," says Jean-Claude Carballes, manager of the Marcoussis Laboratories' Optoelectronic Components Division.

In the case of semiconductor-type lasers, the pattern dimension is, in fact, fundamental. Its dimensional parameters are controlled to within less than 0.1 micron. Moreover, all the energy is localized on surfaces 1.5

microns wide by 200 to 300 microns long. Thus, the concentration of optical energy is very high—much higher, in fact, than with a gas laser—amounting, all things considered, to a power density of 0.1 to 1.5 megawatts per cm^2 .

Beyond telecommunications, Thomson's Central Laboratory researchers are also studying optoelectronic components for the processing of hyperfrequency signals. At Corbeville, a laser modulated around 10GHz has been built. This frequency is of interest not only to radar specialists but also to those specializing in satellite receiving antennas. "Tests have been run jointly with the CNET [National Center for Telecommunications Studies] at Lannion on linking the electronics bays to the satellite receiving antennas," says Baudoin de Cremoux, head of the Applied Optoelectronics Group.

To pursue these lines of research, most of the laboratories have invested heavily in equipping themselves for epitaxy, a method that enables the deposition of material in the form of thin layers not more than a few microns in thickness. After having worked with liquid-phase epitaxy, which is difficult to control and to realize over large surfaces, they now use new techniques such as vapor-phase epitaxy based on organometallic materials.

These new techniques have improved the quality of components and, above all, enabled the breaking away from designs that had been frozen for several years. "The realization of optic components with integrated electronic control enables us to exert an effect on the variation of light," says Claude Puech, head of Thomson's Central Laboratory Optics Group. Modulators and switches based on lithium niobate have been designed. They can be used at hyperfrequencies or at optical wavelengths. In the latter sector, the Corbeville researchers are working on a modulator with very promising prospects, in that it is capable of operating at any frequency between 0 [direct current] and 30 GHz! Another modulator has been designed to operate around 10 GHz but with a narrow passband of a few gigahertz; it is of interest mainly to Thomson-CSF's Radar Department.

These technologies, as of now, permit the grouping together of the source, the detector and the signal processing electronics. To facilitate this operation and reduce the production cost, Thomson and the CNET are working on hetero-epitaxy techniques for "growing" AsGa on silicon. "One can think in terms of components in which the silicon would be used for work not requiring high speed, and the AsGa for high speeds and the optics part," says Claude Puech. Components of this kind would represent a giant leap forward in microelectronics. They would resolve the fundamental problem of linking two chips by means of optical transmission; one could also think in terms of ultra-fast internal connections in the interior of integrated circuits. But let's get back down to earth. For the moment, there are major problems to be resolved, particularly that of stacking together crystals

having different lattice networks. One solution consists of developing "buffer" layers to absorb the mechanical constraints. Two years ago, this seemed like a long shot, but the Thomson and CNET laboratories appear to be at the point of marrying the two components. Still to be awaited is that the technology be proven reproducible and reliable.

For the reception of luminous signals, the Marcoussis Laboratories are preparing avalanche photodiodes that will yield sizable sensitivity gains in high-speed data links. Optimization of these components requires a considerable amount of modeling and characterization, principally to steer the work of epitaxial growth. Very shortly now, photodiodes operating at up to 3 Gbits should be entering the developmental stage.

The CGE Group is also beginning to get involved in optic fibers made of other, fluoride-based, materials. In the long term, they will enable transmission at wavelengths of 2 to 4 microns, essentially for use in long-distance telecommunications. They will reduce absorption by a factor between 10 and 100. Hence, across the Atlantic without repeaters, or almost so!

To exploit to the maximum the transmission possibilities of future fiberoptic networks, the luminous signal at the sending end will have to be varied at a very rapid rate. The configuration developed by Alain Carencu and his CNET team at Bagneux is of interest from the standpoint of being able to vary the intensity of light by means of a very low electrical potential. The classic method, consisting of modulating the beam directly by operating on a laser is characterized by a number of faults, such as broadening of the emission spectrum (inadmissible for long-distance telecommunications links), and the need to control by varying a potential on the order of thousands of volts.

The component developed at CNET, a modulator external to the laser source, offers incontestable superiority over direct modulation for very-long-distance communications facilities. It consists of two light-guides a few microns wide, approximately 1 cm long, and rigorously parallel to each other, obtained by diffusion of titanium in a lithium niobate crystal. The light that traverses the component is channeled inside these two guides. Two microwave connectors are used to apply the intensity-control electrical signal.

Photonics To Front and Center

Different structures have been developed at Bagneux. The one that has shown the best performance, featuring a passband of 7 GHz and a control voltage of 11 volts, will be marketed soon by Alcatel-CIT. For the moment, Alain Carencu holds forth on the optic repeater, which would no longer transform the photons but rather regenerate them. "Currently, the processing of the signal is done electronically, with optics being used solely for transmission. The light is not being acted on directly,

which is the objective of much research now in progress," he says. Beyond integrated optics, the next step now is photonics. The CNET has succeeded in obtaining optical amplification involving the preserving of photons alone.

Meanwhile, at Bagneux, work is also proceeding on a European program—RACE—the object of which is to demonstrate the possibility of manufacturing coherent components. These would enable the multiplexing of several wavelengths on the same optic fiber. "The desired wavelength would then be retrieved in the same way one selects a frequency via radio," says Alain Carencu. Such a method would open up the network to multichannel and wideband transmission applications. The tunable laser remains, for the moment, an outright "monster." For the price of these functions to become competitive, they would all have to be incorporated into a single chip.

9238

MICROELECTRONICS

ESPRIT Phase II Receives EC Approval, Funding

ECU1.6 Billion Allocated

36980255b Duesseldorf *HANDELSBLATT* in German
12 Apr 88 p 1

[Text] Luxembourg, 11 Apr 88—The research ministers of the EC reached an agreement in Luxembourg Monday concerning a second five-year phase of the successful ESPRIT program for promoting modern information technologies, to the tune of 1.6 billion ECU, or DM 3.3 billion. There was also agreement on several smaller projects. However, the ministers failed to settle on the next stage of the joint project with Switzerland and Sweden on nuclear fusion, a practically inexhaustible source of energy. One of the points of contention was the responsibilities of the EC's research institutions (GFS), with their branches in Ispra (northern Italy), Karlsruhe, Petten (the Netherlands) and Geel (Belgium). In particular, the largest center, in Ispra, is to be restructured and opened up to a greater extent to contract research for public and private third parties (cf. *HANDELSBLATT* of 8-9 April 1988).

FRG Minister of Research and Technology and incumbent president of the group Heinz Riesenhuber, who felt that the council had made extraordinarily gratifying progress, also presented two memorandums to the ministers with which he requested greater efforts in developing common standards and better integration of EC research with the EUREKA European research initiative, which extends beyond the Community framework. In the minister's opinion, the harmonization of standards and the early establishment of points of contact in areas with a high degree of innovation should be given even greater priority, such as in the realms of laser technology, robotics and microtechnologies. Norms and

standardization accompanying development, as well as European initial standards are important, he said, adding that the European research programs should be focused more strongly on that area.

With an endowment of 1.6 billion ECU (1 ECU is currently equivalent to around DM 2.07), the successful ESPRIT program, the second phase of which has now been agreed upon, is one of the most important components of the five-year EC research program involving a total of 5.4 billion ECU for 1987 through 1991.

At 911 million ECU, the nuclear fusion program, which has yet to be approved, is also significant in size.

Among the other successes at the Luxembourg meeting were agreement on DRIVE, a program for applying information technology to traffic (60 million ECU for 36 months); DELTA, a pilot program for learning technology (20 million ECU for 24 months); SCIENCE, an initiative concerned with researcher training, mobility and communication (167 million ECU for 5 years); and a boost in the existing biotechnology program from 55 to 75 million ECU for the remaining period of the program, 1988 and 1989. The European Parliament must still issue a statement on all these points. Finally, 60 million ECU was approved for the so-called reference office of the EC, which will be involved in meteorology, chemical analyses and calibrated test pieces for research and industry.

12271

Computer-Integrated Manufacturing Budget Tripled

*36980269a Paris L'USINE NOUVELLE in French
7 Apr 88 p 58*

[Interview with Patricia MacConaill, head of the European Communities Commission's CIM sector; first paragraph is L'USINE NOUVELLE introduction]

[Text] For the second phase of the European program, the CIM sector is expanding its field of action to include process industries, and is launching a "megaproject" based on "plants of the future."

The deadline is 12 April for the submittal of project proposals for the second phase of ESPRIT, under which the budget of the CIM sector, which is preparing the "plant of the future," will be tripled. Patricia MacConaill, head of the European Communities Commission's CIM sector discusses the results of the first phase and the ambitious goals of ESPRIT II.

L'USINE NOUVELLE: The first phase of ESPRIT having come to an end, what are the CIM sector's principal achievements?

Patricia MacConaill: The concrete results are several. In terms of products, a number of softwares have emerged from ESPRIT projects—in the domain of analysis by finite element methods, for example. In addition, some hardware-and-software packages are now being marketed for the monitoring and in-process diagnosis of flexible machining systems. But the best example is undoubtedly the industrial local network project termed the CNMA [Communications Network for Manufacturing Applications] project. Its objective is to complement the MAP [Manufacturing Automation Protocol], the industrial network developed by a team led by General Motors. The MAP is designed basically for use at the supervisory level, whereas the purpose of the CNMA is to provide real-time communications among the workshop's robots, machine tools and other equipment. Launched 2 years ago, the project is still at an early stage. Manufacturers participating in the project are just beginning to manufacture network components conforming to the CNMA communication protocol.

L'USINE NOUVELLE: Will this project materialize in the form of applications?

Patricia MacConaill: Applications already exist. Just a month ago, a new painting workshop was put into operation in a BMW plant. All its communications utilize the CNMA protocol. A British Aerospace plant will soon be following suit, and will be followed in turn by Aeritalia. Thus, three major European industries will be making direct use of the result of a project. In addition, the CNMA will be demonstrated at the Enterprise Networking Event show in Baltimore, Maryland, this June. An optic-fiber facility will link Baltimore to British Aerospace workshops in England where Airbus wing components are being manufactured. Machining commands (simulated) will be transmitted via this link. Americans will thus be able to see the CNMA protocol in action.

L'USINE NOUVELLE: How does the European level of CIM research compare with those of the United States and Japan?

Patricia MacConaill: We have excellent specialists in the basic techniques of CIM. A sizable effort is also being devoted to artificial intelligence in Europe, particularly in France. But we are very slow in putting all of these elements to work. We are at risk of missing the boat to markets of considerable import. The role of ESPRIT is to encourage and support joint effort among Europeans, and to channel this effort in the direction of the market.

L'USINE NOUVELLE: How will ESPRIT II differ from the first phase of the program, and what orientations will comprise the CIM sector's main course of action?

Patricia MacConaill: ESPRIT's budget has been doubled, and that of the CIM sector tripled to between 500 and 600 million ECU's. First of all, we plan to extend our field of action to encompass the process industries. Continuous processes also have need of CIM and artificial intelligence techniques.

The second difference, which, generally speaking, applies to ESPRIT II as a whole, is that, for the first time ever, we will be launching very-large-scale projects. For the CIM sector, we have decided to concentrate our effort on the development of a single "megaproject" termed the Technology Integrated Project. Our aim is to select three industrial sites—one for each type of process—at which we will integrate all the technologies developed under ESPRIT and in other European laboratories. This will mean building actual "plants of the future," which will use the most advanced techniques, particularly in the domain of real-time scheduling and robotics. Their communications will of course use the CNMA protocol. If we succeed, we will be in a position to offer this realization worldwide.

The commercial fallout from these three "showcases" could be substantial, not only for the suppliers of data processing equipment, but also for European industry as a whole, since clients sensitized to the problems of quality control are becoming increasingly aware of the importance of production methods and facilities.

L'USINE NOUVELLE: What role will industrialists play in ESPRIT II?

Patricia MacConaill: During the first phase, the CIM sector was already the richest in industrial participants. This is one of our strengths. For example, many large-scale users are participating in the CNMA project. These include, besides those already mentioned, Peugeot SA and Elf-Aquitaine, the latter having recently joined the project. This has undoubtedly contributed to the success of the project.

For ESPRIT II we plan to focus increased attention on exploitation of its results by the firms taking part in the program. Our aim is not to manufacture directly but rather to generate products, processes and standards that can be put on the market during the unfolding of this second phase. ESPRIT II taught us to work within an international context. I am convinced that this experience was a valuable acquisition.

9238

April 1988 Status of Siemens-Philips "Megaproject"

One-Megabit DRAM Production in Regensburg
36980268 Paris *ELECTRONIQUE ACTUALITES* in
French 1 Apr 88 pp 1, 14

[Article by Pierre Maslo: "Siemens Started Volume Production of 1-Megabit DRAM [Dynamic DRAM] in Regensburg"]

[Excerpts] Munich—After 3 years of collaboration with Toshiba, the Japanese semiconductor manufacturer who, in the last year, has acquired a marked ascendancy over the market, production of the first 1-Mbit DRAMs

started at the Siemens factories at the beginning of this year. Simultaneously, sampling of the first 4-Mbit modules is taking place at the Perlach (Munich) R&D Center. The object of a collaboration agreement signed in 1984 by the German firm and Philips, production of the 4-Mbit memory should start in 1989.

Within the Siemens group itself, opinions differ as to the exact date when volume production of 1-Mbit chips started. According to Mr Franz, manager of the group's components division, the actual production stage started last Christmas; according to Mr Brunner, head of the 1-Mbit DRAM factory of Regensburg, it started in October 1987. Today, the Regensburg line processes 2,500 six-inch wafers per week, with an 18-day cycle time for about 300 different operations. The line operates continuously, 7 days a week and 24 hours a day. From 500 to 600 people work on the product, and 80-operator shifts relay one another every 8 hours. The production rate—a little over 10,000 wafers per month—is said to represent one half of the total production line capacity. Actually, full-capacity production, i.e. about 25,000 wafers per month, will require a new investment of DM50 million (Fr170 million) for photo-repeating- and implanting-type equipment, in addition to the DM430 million (Fr1.5 billion) representing the cost of the Regensburg factory.

The clean rooms themselves cover an area of 4,000 m² and have a cleanliness rating of 10. At present, two thirds of the equipment used is of American origin (GCA) and one third consists of Japanese machines (Nikon, Canon). However, the second investment installment, required for full-capacity production and for the future 4-Mbit chips, is expected to be made in Japanese equipment.

Submicron Line Width

Production of 1-Mbit DRAMs started nearly 2 years ago, in May 1986, and at the time silicon chips with an area of 62 mm² were used; the first sampling took place in July 1986.

Today, volume production involves a 54-mm² chip obtained in 1-micron CMOS technology; it should shrink again to 45 mm² and 0.9 micron in 1989, so that the number of chips per wafer could be increased from 250 to 310 and the access time reduced from 90 ns to less than 80 ns, we were told by Mr Deppe, head of CMOS products development.

According to Mr Franz, the 1-Mbit DRAM represents just one stage, and a way of acquiring expertise on the market of complex logic circuits, in industrial sectors as well as for office automation and telecommunications; the latter market has a strong European coloration and Siemens is the first company in the world to produce an ISDN [integrated-services digital network] echo-cancelling system. In this respect, the 1-Mbit memory, the 4-Mbit memory currently being developed jointly with Valvo, Philips's German subsidiary, and more generally

the "Megaproject," should effectively encourage the development of Siemens's semiconductor branch and eventually make the group one of the 12 leading semiconductor producers.

A \$2.7-Billion Market in 1988

The Siemens 1-Mbit chip will find its first market within the group itself, as it is the 7th electronics and electrical engineering group in the world, with sales of DM47 billion in 1986, i.e., about Fr160 billion. This chip currently sells for DM50 (Fr170), which seems rather high compared with average 1987 and 1988 prices—respectively Fr87 and Fr66, according to Dataquest—but at a time when there is a world shortage of 256-K chips, the Siemens DRAM, even at a high price, should have no trouble finding buyers.

Today, the acknowledged leader on the 1-Mbit DRAM market is Toshiba which ships about 5 million circuits per month, far ahead of its closest competitors, Hitachi, Mitsubishi, Fuji or NEC. In the United States, IBM alone, for its own needs, and Texas Instruments, which manufactures in Japan, have any significant 1-Mbit DRAM production. Under these conditions, provided it increases soon the production rate of its Regensburg line to 20,000 or 25,000 wafers per month, and provided it achieves an output of a quality which could be expected to be similar to that of Toshiba, Siemens could claim an honorable portion of the world market for 1-Mbit DRAMs.

The difference between sampling production and volume production is underestimated in Europe and in the United States, the head of CMOS products development pointed out; experimenting lies only 10 or 20 percent of the way to production, something which the Japanese have understood a long time ago.

4-Mbit DRAMs With Philips

Started in 1984, in collaboration with Valvo, Philips's German subsidiary, the 4-Mbit DRAM project should not lead to volume production before next year. Development of the circuit, in 0.8-micron CMOS technology, is taking place at the Munich R&D center. Technically, the chip will be laid out as 4 M x 1 bit and 1 M x 4 bits, with respective access times of 80-160 ns and 100-190 ns. The experimental chip now being made has an area of 91.3 mm² and includes 8.6 millions of components, with 1 transistor and 1 capacitor to each 10.6-micron cell.

The Siemens/Philips cooperation also covers the development of a 1-Mbit SRAM [static RAM], a sector in which Philips possesses knowhow, which is not the case for DRAMs. The two companies are managing together the development of a production process, the development of products proper, and production engineering. The Dutch and German governments also participate in the project. The German government has contributed 10 percent of Siemens's share. Development sites are

located in Eindhoven for Philips, and in Munich and Hamburg for Siemens, and production will take place in Nijmegen and Regensburg, on the same 6-inch line which, for the time being, is dedicated to 1-Mbit DRAM production.

Details on Production Facilities, Rates

36980268 Paris L'USINE NOUVELLE in French
31 Mar 88 pp 50-51

[Article by Yves Fontaine: "Supermemories: European Kickoff"]

[Excerpts] After 4 years of efforts, the first 4-Mbit memory chips are undergoing industrialization in Regensburg. Siemens thus confirms its position as the European leader in microelectronics.

The Mega collaboration project of Philips and Siemens is out of the laboratory. After 4 years of work, the 2 European giants now have the means to play an important part on the electronic systems market, from automation to data processing.

Their joint efforts were needed to master the microelectronics technology. The stakes are vital for both groups which, together, account for Fr350 billion in sales of electronic systems.

Siemens has now acquired expertise in VHSICs [very-high-scale ICs]. Its Regensburg industrial center produces over 600,000 of the most sophisticated chips per week. One-Mbit and 4-Mbit memories have a repetitious structure which is particularly well suited for that purpose.

To implement the project, extremely heavy investments were required, from both industrial partners, Philips and Siemens, but also from the respective governments of the FRG and of the Netherlands. Siemens will have invested over Fr3 billion in R&D and in a pilot line at the Munich-Perlach center, and about Fr2.5 billion in the Regensburg production facility.

The memory capacity to be achieved dictates the technology used. Thus, the 1-Mbit chips, with a unit area of 54 mm², use 1-micron technology. The 4-Mbit chips, having an area of 91 mm² (i.e. not even twice the area for 4 times as many cells) call for 0.7-micron technology.

For the industrial stage, production was transferred to Regensburg, 100 km or so north of Munich. Production of the 1-Mbit chips started late in 1986; however, because of certain technical problems, large series production started only in October 1987; production of the 4-Mbit chips is still expected to start in 1989. In the 4,000 m² of clean rooms located at the core of the factory, problems are difficult to solve. Indeed, once the first wafers are completed, the transition to industrial

production accounts for 80 percent of the work. Thus, it took 1 year to identify and solve a contamination problem that was holding up production.

At this stage, Westerners have much to learn. Siemens's collaboration with Toshiba, which Siemens sees as an "intellectual guide as far as present CMOS are concerned," was a decisive factor. "The Japanese do not hesitate to spend weeks, even months, on a single process stage in order to get the most out of it. This is a state of mind that we must absolutely acquire, and process-industrialization engineers, whether American or European, find that difficult to accept," Hans Deppe, head of MOS products development, explained.

To ensure the necessary cleanliness, a continuous laminar air flow directed downward brings to the floor the few particles that still remain in suspension. In order not to waste precious square meters, whenever possible equipment was built into the walls of the clean room, leaving inside the room only what is indispensable to perform the task. The wafers are processed in batches of 50. This small number, and the fact that "cassettes" have to be transported from one workshop to the next during production (which involves some 300 operations) make for maximum flexibility.

The memories currently being manufactured in series at Regensburg on 6-inch lines (wafers with a diameter of 150 mm) are 1-Mbit memories. Thanks to 5-shift operation, production takes place 24 hours a day, 7 days a week. At present, 2,500 wafers are produced per week, and the maximum capacity of 5,000 wafers will be reached only during 1989. Indeed, increasing production to that level will require additional equipment, and above all a large investment in training.

The Megaproject is part of an overall policy of penetration of the VHSIC market, e.g. the ASICs [application specific ICs]. Another illustration of this customized-circuit policy is the Advancell concept. This is a library of basic cells, in 1.5-micron CMOS technology, which is shared by Siemens, Toshiba and General Electric and which offers real second-source possibilities among the three partners. Their strategy is also particularly aggressive in the ISDN sector, for which Siemens claims to be the supplier with the largest offer worldwide. This undoubtedly demonstrates the German group's determination to be among the microelectronics leaders of the 1990's.

9294

Siemens X-Ray Lithography Strategy Explained
3698a170 Brussels NOUVELLES DE LA SCIENCE
ET DES TECHNOLOGIES in French
Oct 87 pp 125-127

[Article by Eng Peter Tischer, responsible for microelectronics R&D at Siemens, Munich: "X-Ray Lithography"; first paragraph is NOUVELLES DE LA SCIENCE ET DES TECHNOLOGIES introduction]

[Text] The technology most likely to succeed photolithography for the production of structures smaller than 0.5 micron is x-ray lithography. Dr Peter Tischer, of Siemens Corporate Research and Development—Microelectronics in Munich, agreed to present ongoing R&D in this area.

Perspectives of X-Ray Lithography

We are currently concentrating our efforts on x-ray lithography. In this way, when traditional photolithography resources are exhausted, we will perfectly master the technology most likely to succeed it. Our research into a better alternative for optical applications goes back some 7 years. During that research we opted for x-ray lithography which is, after all, the next logical step in the search for shorter wavelengths and a better resolution. Semiconductor manufacturers initially preferred electron beam lithography, widely used for mask production. However, this process soon proved too slow for direct writing onto individual silicon wafers, as is required for mass production. At the moment it seems that x-ray lithography will not attain full development until there is a need for structural dimensions under 0.5 micron or until the x-ray process becomes cheaper than traditional photolithography.

Mask Pattern Projection Onto a Wafer

The wavelength of x-rays is about 500 times shorter than that of visible light. This presents various problems in the four phases of the lithography process: the x-ray source, the mask, the resist (covering resin), and alignment. At this stage alignment is not a typical x-ray problem, but a more general problem of micrometer positioning. At Siemens we have developed an extremely precise new alignment system, functioning at the exact level required by x-ray lithography.

Source Problems?

Since the x-rays currently used in medicine or materials testing have much shorter wavelengths than those needed in lithography, none of the available sources can be used commercially. Experiments with traditional tubes designed for medical applications but adapted to this end clearly show the limits posed by their weak intensity, resulting in small distances between source and object and a broad divergence. These disadvantages lead to precision requirements during exposure which are virtually impossible to meet within this wafer-mask distance. Thus the need was created for an x-ray source with parallel radiation as produced by an electron synchrotron using a storage ring. The research that we are conducting jointly with the Fraunhofer Institute on DESY—the Hamburg electron synchrotron—confirms this: We really need synchrotron-type radiation.

The DESY storage rings (2.5 km in diameter) were designed with other objectives in mind. Nevertheless our research clearly indicates that this choice was relevant.

We have since decided to build a compact storage ring exclusively designed for use as an x-ray source in lithography. The Berliner Speicherring Gesellschaft has now developed table-top equipment, the prototype of which is currently being tried out at the Fraunhofer Institute for Microtechnology in Berlin. The compact storage ring produces the wavelengths we need combined with a very high radiation intensity and a highly precise adjustability.

Problems Caused by Masks!

The differences in absorption coefficients of x-rays are considerably smaller than those of light. Currently an optical mask generally includes a substrate of 1.5-mm thick transparent glass covered with a 0.1-micron thick opaque chrome film. X-rays, however, require an extremely thin transparent substrate of a material with the smallest possible atomic number. For the absorbent it is just the opposite. It must be as thick as possible and have a very high atomic number. This requires, for instance, 4- to 5-micron thick substrates for 1-micron thick absorbents. Moreover, the pattern of the absorbent must not have a raised profile. Its height should not be more than twice its width. These dimensions already indicate how difficult it is to fabricate a stable mask for x-ray lithography.

The most promising materials for substrate films are silicon, silicon nitride, and silicon carbide. Gold is the absorbing material used by most R&D teams. We are focusing our efforts on the development of new precision methods for mask dimensioning and on defect detection in x-ray masks.

Ideally, the sensitive film, called resist, should absorb most of the radiation, just like the absorbing mask. As is the case with the mask, however, the geometry of the pattern requires a film of limited thickness made of material which should be insensitive to subsequent ion implantation, etching, and deposition processes. Moreover, during these processes there should be absolutely no diffusion of the resist into the silicon monocrystal. Indeed, even impurities with atomic concentrations as low as 10^{-9} and 10^{-10} can affect a chip's performance.

For these reasons, the choice of materials is extremely limited and almost exclusively restricted to organic composites containing carbon, hydrogen, oxygen, and nitrogen, i.e., non-critical materials that can subsequently be eliminated. Although some effective materials are already on the market, the primary objective of organic chemistry should be to develop materials that require only low dose x-rays for precision exposure while at the same time remaining insensitive to processes such as ion implantation.

Active Cooperation of the Private Sector

Siemens, Valvo, Telefunken, Eurosil, and the Fraunhofer Institute signed a research agreement in 1978 to explore the possibilities of x-ray lithography. From the

start, this project has also been supported by the FRG Ministry of Research and Technology. Recently the companies involved in the project agreed to extend this cooperation to other semiconductor technology sectors. For this research project we share a portion of the BESSY storage ring in Berlin. The successful development of the compact storage ring will also allow us to have access to the only x-ray source in the world designed exclusively for lithography. Without last-minute difficulties, this will give us a substantial lead in this field.

Our group's primary goal is mask development. In particular we have already been working on a certain number of different designs of which only the most promising are being developed.

The Advantages of Creating Smaller Structures

X-ray lithography has numerous advantages over other processes. I will mention here only its advantages over optical lithography, the most competitive technology.

First of all, there is a considerable focal depth, allowing manufacturers to print structures onto existing surfaces without additional investments. X-ray lithography also reduces particle-related problems, whereas in optics the smallest, even translucent, particle causes diffractions and design distortions. The most cumbersome problem that cannot be avoided is that of particles that are sensitive to electrostatic charges, including certain resist particles. As the chips become larger and larger, this type of divergence must be avoided if wafers are to function properly.

Another advantage that should be mentioned is a higher tolerance—of some 10 percent—in exposure and development times. Equally important is improvement in the field of view, dependent only on material stability and not on the numerical opening of the diaphragm as is the case in optics. This means that the useful field size available in optical lithography is multiplied by 10.

What Will Become of X-Ray Lithography?

Users looking for features smaller than those obtained with optical systems currently bet on x-ray lithography. At Siemens we already have one client courageous enough to apply this process in practice, for an operation which indeed requires 0.3-micron features. This shows the concrete advantages of x-rays. For the 4-Mbit memory, optical lithography remains the main research method. However, our short-term research indicates that x-ray lithography will reach a level offering comparable advantages in quality and price. The results of these tests will put their mark on the next generation of semiconductor components.

LETI, SGS-Thomson To Do Joint Integrated Circuit R&D

36980272a Paris *ZERO UN INFORMATIQUE* in French 18 Apr 88 p 41

[Article by Olivier Saint-Leger: "Rhne-Alpes; Semiconductors; The LETI's Expertise [Laboratory for Electronics and Data-Processing Technology]"]

[Text] The new French-Italian holding company asserted its determination to become a leader on the semiconductor market by signing a collaboration agreement with the LETI.

Last Friday in Grenoble, in the presence of Alain Carignon, minister of environment, the LETI division of the Atomic Energy Commission (CEA) and the SGS-Thomson Microelectronics group signed a collaboration agreement in the field of microelectronic technologies.

SGS-Thomson Microelectronics was created in June 1987 by Thomson-CSF and STET [Telephone Finance Corporation, Italy], which regrouped their respective subsidiaries, Thomson Semiconductors and SGS Microelettronica. During the past 8 months, the merger of the two entities was carried out, both at administrative and at technical level, thus enabling the new holding company to increase its sales by 6 percent; as a result, sales exceeded \$860 million.

From the time it was created, in 1967, the LETI became a unique applied research group within the CEA. Its activities are oriented toward industrial applications; through various collaboration agreements, it undertakes to transfer knowledge and knowhow to the industry.

Already in 1985, a collaboration agreement on MOS technologies, signed by the CEA and by Thomson, resulted in the production of CMOS circuits with line widths of 1.2 microns, thus confirming the LETI's vocation as a national laboratory.

A 16-Mbit EPROM Memory

According to Pasquale Pistorio, general manager of SGS-Thomson, "the LETI is the most perfect example of team and budget integration." As a result of its agreement with the LETI, SGS sales should exceed \$1 billion in 1990, and the company should become one of the leading 10 producers in the world.

The holding company also has ambitions to exceed \$2.5 billion in 1993. To achieve this, it should fulfill two conditions: it should maintain an excellent research level and a high-performance industrial structure.

As far as research is concerned, the financial program contemplates an annual investment equivalent to 17 percent of sales; and, as for the industry, Pasquale Pistorio has announced that a new Class-1 factory, representing an investment of Fr1 billion, will be built in 1990.

The material details of this collaboration agreement are defined by a Program Committee consisting of four members from the CEA and four members from SGS-Thomson Microelectronics; they will be implemented by SGS-Thomson and LETI personnel at the Microelectronics Center of the LETI division, located at the Grenoble Center for Nuclear Studies (CENG).

The first objectives involve essentially the development of production processes for BICMOS integrated circuits and of the technological stages leading to the production of a 4-Mbit EPROM memory. In the next three years, research should lead to the production of a 16-Mbit EPROM and to a CMOS process using a basic feature size of 0.5 micron. But people at the LETI laboratories are looking farther ahead and already contemplating a 64-Mbit EPROM memory.

As for SGS-Thomson Microelectronics, it will focus its efforts on the design and industrial development of a 0.8-micron CMOS production process and on the industrialization of the mixed 1.5-micron process.

Grenoble, a Leader

This cooperation agreement enables SGS-Thomson Microelectronics to assert its determination to establish itself in the semiconductors industry, thus providing Europe with a strategy to oppose to Japan and the United States. The creation of a central research pole was announced by the parties to the agreement, and it should channel all of the group's initiatives. In other words, Grenoble, which already has the benefit of considerable local expertise in the field of research, industry and academic training, should become the largest research and production site of the group.

In his speech, Alain Carignon stressed the government's commitment to the capital of the Dauphin. The state contribution (some \$80 million) will be devoted not only to research and development, but also to maintaining the high level of expertise of all the personnel involved.

9294

Biosensor R&D, Achievements in UK, France, Denmark

36980273 Paris *INDUSTRIES ET TECHNIQUES* in French 1 Apr 88 pp 56-59

[Article by Claude Bonner: "Slowly But Surely: Biosensors"]

[Excerpts] Biosensors detect and measure the concentrations of organic substances in biological environments. But the number of these specific probes available to industry is as yet limited.

It must be acknowledged, in this regard, that the technology of biosensors "is still in the Stone Age," as put by Frederic Leme, head of development at SGI in Toulouse, one of those rare firms that markets a biosensor—the "Microzyme", an analyzer of lactate, which is used in sports medicine.

In addition to the Japanese and the British, the Americans, French and Germans are also intensively engaged in research on biosensors.

Why this feverish activity? "One of the reasons," says Pierre Coulet, head of the University of Lyon's Enzymatic Engineering Laboratory, "is that the biosensor represents the missing link in present-day continuous fabrication processes." It was he who originated the glucose biosensor being marketed by Solea Tacussel, namely, the Glucoprocasseur, which is used in the food processing industry as well as that of pharmaceuticals.

The military market factor, still a minor one at this time, nevertheless remains an unknown that could change all given factors, judging from the success scored by the personal-type gas detector. This "ballpoint pen" of sorts "beeps" upon sensing the presence of toxic emanations, thus warning the soldier to wear his mask. Designed by Thorn Emi on the basis of an order placed by the British Defense Ministry (a contract valued at Fr260 million!), this biosensor—the NAIRD [Nerve Agent Immobilized Enzyme Detector]—could fuel the interest of the military in this technological approach, if indeed this is not already the case, secrecy being, as it is, *de rigueur* in this environment.

Great Britain is currently Europe's most advanced country in the realm of biosensors. Its domestic market is 30 times greater than that of France, its nearest follower. Moreover, it is one of the first countries to have launched a full-scale research program. Under this program, the Thorn Emi and Amersham International groups have teamed up with the Britain's National Institute for Medical Research, with support from the Department of Trade and Industry, to study biological and chemical sensors. In France, a biology and medical engineering club has been formed under the aegis of the CNRS's Industrial Liaison Committee. Its membership includes some 40 or so university and industrial organizations.

Biomedical—the Largest and Most Promising Market Sector

In France, it is also significant that of the three firms designing and marketing biosensors, two are focusing on the biomedical. SGI, at Toulouse, where the lactate analyzer has been sold to 15 French and foreign sports centers, and Seres, at Aix-en-Provence, which markets the Enzymat for the metabolic determination of glucose. This apparatus was brought out with the help of the UTC's Enzymatic Technology Laboratory at Compiègne, where the researchers are among the 10 or so

French specialists in this field, along with Pierre Coulet at Lyon and Philippe Contat of the University of Toulouse. "One of the most promising aspects of biosensors in medicine is the permanent monitoring of those of a patient's vital functions requiring close supervision," says Pierre Coulet.

A Biosensor Based on Human Olfactory System

Dr Georges Dodd, of the University of Warwick's Chemistry Department, who is by no means a practical joker, is seeking to imitate the human olfactory system by means of a quite complex combination of sensitive biosensors—an undertaking at least as delicate as, if not more so than, creating a tasting robot. Such a biosensor would be "very useful in the quality control of fragrances, and the detecting of explosives, drugs, and of fumes in industrial environments," Georges Dodd points out.

Nevertheless, although market studies project a rising market for biosensors, prudence remains the watchword; for, misadventures are always a possibility. This is borne out by what happened in the case of Solea Tacussel's Glucoprocasseur. Warmly received by biomedical analysis specialists while still in the planning stage, and assured of a radiant future, it had to dwarf its ambitions in the face of a market that had shriveled like a pricked balloon with the advent of multiparametric detectors. Adopted by Pfizer, which mass produces antibiotics, by MacDonald's and by Vico, whose potato chips are known to everyone, the Glucoprocasseur is nevertheless capable of reducing sample analysis times by 75 percent—a test based on measuring the consumption of glucose by microorganisms. This type of instrument, which is portable, accurate, and characterized by a short response time, is ideal for use in a laboratory pending the advent of on-line biosensors: "Within 5 years from now," according to some market study projections, including that by the CPE [Forecasting and Evaluation Center] in Paris. They will replace present-day techniques—liquid-phase chromatography, for example, which is effective but costly. The road between these two points is an obstacle course. First of all, biosensors will have to be made capable of withstanding the severe and widely diverse environments of industry. Their sensing element, for example, owing to its fragility, cannot withstand the rigors of a molasses environment; nor, for that matter, temperatures in excess of 60 °C. In the latter regard, the Danish firm Novo, a leading manufacturer of enzymes, has given rise to some hope, with its marketing of an alpha-amylase capable of withstanding 105 °C for 5 minutes. The product of a bacillus obtained by selection of microorganic stocks, this amylase is used in the industrial processing of starch. If the amyloid sector is the leading user, it is because its industries are characterized by complex and intensively elaborated manufacturing processes. This is not the case of the sugar industries, where on-line control is still not a major concern, and where the processing of sugar beets is very simple. "Water at 72 °C is all that is needed to extract the

sugar," says Pierre Coulet. Here, another obstacle is seen to the incremental development of biosensors: "The incapacity on the part of the industrialists for conceptualizing potential applications," according to the CPE report. "What measurements are to be given priority?" ask those concerned when confronting the innumerable choices offered by the vast food processing industry alone. Generally speaking, except for a few multiparametric models, a biosensor is in most cases application-specific; that is, sensitive to just one compound, gaseous or liquid, even though it can pinpoint that compound in a mixture with an endless number of others. Be it noted that research is costly....

The large majority of laboratories and of firms like Cambridge Life Sciences in England, and SGI in France, can only work on a "commissioned research" basis. With the discovery of Novo, "what remains to be done is solely to understand why the amylase remains stable at over 100 °C, in order to create other similar enzymes," concludes Pierre Coulet. Unfortunately, nowhere in the world does there exist a true protein engineering technology capable of transforming industrial families of enzymes into families more resistant to high temperatures or to potential poisoning environments. Enzymes, microorganisms and other microbes produced *in vivo* for use as biosensors are of course designed to live under biological conditions: non-acid pH, a temperature of 37 °C, aqueous environment, etc. This explains why ecology and medicine are favored sectors: The sensor easily finds biomimetic—"true to life"—conditions in them. The environmental protection market, faltering for reasons that are more political than technical, actually already has its biosensors. The Lyonnaise des Eaux company and the Compagnie Generale des Eaux have each developed an electrode that is sensitive to pesticides in industrial waste waters, with thresholds of 50 milligrams per liter and 5 milligrams per liter, respectively.

ISFET Silicon Chip Biosensors

Both companies have moreover teamed up together to develop an instrument capable of detecting one *Escherichia coli* bacterium per 100 ml of potable water, an infinitesimal threshold that is inaccessible other than by the biosensor technique.

The Elf company, whose work is centered in large part on its own needs, has produced ISFET [ion-sensitive field-effect transistor] biosensors on silicon chips in its laboratories at Lacq. Mass-produced, they are used to measure pH in the chemical and food-processing industries. Be it noted that Elf had to team up with an entity specializing in microelectronic machining, the Swiss Electromechanics Center. The future may well bring biosensors devoid of electronics: Indeed, proteins exist that have electronic properties and that could straightaway replace the silicon chips. Associating these proteins

with semiconductors, "one can imagine an intelligent biosensor from which selected electrons would pass directly from an enzyme to a microprocessor," fantasizes Michael Gronow.

9238

FRG-France Conflict Over Participation in EUREKA Program 'JESSI'

Project Delay Possible

36980267 Paris *ELECTRONIQUE ACTUALITES* in French 8 Apr 88 p 3

[Text] Siemens has stated that no company was excluded *a priori* from the JESSI project [Joint European Submicron Silicon] aimed at producing a 64-Mbit memory; specifically, SGS Thomson Microelectronics would not be banned from the project. The spokesman for the West German company added that JESSI was still only in the definition phase and that "the question being considered is finding out what everyone can contribute."

These declarations are meant as a response to an article in the *FINANCIAL TIMES* which insisted on the exclusion of STM from the JESSI project by Siemens. The German group was reported to be particularly stubborn about the participation of STM, participation which it was trying to minimize. SGS Thomson Microelectronics reportedly would have been relegated to playing a secondary role in JESSI, while the company wanted to be involved at the highest level, in the study of submicron technology and in setting up a pilot production line. The recent statement in the *TRIBUNE DE L'EXPANSION* by Dr Herman Franz, who is in charge of Siemens Semiconductor operations, according to which "Philips and Siemens will develop the technology and STM could be associated with the design and equipment work," caused STM to react by sending Mr Geyres, STM project director, to the FRG to clarify the "affair."

The Germans are saying that the French do not want to be involved in this project whereas Mr Lacour, president of the French delegation, emphasized the French desire to participate. The result could be a delay in the final development of the decisions planned by the Germans and the Netherlands for next June. Furthermore, French authorities are hesitant about the construction of a research center in the FRG, favoring a solution calling for research performed in the laboratories of the companies involved in JESSI: STM, Philips, Siemens, and Plessey.

Remember that JESSI adopted the objective of producing submicron circuits hoping to thus form a technological axis capable of competing with the United States and Japan. R&D costs are estimated at \$2 billion and European government participation is anticipated.

SGS-Thomson Comments

36980267 Paris ZERO UN INFORMATIQUE in
French 11 Apr 88 p 3

[Article by Philippe Moins: "European Tensions Surround JESSI Project"; first paragraph is ZERO UN INFORMATIQUE introduction]

[Text] SGS-Thomson has every intention of being a full partner in the European submicron component project JESSI. The French-Italian group stood up to Siemens last week.

To master the submicron technology which will be at the heart of the components of the 1990's, the Europeans must present a united front no matter what. "If you add up the annual sales figures of Philips, SGS-Thomson, and Siemens, the three major European semiconductor suppliers, you still have less than the Japanese leader," explains Philippe Geyres, vice president and director of strategy for SGS-Thomson. "Cooperation is therefore an absolute necessity." However, not all the partners see eye to eye on European cooperation.

And, during definition of the JESSI program, a few misunderstandings or differences of opinion have erupted on the industrial scene. For fear of being left out, SGS-Thomson spoke up a few days ago in defense of an equitable distribution of tasks. "Balanced foundations and balanced financing are necessary. We do not wish to be confined to a secondary role," stresses Philippe Geyres. In other words, Siemens and Philips, already partners in the MEGA project (development and production of 4-Mbit D-RAM chips and 1-Mbit S-RAM chips), must not continue their collaboration as a duet for the 64-Mbit chip of the 1990's. SGS-Thomson proclaims loud and strong that it will be an integral part of the JESSI program, "a joint initiative of France, the Netherlands, and the FRG" which could even acquire a fourth partner with the UK company Plessey. JESSI, which hopes to perfect semiconductor technology in the neighborhood of from 0.5 to 0.3 microns, is still only in its definition phase.

With \$2.5 billion in financing over 8 years, it should begin to bear fruit in 1993-1994, the year of the start of volume production. Both the research phase proper and the movement into series production should permit the different partners to make good use of their complementary natures.

At least that is the opinion which prevails at SGS-Thomson. "Manufacture of a silicon wafer requires a large number of steps. Europe has only a dozen centers—including three in France with Thomson-SGS, LETI [Laboratory for Electronics and Data Processing Technology], and CNET [National Telecommunications Studies Center]—working on components. It is possible to distribute the work; cooperation in research is relatively easy."

Stage Two:

Movement into volume production. Here again the strategies of the European manufacturers are complementary. Philips gives priority to static RAM memories while Siemens concentrates on dynamic RAM's, SGS-Thomson on EPROM's and EEPROM's, and Plessey on predefined circuits. "Consequently, transfers and exchanges between the partners are completely conceivable." The JESSI project thus seems to be the European answer to Sematech, an American initiative in which the semiconductor manufacturers on the other side of the Atlantic are mobilizing \$1.5 billion over 6 years. It also serves as protection against the tidal wave of Japanese chips: Supported by the omnipotent MITI [Ministry for International Trade and Industry], the Japanese manufacturers in fact control half of the world market in components.

"What is at stake is above all maintenance of the technological independence of Europe. Otherwise, there is the risk of seeing 2 million jobs in the electronics sector disappear," warns Philippe Geyres. Responding to the rumors circulating last week, Siemens denied wanting to retain control of JESSI saying that it was a project "open to everyone." The months to come will reveal whether the cards are dealt equitably among European industrials.

Goals of Projects, Effects of Conflict

36980267 Paris L'USINE NOUVELLE in French
15 Apr 88 pp 16-17

[Article by Alain Dieul: "Integrated Circuits: The Siemens-SGS Thomson Clash"; first paragraph is L'USINE NOUVELLE introduction]

[Text] The Europeans cooperating in the JESSI project, targeting production of the integrated circuits of the year 2000, are arguing about their roles in the project. SGS Thomson has no intention of being content with a minor role conceded by Siemens with the tacit support of Philips.

The game that STM [SGS-Thomson Microelectronics] is currently playing against Philips and Siemens is an important one. For the French-Italian company, it is a question of participating as a full partner in the European submicron technologies project (dubbed JESSI). Although what is at stake is far away in terms of time, it is nevertheless quite basic: The heart of the electronic systems of the year 2000. In fact, it concerns the production of very high capacity memories (64 megabits) while the most advanced memories currently in production offer 1 megabit. All this is a long way off, but the decisions are being made now. Furthermore, the financial resources are in scale with the technological stakes: Fr15 billion financed from European public funds.

The JESSI project is not new. It was adopted as a EUREKA project 2 years ago at the Stockholm summit. Since then, although little progress has been made, the landscape of European electronics has changed. The SGS-Thomson grouping within STM (\$857 million in sales) situates the French-Italian firm presided over by Pasquale Pistorio between Philips (\$1.6 billion) and Siemens (\$657 million). This new hierarchy is upsetting the established order and could jeopardize the privileged relations between the number 1 Philips and the former number 2 Siemens.

Under these conditions, the firefight which just broke out in broad daylight between Siemens and STM is only the visible part of the combat which is going on at the European level. Herman Franz, member of the board of directors of Siemens and manager of the components division, ignited the powder by innocently proposing that within JESSI Philips and Siemens could develop the production technology and that STM would only be involved in the design and development of the equipment. His words were immediately seized upon by Philippe Geyres, vice president of the STM group, who declared STM's desire "to be involved as an equal in a project of this size and that STM would not be relegated to a secondary role." Right away, the French-Italian group let it be known that if the Siemens-Philips positions were retained, the project would no longer be European in nature and it would be necessary to suffer the consequences.

No doubt these immediate reactions will be soothed by the time of the first meeting about JESSI at the end of April. At Siemens, they are trying to calm things down. "This program is certainly open to everyone, and Siemens is not opposed to any form of participation by anyone whatsoever," stated Eberhard Posner, spokesman for the group.

Be that as it may, STM is having to swim upstream to pay for the period of uncertainty which followed the merger of SGS and Thomson-Semiconductors. It was not until last 5 November that it confirmed its participation in the program. It would be a mistake to imagine that the other partners would now offer it a choice position in the project. This is normal in a context like that of semiconductors where only ten or so of the large manufacturers will survive during the 1990's. With a critical world market threshold of 3 percent, nothing is given away. As for Philips, it has nothing to worry about from STM, but that is no longer true for Siemens.

There is another problem: The German and Dutch firms have become accustomed to working together. The two giants have already developed the components for the final years of the 1980's. Within the MEGA project, Siemens controls production of the 1-megabit DRAM memories for data processing, and development of the 4-megabit ones is well underway. For its part, Philips is

producing 1-megabit SRAM's oriented more to industrial applications. The financial effort of each was colossal. Siemens invested Fr3 billion in R&D in its Munich-Perlach center and Fr2.5 billion for the production unit at Regensburg. As for Philips, on the Nat Labs site at Eindhoven, 550 people are working on R&D of these circuits with a budget of Fr4.5 billion.... This is impressive, even though the government subsidy from Bonn and Amsterdam amounted to Fr1.7 billion. Already, the balance sheet of this alliance is positive. Commercially, the two groups have shared the pie in the memory market, but, even more significantly, they also have the means to be independent and to play a decisive role in the electronic systems market where together they post more than Fr350 billion in sales!

By letting the German and Dutch companies cooperate on the MEGA project, Thomson and SGS took a risk. The Italians and the French preferred to unite in another EUREKA project, Number 102. There, they developed nonvolatile EPROM memories, i.e., memories that retain data even after power is removed from the circuit. With LETI support, STM perfected micron technology which is being reduced to 0.8 microns. The first 1-megabit memories are in production, and researchers are developing the 4- and 16-megabit memories with JESSI designated to pick up the next generation—with 64 megabits!

Thus, these different technologies seem complementary, and this is how STM would have liked to see JESSI evolve, with each company developing its expertise to be shared later on. Whereas LETI has at its disposal advanced studies on the equipment for the clean rooms of the year 2000, the Philips-Siemens bloc has an advantage of scale that it does not necessarily wish to share. To produce integrated circuit patterns, the most delicate operation is microetching. This involves applying the various connection levels of the chips by isolation using a mask.

There are several competing techniques. Optical procedures dominate the market, but toward the end of the 1980's, X-ray systems yielding ten times better resolution should come on strong. In the United States, the Sematech project has just been awarded a budget of Fr9 billion for a period of 5 years. The final phase of the project should yield circuit structures on the order of 0.3 microns obtained by microetching—using x-rays. The first clean rooms in Austin, Texas, will be operational as of September.

Worldwide activity is effervescent in this field. After having been the world leader in research in this area, France abandoned all the studies conducted on the Orsay synchrotron. She is paying for this error today while the Germans are still on course thanks to the Fraunhofer Institute's research which is being closely watched by the entire world of microelectronics. Philips, Siemens, and the German Government have invested massively (Fr330 million) in the study of an extremely

compact synchrotron which can be used in production. High-level sources at the Fraunhofer Institute claim that this tool will be indispensable for cost-effective production of 64-megabit chips. If this proves true, the German research will save Europe from a situation in which it would be inexorably dependent on the American and Japanese manufacturers of these strategic machines....

For now, the leaders of the different national groups involved in JESSI are not giving up hope. Although the situation is tense, the JESSI project is inconceivable without STM; and if unity is not achieved, the three European semiconductor giants will all come out losers. Even Philips, the only one of them in the top ten worldwide, would not be guaranteed a future in integrated circuits....

12666

France, FRG, UK, Belgium Show Chip Testing, Manufacturing Equipment

FRG Laser Scanning Microscope

36980271b Paris *INDUSTRIES ET TECHNIQUES* in French 1 Apr 88 pp 33

[Article by Laurence Girard: "Automated Inspection Sets the Pace"; first paragraph is *INDUSTRIES ET TECHNIQUES* introduction]

[Excerpts] Dimensional inspection of alignment and defects: the automated systems for wafer inspection shown at Semicon Zurich meet the industry's needs for speed and for resolution up to 0.3 μm .

To keep up with current trends in semiconductor manufacturing, measurements at Semicon Zurich were below a micron. Submicron resolution, beyond the reach of optical microscopy, is necessary during the defect inspection stage of production. Electron microscopes have proved difficult to use here. The majority of manufacturers have opted for transitional solutions combining high resolution and ease of use comparable to that of optical microscopy. Siscan Systems, Heidelberg Instruments and Zeiss integrate laser microscope technology (confocal laser scanning microscopes) into their critical flaw detection equipment. This makes it possible to inspect structures and to visually display them in three dimensions. The Syscan II measures line widths up to 0.3 μm , with repeatability of 0.0005 μm . It is also possible to measure the surface state of the wafer. The measurement performance of Heidelberg Instrument's LPM is similar, but the unit has been designed to limit the amount of floor space needed.

This is a crucial point given the cost of clean rooms. This young German company, created 4 years ago, has already sold ten of these units, 90 percent of them for production needs. To keep up with changes in the industry, an 8-inch wafer version should be available at

the end of the year. The microscope offered by Zeiss is not an automated wafer inspection system, but it incorporates a hard disk for the creation of picture data bases and for local intelligence.

Belgian Manufacturing Devices

36980271b Paris *INDUSTRIE ET TECHNIQUES* in French 1 Apr 88 pp 32

[Article by Philippe Le Coeur: "Submicron Manufacturing—Integrated Circuits; first paragraph is editor's lead-in]

[Excerpts] At Semicon Zurich: new projection lenses, a shorter working wave in optical lithography, and new etching processes.

After 3 years of cost-cutting, semiconductor manufacturers are again investing in production equipment. This is a response both to growing demand and to new technological requirements.

The Semicon exposition held in Zurich at the beginning of March provided an opportunity to explore the changes taking place—particularly in lithography. Here more than anywhere else, optical photoamplifiers demonstrate their ability to accurately reproduce images of various circuit depositions, no matter how fine.

Competition Between Optical Photoamplifiers and X-Rays

This ability is the combined result of new projection lenses, a reduction in the length of the emission wave and new photosensitive resins. ASM, for instance, displayed its PAS 2500/40 photoamplifier, which operates at 365 nm and can insolate 40 wafers 150 mm in diameter each hour, with resolution of 0.6 μm and alignment precision of 0.15 μm .

Electrotech demonstrated the improvement in deposit techniques with its ND 6210 plasma deposit machine. The "distributed electronic cyclotronic resonance" etching process (eight plasma sources, eight magnets) developed by CNET-Grenoble won converts. The license for it was bought up by Alcatel Deposit and Etching Systems, and by Electrotech, who will market machines dubbed RCE 160 and MPM 390. Operating at very low energies and pressures, these units feature very selective, uniform etchings, free of structural flaws and with minimal contamination. These same imperatives led UCB Electronics to develop the Plasmask photosensitive resin and the photoetching process that goes with it: after application of the resin, and insulation and treatment with a silitated agent, the wafers are subjected to an anisotropic oxygen plasma. This technique produces nearly perfect "verticality" in the etching.

09825

France To Design Multiwafer Molecular Beam Epitaxy Unit

36980271a Paris *ELECTRONIQUE ACTUALITES* in French 8 Apr 88 p 12

[Text] Picogiga and Isa Ribier have just signed an agreement to collaborate on the development of a multiwafer molecular beam epitaxy unit.

Unlike the old units, which could only treat one wafer (with a maximum diameter of 75 mm) per operation, the new unit will be able to treat seven wafers 50 mm in diameter or four wafers 75 mm in diameter per operation. It will be possible to boost its capacity to twelve 50 mm wafers or seven 75 mm wafers. A feature allowing epitaxy of substrates up to 150 mm is also planned. The projected production rate is 12 epitaxy operations per day, with 2 percent uniformity and reproducibility.

Picogiga is a French "start-up" specializing in GaAs MBE (molecular beam epitaxy) on GaAs substrates. The company began production with one Ribier machine and had plans to install a second Ribier machine (see 29 January 88 issue of *ELECTRONIQUE ACTUALITES*) at this time, to double its production. The epitaxy unit is the key to its production. Picogiga was projecting a sharp increase in its sales to Japan, and has just established a second subsidiary in the United States.

Isa Ribier is a world specialist in ultra-high vacuums and MBE machines. Picogiga and Isa Ribier, each of whom generates 85 percent of its sales revenues from exports, believe that "this association will create a synergy that will strengthen their position as leaders in their fields." The goal in developing this new multiwafer machine is to achieve "low-cost" production of high performance GaAs materials and components, such as high electron mobility transistors (or TEGFET), heterojunction bipolar transistors (or TBH), and quantum well lasers. Targeted applications include supercomputers, on-board radar systems, satellite telecommunications, and so on.

09825

NUCLEAR ENGINEERING

Ansaldo To Participate in 'Trieste Synchrotron Light Laboratory' Project

3698m299 Rome *FINMECCANICA NOTIZIE* in Italian No 1, 31 Jan 88 pp 3-4

[Text] Ansaldo, the world leader in the sector of superconducting magnets and the major Italian manufacturer of systems and components for physics equipment, is involved in the development project of the "Trieste Light Synchrotron Laboratory," which will be located west of Basovizza, in the Carso area, at the initiative of the Italian government and the Friuli Venezia Giulia regional authority.

The work will be carried out by a joint-stock company established for this purpose by the Consortium for the Trieste Research Area, Friulia, and SPI (IRI) [Institute for Industrial Reconstruction]; the company will be headed by Nobel prizewinner Prof Carlo Rubbia.

The Trieste third-generation light machine is one of the most advanced in the world; it is an electron accumulator and accelerator that will be used for the production and utilization of synchrotron light given off by a moving electron when the action of a magnetic field forces it to curve its trajectory. The light is generated in high-intensity beams which are concentrated in extremely narrow cones, and has an energy range which, depending on the electron energy and the radius of the curvature of the trajectory, can cover a spectrum ranging from ultraviolet to X-rays.

The light machine will be composed of a booster-preinjector system which will produce an electron beam with an energy of 1.5-2 GeV; this beam will be introduced into an accumulation ring with a 180-m circumference and with 12 rectilinear sections, each 6 m long, in which "wiggler"-type magnetic devices will be inserted to produce narrow light beams with apertures of a fraction of one-hundredth of a degree, in the energy spectrum of ultraviolet radiation in a vacuum and of "soft" X-rays.

08606

SCIENCE & TECHNOLOGY POLICY

Berlin Promotes Founding of Advanced R&D Institutes

36980228 Duesseldorf *HANDELSBLATT* in German 12 Feb 88 p 26, Feb 88 p 6

[Article by George Turner, Senator for Science and Research of the Land of Berlin: "Research Must Be Flexible and Implement New Discoveries"; first two paragraphs are *HANDELSBLATT* introduction]

[Excerpts] Berlin—Research: The Berlin model meshes science and private industry.

Modern industrial society requires scientific resources in all fields in order to be able to meet the diverse challenges of the future. The international competitiveness of a region, of a [German] land, depends increasingly on close cooperation between private industry and the heavily publicly supported sector of the economy. The basis of successful cooperation is a solid foundation in the basic sciences in the universities and in extrauniversity research institutes. In this area, Berlin has good resources which can be successfully expanded.

Research Areas With Promise for the Future

Frequently, interregional comparison leads to interregional competition. In this respect, Berlin has avoided the mistakes of other less structurally sound regions of

making acquisitions and competing in areas lacking a substantial foundation. New institutions can only reasonably be developed where they complement existing resources and simultaneously tap research areas with a promising future. Judicious self-denial in technology policy will have greater success over the long term: High quality in individual measures clearly takes precedence over great quality [as published] of research areas.

The model for the adjunct institutes ["An-Institutes"] was conceived as far back as 1982. The name is derived from the fact that research institutes are linked "to" one of Berlin's universities as private industry entities with the legal organizational form of GmbH's by means of a cooperative agreement. The cooperative agreement regulates access to the staff and equipment of the university and specifies the amount of money to be paid to the university for services. It further prescribes that at least one member of the management of the adjunct institute must simultaneously teach at the cooperating university.

The advantage for the universities lies primarily in the fact that diploma and doctoral candidates obtain access to research which is relevant to industry under practical conditions; this provides the foundation for long-term trusting cooperation between business and science in selected research areas.

Record of Success of the Adjunct Institutes

The successes of the adjunct institutes became evident very shortly after their creation. Of course, problems of the labor market caused by economic trends cannot be controlled quickly using these exemplary newly established institutes; however, they tap research areas and win industrial partners for the Berlin area. Their indirect labor market effects are of great significance for infrastructure policy for the middle- and long-term, and they also contribute to balancing the geographical periphery of the city.

A total of five adjunct institutes were founded during the period between 1982 and 1987. In each case, research areas were selected in which prominent scientists were already working at the universities, or could be attracted to Berlin in parallel professional negotiations. Representative examples are Prof Reinhard Furer in the astronautics technology sector, Prof Horst Weber for solid-state laser technology, Prof Gerhard Mueller in laser medicine, Prof Peter Mnich as a specialist in rail systems, and Prof Hermann Appel for the field of motor vehicle production and plant development.

The following have been founded to date:

- The Engineering Society for Plant Technology and Road Vehicles GmbH (IAV);
- The Institute for Rail Technology (IFB);
- The Berlin Laser Medicine Center GmbH (LMZ);
- The Solid-State Laser Institute GmbH (FLI);
- The Berlin Space Institute GmbH (WIB).

Berlin Space Institute GmbH (WIB) Cooperative Agreement With the Free University of Berlin Capital: DM600,000

	Participation percentage
Space Tec GmbH (holding company for small and medium-sized companies)	40
Grob-Werke GmbH	16 2/3
Thyssen Henschel	16 2/3
Daimler Benz AG	16 2/3
Foundation for Friends and Supporters of Astronautics Technology (temporarily Deutsche Bank Berlin AG)	10

The staff size of these research firms varies—based on when they were founded—from 20 to 150 scientific employees; altogether, the five new institutes employ approximately 300 scientists (as of December 1987).

Cost Neutrality Sought for the Long Term

There is already a very limited possibility of founding more new institutes in addition to the existing university and extrauniversity research institutes and adjunct institutes because of their long-term effects on the public budget. For this reason, Berlin has developed a new instrument of research policy which is now ready to be applied: Fixed-term R&D centers will be set up including university and extrauniversity institutes and the specializations developed in them. After approximately 5 years, the area will either remain a separate solid institution or be reabsorbed into the original research institution.

"Head-hunting," the increasingly difficult—and expensive—search for "heads" with scientific and managerial qualifications to lead new institutions no longer represents the most urgent task of scientific policy. Concentrated in a limited sector of research and only used for a fixed period of time, the development centers represent a logical complement to the adjunct institutes; they facilitate integrated research and simultaneously offer options for future industrial use.

A fixed-term R&D center is financed out of project funds for an initial 5 years by the Senator for Science and Research to provide a scientific office. The office is represented scientifically by a university professor or institute director along with whom a very small scientific staff coordinates the work of the individual member organizations of the research center—cost neutrality is the long-term objective.

University institutes, extrauniversity research institutes, and industrial partners work together under the organizational roof of a center, which, as a nonprofit research association (e.V. [registered association]), may apply for project funds from the land of Berlin, from the Federal Minister for Research and Technology, and from other funders.

The center is obligated to publish its research results regularly and to report on its activities within the framework of an annual semipublic status seminar. In addition, an advisory council monitors research and results.

R&D centers are deliberately established in research areas on the interface between basic research and industrial research. These research areas should be relatively broad, i.e., not perform "supply services" for only one or a few industrial firms.

For the time being, four R&D centers are being formed during the period between 1988 and 1991 [as published]. Financing through project funds is guaranteed, and the first establishments are specified in the contract agreement:

- "Energy research/New energy technology": Various applicational fields have been tapped by individual projects of the Berlin Energy Research Program in the past. The integration of different techniques into reasonable, marketable systems under consideration of the energy management in user countries is an important area of research; results can be implemented industrially in a relatively short time. Berlin will develop model solutions for energy problems of Third World countries, building on the experiences of the international institutions for developmental policy which are located here.
- "Rapid data transmission": This area of communication and data processing technology has received significant impetus in the Berlin area through major research projects in the past. The existing research groups of the universities and the extrauniversity research institutions are to be united.
- "Surface technology": A clear demand for research results and products of surface technology is already emerging. The proven infrastructure in the area of microstructure and semiconductor technology is being expanded by project cooperation in metals research and in connection technologies using diverse materials. For this, the achievement potential both inside and outside the universities is to be applied to the field of materials research and testing.
- "Nonmetallic materials": The most recent scientific discoveries of solid-state physics (superconductivity) and new fields of application for nonmetallic materials (e.g., in engine technology) will have priority in the projects of this R&D center.

Greater political value will be placed on research policy in the future since it contributes to the future security of Berlin and its economy. The international reputation of Berlin as a scientific city can however only be maintained by constant modernization of the scientific landscape. Research policy must be flexible and quickly implement new discoveries.

Wasted effort and error are also possible here: For that reason, ideas and measures of this policy sector must be subject to regular self-critical examination. Thus, the

newly developed goals can be achieved with the most economical use of funds in the four projects. Even under the current framework conditions of the labor market, the contribution of research policy to the issues of economic policy is obvious. It must operate with higher levels of freedom and longer time perspectives; the integration of the two policy areas has succeeded in Berlin and has at least in some cases created exemplary new instruments. For the sake of the future, it is important to consolidate and to continue this development.

12666

Overview of High-Tech Policy, Purchases in Finland

36980256a Duesseldorf VDI NACHRICHTEN in German 11 Mar 88 p 8

[Article by Wolfgang Mock: "On the Outskirts of Europe, but by no Means in the Shadows—Finland Seeks an Association With the European Industrial Nations; The EFTA Country is Expanding its Technical and Scientific Infrastructure"]

[Excerpts] Ever since the Finnish mixed concern Nokia purchased SEL's division of entertainment electronics at the beginning of the year and only shortly afterwards the data systems division from Ericsson, this small country in the far north has been increasingly in the news. The successes of the Finnish economy did not happen by chance: A few years ago a deliberate structural change in the direction of innovative high tech industries was introduced, in association with an increased cooperation between science and industry.

"At present," said the general director of the Finnish Center for Technological Development (TEKES), Juhani Kuusi, "Finland is being gripped by a comprehensive change in its industrial and social structure. Its adaptability to international economic changes has proved to be relatively substantial so far. How this positive development is carried forward depends not least on the successes of its technology policy."

The Structural Change Already Is Showing Initial Successes

But as far as research and development (R&D) expenditures are concerned, Finland still has a considerable way to go to catch up. Thus at present this country spends about 1.7 percent of its gross national product for R&D, but the United States, Japan, the FRG, and even Sweden spend between 2.8 percent and 2.9 percent. The Finnish government was also aware of this deficit situation, and at the beginning of the 1980's one of its most important technology-policy goals was established as being to push this percentage up to 2.1 percent by 1991 and to 2.7 percent by the year 2000.

In 1985 the private economy and the public spent almost 5.1 billion markkaa (Finnish marks: 1 FM = 0.4 DM) for R&D, more than 60 percent of which came from industry funds.

In order to be able to influence research and development in specific directions, new structures were created on the government's part. In 1983 TEKES, the Center for Technological Development, was founded.

Even though in conversations Finnish economic spokesmen doggedly insist that the Finnish state is not paying any subsidies to industry, the sheer existence of TEKES relegates such assertions to the domain of high-tech folklore. TEKES plans, coordinates, and finances national technology programs and promising projects of applied research in universities and research institutes, and it supports international cooperation in the sector of high technologies. Moreover TEKES maintains 11 regional information centers.

The sums that TEKES has available as monies for assistance to research are small in comparison, for example, to FRG assistance funds: Available for applied research at the universities and research institutions are the equivalent of DM 65 million, and DM 122 million is available for supporting industrial R&D; industrial projects are assisted in amounts up to 50 percent of the R&D costs. By and large these funds come from the budget of the trade and industry ministry.

The ambitious attempts to push up these R&D expenditures are benefitting the 17 Finnish universities and colleges to a degree that German college teachers can only dream of: According to a government decision made in September 1986, funds for the Finnish colleges are to be increased to such an extent that their annual real growth will come to at least 15 percent.

Elisabeth Helander, research director of the Finnish Academy, an institution comparable to the German Society for Promotion of Research, is confident that matters will go further than merely this decision: "Everything points to the likelihood that this decision will be realized."

And the more the colleges participate with industry in this joint project, the more can they count on support. Thus, for example, in 1987 the Tampere Technical College located 200 km north of Helsinki was able to win 207 industrial contracts and thereby finance just over half of its total expenditures of 145 million markkaa.

Through such a college policy the country is deliberately attempting to pursue a regional structural policy. Timo Lepisto, rector of the Tampere Technical College, said that "of course we are trying to offer our services above all to the surrounding region."

Another step in this arrangement is the building of its own technology center in the vicinity of the college. As is the case with many industrial nations, Finland as well is placing high economic and also structure-policy hopes on the model of technology centers or technology villages. Six such technology villages exist by now in Finland, the first and northernmost one being founded in 1982 in Oulu in close proximity to the university there and to a government engineering school.

State and Industry Are Pulling Together

Meanwhile, 90 firms have settled there in the area of the technology village, which employ a total of over 500 workers. The branches represented are microelectronics, software, and a few biotechnology and medical technology firms. Here also the government is giving intensive subsidy help for technical advances, whether via various financing monies or directly through grants from the trade and industry ministry.

But even more important is the fact that industry as well is more and more prepared to make use of the R&D possibilities of such technology villages. Nokia, one of the three largest businesses, has a 30-percent share in the sponsor company of the Oulu technology village and is involved to a smaller extent also in the other five technology villages.

Firms such as Nokia or the state chemical concern of Kemira are showing the direction that Finnish industry is trying to follow: Into the markets of tomorrow with an aggressive R&D policy. Nokia is investing over 5 percent of its net turnover, almost 60 million markkaa, in R&D and in-house training and advanced training; Kemira is currently building its own research laboratory that will employ over 250 workers.

But at the same time the government is increasingly recognizing the necessity of intervening in a directing and structuring fashion, is launching technology programs, and is supporting the participation of this EFTA [European Free Trade Association] country in Eureka and EC research programs. Peter von Koskull, the Finnish consul general, justified these efforts on the part of his country by saying that "we are in a corner of Europe, and we will remain there if we ourselves do not become active."

12114

FRG R&D Funding Trends 1965-1986

Statistical Study Summarized

36980256b Duesseldorf VDI NACHRICHTEN in
German 25 Mar 88 p 1

[Text] In the two decades since 1965, the expenditures of the FRG economy for research and development (R&D) rose from DM 3.5 billion to just under DM 36 billion (1985). Thus they have grown more than twice as rapidly as has the gross domestic product.

These are some of the results of a study that has now been presented by the Association for Scientific Statistics in Essen.

Furthermore, German industry has invested the heaviest in persons: As a part of research and development outlays, expenditures for research personnel increased by a factor of 13; in 1985 more than 65 percent of all R&D costs of companies went into their scientific personnel.

In connection with scientific personnel a further trend is making itself visible: The research teams are becoming smaller. While in 1964 an average of 2.7 persons were still working as assistants to a researcher, today the figure is just under 1.9.

The study leaves no doubt about the fact that R&D activities have contributed considerably to the increase in turnover of individual industrial branches; among the companies with a high R&D input, from 1971 to the present turnover rose by a factor of 3 1/2, whereas in companies involved with mining and the processing trade the increase was only about 2 1/2 times.

12114

Private Versus Public R&D Funding 1974-86

36980232c Duesseldorf *HANDELSBLATT* in German
24 Mar 88 p 8

[Article by Dr Werner Gries, chief of section in the Federal Research Ministry: "The Strength of the German Economy Lies in the Breadth of its Range of Offerings"]

[Text] Bonn, 23 Mar—In the FRG, DM34.7 billion for research and development was financed by the economic sector itself in 1987. Compared to the total German research expenditures amounting to just under DM57 billion, this is almost 61 percent. In the years 1981 to 1987, the economic sector increased its total expenditures for research by 57 percent, whereas the outlays in the governmental sectors increased by 27 percent.

Last year, of the total expenditures by industry for research and development 20 percent pertained to the chemical industry, 34 percent to steel, machinery building, and the auto industry, 31 percent to electrical engineering, precision engineering, and optics, and 15 percent to the remaining industrial sectors.

The strength of private-company research and development in 1985—the last year recorded—lay at 3.2 percent of turnover, compared to 2.8 percent in 1981. The following are particularly research-intensive (share held by research outlays in turnover):

- electrical engineering: 7.8 percent
- precision engineering/optics: 5.3 percent
- chemical industry: 4.8 percent
- production of vehicles and their parts: 3.7 percent
- machine-building: 3.3 percent

In 1985 a total of about 271,000 researchers were employed in company research facilities. In addition to this there were in the economic sector 3,600 researchers at institutions for cooperative research.

The government's assistance measures concentrate on the training of researchers in universities, the improving of basic conditions (through tax breaks and/or by provisions in laws and ordinances), and on granting direct financing funds for research projects.

As a rule, when talking about public research support only the sector "financial expenditure for research and development" is being discussed. In this connection, the view of the federal government is that public assistance should come into play in the economic sector wherever research and development need to be supported for overriding social or overall economic reasons.

Indirect assistance measures, which aim at the general strengthening of research activity, reached a maximum in 1986 at DM1.2577 billion and decreased in 1987 to DM1.1664 billion. With the discontinuation of the tax concessions in 1989, a more marked decline in indirect assistance measures can be anticipated, especially outside the sector of the BMFT.

In addition to the assistance measures that are meant to increase the supply side of technologies, the federal government also counts as research assistance those measures that support research from the demand side. In detail, these are:

- Tax concessions for capital expenditures in the sector of energy generation on the basis of Article 4 of the Investment Allowance Law (DM433 of annual loss of tax revenue);
- R&D special depreciations based on Article 82d of the EStDV [Income Tax Regulation] (DM200 million), for a period until 31 December 1989, then being discontinued;
- Tax concessions for goods that are used for environmental protection (DM700 million of tax revenue shortfall);
- Tax concessions for measures of energy conservation, among other things for the installation of facilities for utilizing renewable energy sources (tax shortfall amounting to DM20 million).

Facilitating the Adjustment Process for the Economy

The goal of these measures, which are being eliminated in some cases as a part of the tax reform, is to facilitate the adjustment process for the economy in certain technology sectors.

In addition to these indirect measures there is also some special assistance via the Federal Ministry for Research and Technology that is designated as indirectly specific

promotion. In these sectors allowances are given, upon application, for research and development, especially in fields considered to have a promising future. As a rule these measures have an aspect of small-business support associated with them. The following programs are of this type: Special microelectronics program (discontinued in 1986), production engineering, peripheral microelectronics equipment, and biotechnology. In 1987 the financial expenditure for assistance in these sectors was DM117.8 million.

The total public research assistance of the federal government to the economic sector (including tax breaks) was DM6 billion in 1986 (see table). Thus it lies at the same level as in 1982. But the shares in this held by the different ministries have shifted. The defense ministry has drastically increased its research expenditures by a total of DM800 million. Research support by the economics ministry has remained about the same, and the research ministry has reduced its research assistance to the business sector by DM1 billion.

Measured by turnovers, the relative research expenditures in the small and medium-sized businesses (less than 500 employees) are especially high. Companies that carry on research and have less than 100 employees spend, on an average, 5.9 percent of their value of sales for research and development. With increasing business size, this share decreases to 2 percent in the size class of 1,000 to 10,000 employees, but with very large businesses it again doubles to 4.1 percent.

Those companies that received subsidies from the personnel costs subsidy program increased their research personnel proportionately more than average between 1980 and 1987. In addition about 15,000 new employees were hired from 1985 to 1987 under the program of assistance for research personnel expansion. Since the personnel-oriented research assistance to small and middle-sized businesses has attained its goal, it can—in the opinion of the federal government—be ended in the wake of the tax reform. The personnel costs subsidy program was discontinued in 1987. The assistance for research personnel expansion is likewise being concluded.

Since in recent years the research ministry has expanded its research assistance to small and medium-sized businesses and a stagnation has set in at the economics ministry, it can be assumed that in the next few years the BMFT will increase further its research assistance to

small and medium-sized businesses proportionately more in comparison to the increase in its budget, whereas at the economics ministry a drastic reduction will take place.

According to the studies by the federal government, which are supported by analyses of a number of research institutes, the international competitiveness of the FRG is still good. The competitive lead in research-intensive products has made a contribution to this. In 1986, the strongest impacts on the stimulation of employment also came from the research-intensive industrial branches. These were the branches of electrical engineering, machine-building, automaking, and chemistry.

The strength of the FRG lies not so much in a few key technologies as it does in the breadth of its line of products offered, which is reached by almost no other country. In the sophisticated technologies that require to a special degree the integration of thoroughly mastered traditional technology and newly developed high technology, in 1986 alone German firms exported more than four times as much to the United States as was imported from there into the FRG.

The comparative advantages of German industries compared to the United States were the greatest in automaking and machine building, in precision engineering, optics, and metal working. The United States dominates in fissionable and fertile nuclear materials, data-processing equipment and office machines, and in aviation and aerospace. In our trade with Japan there are positive focal points in the chemical industry. There were trade shortfalls with TV sets and office machines, in electrical engineering, precision engineering, and optics.

In the view of the federal government, good promise can be seen for the FRG as a locus of research and development and thus for ensuring its long-range economic competitiveness. The FRG is one of the countries that have always accumulated an abundance of assets in the training sector and have also increased more their fraction of highly qualified gainfully employable persons (to 38 percent in 1985 compared to 35 percent in 1975). The German companies' fraction of turnover that is generated by products in the phases of market introduction and growth has distinctly increased since 1982, according to an ascertainment by the Ifo Institute.

As far as the past is concerned, the German economic sector has greatly increased its research expenditures that come from its own funds, whereas the government has held back in recent years. Our broadly diversified technological competitiveness is still good. And the basis exists for a continued ability to compete in the future.

R&D Assistance to the Business Sector by the Federal Government Inclusive of Research-Related Tax Revenue Shortfalls of the Laender and Municipalities, 1974 to 1986

Year	Expenditures Total ¹⁾ Mill. DM	Including			Tax Revenue- shortfalls ²⁾ Mill. DM	Assistance- Total Mill. DM
		BMFT Mill. DM	BMWl Mill. DM	BMVg Mill. DM		
1974	2,916	1,284	300	1,283	353	3,269
1975	3,162	1,501	285	1,319	149	3,311
1976	3,053	1,273	240	1,462	106	3,159
1977	3,110	1,444	139	1,449	153	3,263
1978	3,494	1,669	173	1,559	138	3,632
1979	4,546	2,164	610	1,657	169	4,715
1980	4,622	2,195	798	1,496	191	4,813
1981	4,636	2,328	852	1,355	289	4,925
1982	5,638	3,249	816	1,458	283	5,921
1983	5,075	2,650	715	1,595	364	5,439
1984	5,160	2,612	702	1,729	530	5,690
1985	5,780	2,534	897	2,235	615	6,395
1986	5,415	2,230	843	2,237	633	6,048

¹⁾ Inclusive of the expenses to economic firms abroad

²⁾ R&D investment allowance (Article 4 of the Investment Allowance Law) and R&D special depreciations (Article 82d of the Income Tax Regulation), tax revenue shortfalls of federal government, Laender, and municipalities

Source: Federal Research Report

12114

Philips' Role in European R&D Overviewed
3698a172 Brussels NOUVELLES DE LA SCIENCE
ET DES TECHNOLOGIES in French
Oct 87 pp 133-135

[Article submitted by Philips: "Philips Strengthens Its Industrial Position Through European Technological Cooperation"]

[Excerpt] Since the beginning Philips has stimulated initiatives for European technological cooperation. As a multinational with major R&D operations, Philips is very interested in these European research programs, over half of which are conducted in the Netherlands. In all, Philips participates in 51 projects.

ESPRIT

ESPRIT [European Strategic Program for Research and Development in Information Technology] covers a vast area of activities: microelectronics, data processing, software technology, office and factory automation. After an analysis of existing potential, the program's first phase began in 1984 and will end in 1988. Some 225 projects involving 387 companies and research institutes were defined in three stages. Philips participates in 35 projects. The EEC has obligated approximately 36.8 billion Belgian francs in subsidies for the first phase. Philips will receive about 2.24 billion of this during the 1983-1987 period. Approximately 160 Philips staff are or have been involved in the various projects.

Some ESPRIT Projects:

—Development of methods to integrate bipolar and C-MOS transistors onto a single chip using VLSI (BICMOS) technology.

—One of the projects involves the development of an advanced data processing architecture allowing the simultaneous processing of a program by a large number of microprocessors. This "parallel processing" is very important for research using artificial intelligence techniques or for very complex integrated circuit simulation.

—One project focuses on upgrading software efficacy and quality. In the same context Philips participates in the development and use of advanced software for manufacturing process control.

—Seventeen European companies have begun development of an open systems architecture for factory automation.

The objective is to provide computer manufacturers and users with a strategy that enables them to keep abreast of developments in data organization and management. New applications may be based on these guidelines. The use of compatible computer equipment allows companies, regardless of their type or importance, to automate their factories gradually.

—Finally, mention should be made of a project involving access to very large databases providing text and audiovisual information, using Laser Vision optical disks.

RACE

The RACE [R&D in Advanced Communication Technologies in Europe] program focuses on streamlining the European telecommunications industry, an important condition for future economic development. In Europe, eight major companies are currently involved in this field, compared to only three in the United States and two in Japan. The development of a wideband integrated communications network by 1995-2000 is planned in order to achieve a progressive European reorganization.

The main issue for RACE is to know the architectures of these networks and how to ensure a smooth transition from the current national networks to the new networks. Approximately 46 billion Belgian francs were set aside for the total 1987-1991 R&D budget. A definition phase was begun in 1986 including the description of the technology and management structures of wideband networks, of possible services, and of required subsystem components.

Philips has hired 30 people for 10 projects endowed with 423 million Belgian francs in subsidies.

To date this definition phase has not yet developed into the project phase. Other activities and their financing are still being studied.

Without the development of the infrastructure as proposed in RACE, basic technologies can only be applied with difficulty to new services. This is the reason why future cooperative programs such as DELTA for data processing technology for education, BICEPS for health care, and DRIVE for traffic depend on RACE's progress. Late in 1986 a call for research proposals was made in Brussels. These must be submitted during 1987.

BRITE

The BRITE [Basic Research in Industrial Technologies for Europe] program involves the application of new methods in the development, testing, and manufacturing of products in existing industries. BRITE's first stage presently includes 100 projects for a total budget of 5.52 billion Belgian francs. Small- and medium-sized European companies are the main beneficiaries of new manufacturing techniques. Philips will participate in six projects, with seven researchers and 73.6 million Belgian francs in EEC subsidies.

Research subjects include advanced materials (e.g., research and production of wear- and corrosion-resistant elements), CAD/CAM, microelectronic and laser applications, and new connection techniques.

Some of the projects in which Philips participates include: wear- and corrosion-resistant film application processes, modification of surface characteristics using ion implantation, and two other projects in the area of ceramic materials and laser applications in production processes.

EUREKA

The main characteristic of all the above-mentioned cooperative projects is the "precompetitive" aspect. Essentially they involve the development of technologies that should enable companies to conquer the market with new products and systems. However, this will still entail many problems, considering the fact that availability of new technologies does not automatically guarantee commercial success. Market circumstances play a decisive role. For instance, in 1985 a number of advanced technology projects was introduced under the EUREKA label. This program also seeks to create market opportunities that allow the successful introduction of new products and systems. This involves, for instance, agreements in the area of patent and cartel rights, a more open European market through the harmonization of standards, and the abolishment of customs formalities.

The EUREKA structure differs considerably from that of EEC cooperative programs. A central management, regulations, and subsidies are virtually non-existent. National authorities provide minor or major contributions depending on their interest. Subject selection is not confined to particular themes.

Philips participates in 15 EUREKA projects representing a total investment of approximately 5.52 billion Belgian francs.

These include:

- HDTV [High Definition Television] project based on the MAC standard;
- CARMINAT, an electronic monitoring system for the car;
- JESSI [Joint European Submicron Structures], for the miniaturization of integrated circuit structures;
- TRANSPOLIS, a communications infrastructure for distribution centers;
- IHS [Integrated Home System], aimed at the joint development of a communications system for home equipment control.

25048

SUPERCONDUCTIVITY

Superconductivity R&D at Thomson, Pechiney, Other French Labs

36980270a Paris *ELECTRONIQUE ACTUALITES* in French 1 Apr 88 p 11

[Article by S. Dumontet: "Ten to Fifteen Percent Increase in CMOS Circuit Speed With New Superconducting Materials"]

[Excerpts] At a conference organized at the Paris Advanced Institute for Electronics last 9 March on the theme "Superconductors: Current Realities and Future

Implications", industry representatives (IBM France, CGE, Thomson), a Ministry representative, and a Crismat de Caen representative explored developments in the field.

One problem for industrialists is the huge research investment demanded for an outcome that is more or less long term. Moreover, given the outlook for superconductors and the international competition in the field, remaining on the sidelines would be difficult. One source of financial backing for industrialists are the research contracts awarded by the Ministry of Research and Higher Education. The Ministry will allocate Fr30 million in 1987 and 1988 for superconductor research (requests totaled 85 million). Eight research contracts have already been awarded.

The pilot companies granted contracts are:

- Pechiney (in collaboration with Thomson, CEA and other laboratories),
- CGE (with Rhone-Poulenc, CNET and laboratories),
- Thomson (with Rhone-Poulenc and other labs),
- Saing-Gobain (with Thomson, Bull and laboratories),
- the Solid Physics Laboratory at Orsay,
- the Strasbourg unit Physics Laboratory, and
- the Electromagnetic Radiation Laboratory at Orsay.

The creation of a European cooperation program for superconductor research has also just been announced.

Nitride Buffer Layer

In microelectronics, French researchers recently cleared one hurdle standing in the way of using these new superconducting materials. A Crismat de Caen team (see the 26 February 88 issue of *ELECTRONIQUE ACTUALITES*) managed to integrate them with silicon. The team came up with the idea of using a nitride film (0.2 microns), ordinarily employed in semiconductor manufacturing processes, as a buffer layer between the semiconductor and the silicon. According to the Crismat representative, it is not possible to overlay the semiconductor directly onto the silicon, because the procedure for obtaining conduction in the material requires raising its temperature to 900 degrees C. At this temperature, there is diffusion with [line or word missing here from original text] between the silicon and the material deposited. This diffusion leads to a loss of oxygen (indispensable for superconductivity) in the superconducting material. A buffer layer is therefore vital, and the Crismat representative explained that silicon oxide does not work. The Americans have used strontium titanate as a buffer layer, but as the price of this product is prohibitive (from 5,000 to 10,000 F/cm²), French researchers have decided to explore other options. A Crismat researcher told us that three types of nitride had been tested: gallium nitride, aluminum nitride and silicon nitride.

The deposited superconducting material begins to conduct at 100 degrees K. Zero resistance has been reached at 60 degrees K, and now at 77 degrees K.

Thomson is also working on the compatibility of silicon and YBaCuO type materials. The company has announced that it produced (at the Central Research Laboratory) superconducting thin films stable over time, (films made at the end of 1987 still show the same superconducting properties), using the molecular beam epitaxy technique.

The Strong Current Problem

Thomson researchers believe applications will be found more quickly in electronics than in electrical engineering, because of the difficulty of producing strong currents with these new materials. CGE also stresses that the problem with these critical high temperature superconductors is their anisotropy and low current densities, which is why they would be better adapted to low current applications. The company emphasized the great strides that have been made with the "old" superconducting materials—niobium alloys—and the necessity of "continued support of development efforts." These metal alloys were used in building high energy magnets (notably, the Geneva bubble chamber). The company announced Althsom's latest record: a wire composed of 254,100 titanium niobate filaments that can carry a current of 4,000 to 10,000 A/mm² at 0.55 Tesla.

In CGE's opinion, one interesting possibility for all types of superconductors would be to take advantage of their property of becoming insulators with an increase in current; in other words, to make the best use of the conduction phenomenon. The company mentioned that it had demonstrated this 6 months ago. A magnetic field is used to achieve conduction, which is accomplished very rapidly, in 1/1,000th of a second. The CGE adds that this raises the possibility (demonstrated in the laboratory) of making a 100 Hz chopper, which could lead to new methods in electrical engineering.

09825

TECHNOLOGY TRANSFER

Italian Sysdata in USSR

36980265a Milan AUTOMAZIONE OGGI in Italian
Jan 88 p 18

[Item: "Sysdata Confirms Its Professionalism in USSR"]

[Text] A Russian delegation has visited Sysdata, a Turin-based firm engaged in verifying the status of work on the project to provide the Soviet Gatovo and Riazan establishments with an integrated control and supervisory information processing system, for which Cogolo, a Udine-based firm, is to provide the installations on a turnkey basis.

Sysdata's part of the project has to do with:

- Automatic step-by-step control of the production process, from the raw material to the finished product, including the intermediate stocking of the semifinished material;
- control of on-the-job presence of the personnel and of authorized access to individual areas;
- monitoring of the operation of the productive plant;
- and lastly, measurement and control of energy consumption.

Process control within the outer-shell-dyeing section, on the other hand, is the province of Eidon, another Udine-based firm. The installation, which is to be completed by 31 July 1988, is currently at an advanced stage.

9238

Italy's Italmipianti Sells Automated Plant to USSR

36980266 Rome *BOLLETTINO TECNICO FINSIDER*
in Italian Dec 87 pp 149-159

[Article by M. Vezzani, F. Gualco, L. Biraghi]

[Text]Foreword

Italmipianti has designed and is now constructing a steel complex for the production of 720,000 t/y of seamless pipes and 210,000 t/y of round blooms in the industrial area of Volzhskij, USSR, 30 km away from Volgograd.

The production of the plant has to meet the Soviet market demand of pipes for the oil industry and includes casing and gaslift pipes.

The round blooms too are intended for the production of high-quality pipes by extrusion in another plant.

The pipe plant is based on the scrap-electric-arc-furnace cycle and is supplied on a "turn-key" basis.

General Description of the Pipe Plant

The steel complex is located near the town of Volzhskij, about 30 km away from Volgograd over an area of about 1,000,000 m² not far from an existing pipe mill producing welded and seamless pipes with small diameters, with which a functional integration will be made for the optimization of the plant common services.

The plant operating on a three shift basis will be able to produce 720,000 t/y of seamless pipes with diameters ranging from 159 mm to 426 mm (16 3.4"), which will mainly be used in the research and utilization of energy resources (oil and natural gas), as well as 6,000 t/y of pipes intended for the manufacturing of protectors.

The plant will also produce 210,000 t/y of continuously cast round blooms with diameters ranging from 150 to 350 mm intended for feeding the pipe mill with an extruding press located in the existing plant.

The production cycles is based on an electric steel plant using scrap iron as raw material with the possibility of charging as much as 30 percent of prereduced iron ore in order to obtain the molten steel required by the continuous casting plant. The blooms produced will be rolled by a seamless pipe mill (according to the PPM-MPM process) and then treated in a pipe finishing plant.

The main plant units of the steel complex are the following:

—raw material receiving and preparing plants (scrap, additives, ferroalloys);

—lime kilns;

—steelmaking shop equipped with two 150t electric-arc furnaces and with ladle steel treatment plants of the LF and VOD type;

—continuous casting plant equipped with two 4-strand machines producing square blooms in the range of 240, 300 and 350 mm, one 4-strand machine producing round blooms with diameters from 150 to 350 mm (the machine for round blooms can cast also square blooms) and on peeling line with a production of 210,000 t/y of blooms for feeding the extruding press located in the existing plant;

—seamless pipe mill able to produce 780,000 t/y of semifinished pipes, consisting of a walking beam furnace, a press piercing mill, an elongator mill, a multistand pipe mill, an extracting-sizing mill;

—an intermediate store for the pipes produced by the pipe mill for feeding the finishing lines;

—a pipe finishing plant consisting of the following:

- 1 gaslift and casing pipe heat treatment line;
- 1 gaslift pipe heat treatment line;
- 2 casing pipe finishing lines;
- 1 gaslift pipe finishing line;
- 1 pipe upsetting line;
- 1 coupling production line;
- 1 protector production line;

—a warehouse for storing and dispatching finished pipes;

—plant services:

- water treatment plant;
- electrical substation;
- fume cleaning plant;
- general warehouse;
- maintenance shops;
- garage; laboratory;
- management building;
- canteen; and
- locker rooms.

The plant is, therefore, completely independent, excluding power supply (from electric network), fluid and gas supply (from the existing pipe plant).

Material Flow Chart

The quantity of raw materials and plant production values are synthetically shown here below.

Main Innovative Contents of the Project

Volzhskij pipe plant gathers and consolidates all technical and innovative characteristics of Italmimpianti design, INNSE patented PPM/MPM process and Dalmine production and management experience.

Moreover, the best suppliers present on the market have been selected for the various equipment. The peculiar properties of the new plant, belonging to the last generation of pipe mills, are mainly the following: *a) grade of steel produced:*

The range of pipes produced requires a steel with very high characteristics. The steelmaking shop is, therefore, able to produce alloy steels and is also equipped with two different out-of-furnace refining systems (LF and VOD), which enable high qualitative standards to be reached. *b) High productive capacity (720,000 t/y)*

As regards production volume, Volzhskij pipe plant is one of the largest in the world. 720,000 t/y of pipes is the maximum output till now reached by modern technology with only one rolling mill. *c) Maximum diameter for seamless pipes*

Besides the wide production range (6.5/8"-16.3/4") the new plant has the peculiarity that, among all the pipe mills using retained mandrel continuous rolling technology (PPM/MPM), it is the one which produces pipes with the largest diameters. *d) No bloom conditioning required*

The consolidated production technology, the operating procedures adopted and the up-to-date plants make it possible to obtain a continuously cast semifinished product with constant quality characteristics, which enable bloom conditioning elimination, thus obtaining better yield, higher productivity, higher reliability of the finished pipes and, therefore, lower production costs. *e) Heat treatments*

The heat treatment included in the cycle assure the quality required by the production mix and are carried out by highly automated plants, which minimize operator's actions. In particular, the inner and outer quenching of pipes is also carried out under a strict quality control performed before and after the heat treatment. *f) Advanced ecologic solutions*

The stringiest Soviet standards imposing restrictive bonds as to air and water pollution, noise, vibrations, firefighting, personnel and plant safety, etc. have been taken into consideration during the design of the Volzhskij plant.

Moreover, the rigorous environmental conditions (about -40°C in winter) have often required innovative technical solutions.

Volzhskij pipe plant will also be a good example of no polluting plant; in fact, thanks to fume cleaning and disposal, water treatment (all waters are wholly recycled in a closed cycle and never discharged) and total heat recovery (used also for teleheating), there will practically be no effluent from the plant.

Main Engineering and Construction Aspects

The general schedule envisages the construction of the whole plant within 39 months starting from Contract signature (24th September'85) on a "turn-key" basis.

The engineering will be performed in about 24 months; the civil works will be carried out in 32 months approximately; the erection works will be completed in about 25 months (erection is partially carried out by Soviet labour); the trials operation and final tests will last nine months. Italmimpianti's obligations include also training of Soviet personnel and supervision of plant start-up. The steel complex construction schedule envisages that around 26 month the peak value of about 200 persons engaged a site will be reached (excluding Soviet fitters).

A camp equipped with all the infrastructures necessary to assure board and lodging for the site personnel has been construction over an area of about 210,000 m², considering also the particularly severe weather conditions (+40°C in summer and -30°C in winter).

The Italian specialists travel from Italy to USSR and back by especially organized charter flights connecting weekly Genoa and Volgograd. Goods transports are organized by the optimized use of trucks, trains and ships depending on the weather conditions.

Main Plant Parameters (table "T1")

The main plant parameters are as follows:

- utilized plant are 1,056,000 m²
- covered area 311,000 m²
- total volume of reinforced steel constructions 150,000 m³
- excavations 700,000 m³
- piles 45,000 m
- diaphragms 50,000 m²
- total quantity of concrete used 205,000 m³
- steel structures 60,000 t
- electrical and mechanical equipment 110,000 t.

Raw Materials

Volzhskij steel complex includes a lime plant and a ferroalloy and additive processing plant. The lime plant is designed to produce up to 80,000 t/y of lime sized 5 to 50 mm. The line consists of a jaw crusher, two vertical kilns, screening and storage equipment. The ferroalloy and additive processing unit consists of distribution, crushing, drying and grinding equipment. The line is able to process up to 55,000 t/y of materials.

It is designed to allow for maximum flexibility in using incoming materials, which undergo the different processes envisaged to meet the steel complex requirements.

Scrap Yard—Steelmaking Shop—LF—VOD

Scrap Yard

This yard stretches over five covered aisles for a total surface area of approximately 38,000 m². The material is shipped almost totally by rail. The quantity of processed material is equal to approximately 1.2 MT/y.

Table "T3"—Continuous Casting

Characteristics	Square bloom section	Round bloom section
Production of cast steel	8,865,000 t/y	230,000 t/y
Manufacturer	INNSE	INNSE
Number of units	two 4-strand CCM	one 4-strand CCM
Bloom size	240-300-360	156-196-228-340-360
Machine type	with curved mould, 3 bending radiuses and 5 cooling areas	
Dummy bar insertion	from the bottom	

Steelmaking Shop—LF—VOD

The plant can produce approximately 1. MT/y of molten steel by means of two 150 t Tagliaferri furnaces with water cooled panels of the tubular type.

Steel refining is performed in two ladle furnaces (LF) with a capacity of 150 t and the plant is equipped with powder oxygen lancing facilities. The steelmaking shop is also equipped with a 150t VOD plant, where steel is degassed using argon, and ferroalloys are added.

Steelmaking Shop (table "T2")

- Molten steel production 1,100,000 t/y
- continuous cast steel 100 percent
- electric-arc furnace manufacturer Tagliaferri
- number of units 2
- rated capacity 150t

—transformer rated power 110 MVA

—furnace with water-cooled panels.

Continuous Casting

All molten steel is cast by two square bloom CCM and by one round bloom CCM. The round blooms are intended for another adjacent plant, which produces pipes by extrusion. The continuous casting machines manufactured by INNSE are 4-strand type.

The CCM are provided with three bending radiuses. The casting technique is of the sunk nozzle type with protected flow. The curved moulds are equipped with electromagnetic stirring and with level automatic control.

The cooling system is of the drip type and consists of a primary and a secondary circuit controlled by a process computer.

Furthermore, the CCM allows a rapid change of section setting; the round bloom CCM is also provided with the equipment for casting square blooms.

Tube Hot Mill Line

Process flow

In order to produce the required yearly tonnage of approximately 800,000 metric tons of seamless tube in the complete range of requested dimensions (OD 159-426 mm), Italmimpianti-INNSE proposed a hot mill process employing continuously cast square billets as raw material, a piercing stage in a press piercing mill (PPM) followed by a cross-rolling mill as elongator and a finishing stage of the tube in a retained mandrel mill (MPM) followed by a sizing mill. The process flow is carried out according to tables T4 and T5 [omitted], where the mandrel sizes in the deformation steps are also shown.

Layout of the Mill

The layout of the hot mill line is shown in the drawing D7 [omitted].

The equipment is arranged in four longitudinal bays with a total covered area from walking beam furnace to intermediate storage of approximately 34,000 m².

The hot mill equipment is installed at a level of 6 meters above the floor level. Adjacent to the rolling mill area two workshops are provided for mandrel and roll conditioning and storage.

General Description

The Volzhskij pipe mill is the largest of its kind in the world. The mill includes considerable improvements concerning the machine design, the process itself and the operational cycle that make it the most advanced in the world.

The whole range of pipe sizes 159 to 426 mm with a maximum length of 36 m is obtained without reheating on the sizing mill located in line with the MPM.

Automatic gauge control on the MPM and sizing mill will guarantee a constant quality level of the product.

For the automatic control of wall thickness on the MPM a hot measuring device is located after the mill.

The system connected with a computer gives the real wall thickness value during rolling. For the automatic gauge control the MPM stands are equipped with hydraulic cells between roll chocks and the adjustment screws.

PPM, MPM and sizing mill employ stationary stands with quick roll change devices. In these mills, rolls and chocks are housed in cartridges that are pushed out of stands automatically for the roll change. The time for the roll change operation, carried out in automatic sequences without the need of bay cranes, is less than 20 minutes (see dwg. D8 [omitted]).

Equipment Features —Billet reheating furnace and hot saw

At the exit side of the walking beam reheating furnace (200 t/y) a hot saw is installed. The saw, of the rotary feed type, cuts the blooms into two or three lengths, whose temperature is maintained in a holding furnace in order to guarantee the required temperature for rolling *Press Piercing Mill (PPM)*

PPM consists of 2-high roll stands with 1,430 mm roll diameter, driven by a 1,100 KW d.c. motor. A rack and pinion type mechanism operates the billet pusher and a similar system controls the strokes of the piercer plug bar. A plug bar circulating system is provided for cooling, lubricating and inspecting. —*Cross Rolling Mill (Elongator)*

A vertical cross rolling mill with horizontal shoe guides is employed as equalizer elongator. The two rolls, having a 1,200 mm max diameter, are mounted in drums for the continuous adjustment of the feeding angle and are directly driven by two 4,750 KW d.c. motors. —*Retained Mandrel Mill*

The MPM consists of seven 2-high roll stands arranged in tandem alternatively and at 45 degrees to the horizontal. The first three stands have 980 mm max nominal diameter rolls and the four stands have 800 mm max nominal diameter rolls.

Rolls are driven by twelve 1,600 KW d.c. motors. The mandrel retaining system, pinion and rack type, is controlled by 420 KW d.c. motors. A mandrel circulating system is provided in order to cool, lubricate and preinsert the mandrel into the shell. *Extracting-Sizing Mill*

Directly in line with the MPM, the extracting-sizing mill is installed with ten two-high stationary stands each driven by 450 KW d.c. motors.

The maximum tube length at the outlet of the mill is 36 m and the max outlet speed is 5.5 m/sec. *Cooling Bed*

The cooling bed consists of three sections: first one with counter-rotating chains, second one with simple chains and third one with water tank for cooling in water. —*Tube cold cutting and testing area*

This area consists of:

- our cold-cutting machines arranged in parallel;
- two straightening machines with six rolls each;
- two non destructive test units or pipe mill process control.

Heat Treatment and Finishing Area

General

Heat treatment and finishing lines extend beyond the rolling mill and cover an area of 54,000 m².

The plant is designed to produce casing and gaslift pipes in accordance with the mix given in table T6.

Description

The plant is fed by the intermediate warehouse and is subdivided into the following lines or production areas:

- 1) upsetting line
- 2) heat treatment, quenching and tempering line
- 3) heat treatment normalizing line
- 4) casing finishing line 1
- 5) casing finishing line 2
- 6) gaslift finishing line
- 7) coupling workshop
- 8) protector workshop.

Heat treatment lines feed again the intermediate warehouse.

Finishing lines convey the pipes ready for shipment to the finished product warehouse. The location of coupling and protection production area makes the plant completely independent and able to meet the most various requirements, optimizing the yield of all the units.

Main Technological Solutions

The plant has been designed according to the most modern and patented knowledge and technological solutions. Technologically speaking it is the evidence of the most advanced process schemes developed by Dalmine in Italy and consolidated by many users in the world.

Special attention has been given to the quality and to the possibility of meeting the ever increasing market requirements.

All pipes are checked at heat treatment line outlet, classified and set to the repair area before the finishing line.

We point out that the same pipes undergo a previous control at rolling mill outlet to check the rolling process.

The casing pipe thread is cut on a rolling pipe machine with extremely reliable and flexible batteries in series. Thread control on 100 percent of the pins, hydraulic test, inspection and bolt passage, painting and marking operations are automatic. As further warranty and because of the considerable wall thickness, a ultrasonic inspection is provided in the finishing line.

Bloom Reheating and Heat Treatment Plant

Bloom Reheating Furnace

It is a top and bottom fired furnace heated by natural gas, with six control zones and with two independent charge rows. The production rate is 200 t/h and the bloom charging and discharging operations are carried out by means of independent completely automated machines (one for each row). The natural draught stack is equipped with a heat recuperator for air pre-heating and with a boiler for steam production.

Temperature Holding Roller-hearth Furnace

This roller-hearth furnace heated by natural gas burners and positioned behind the saw has the function of keeping the already cut blooms at the right temperature before proceeding with rolling operations.

Rollers are actuated by means of two control units driven by d.c. motors and by gear trains.

Heat Treatment Plant

There are three walking beam furnaces with refractory steel beams heated by natural gas burners. Furnace charging and discharging operations are performed by means of roller tables positioned inside the furnaces. The only tempering furnace is of the front charging type.

A quench tank for internal-external hardening of casing pipes is placed between the hardening and the tempering furnaces.

Centralized Water Treatment Plant

The plant environmental conditions have led to the choice of centralizing in only one closed and heated building all treatment plants and recycling systems of the various types of water used in the plant production cycle.

The following treatment processes are mainly performed in the centralized plant: 1. *Primary water treatment plant*

The plant is intended for the treatment of raw industrial type water coming from a source outside the plant and only sometimes for the treatment of rain water and process waste water. The plant based on water softening by means of lime is able to produce approximately 300 m³/h of softened and filtered water.

The softened water is used in almost all the closed circuit recycling systems, which utilize fin fan heaters as heat exchangers. It is also used to produce demineralized water and for the plant general services. 2. *Demineralization plant*

The plant, consisting of cationic/anionic units and of mixed cationic/anionic beds, is able to produce two types of water with a different demineralization degree.

The water coming from the cationic and anionic units is used as make-up water in the open cycle cooling circuits, which utilize evaporation type cooling towers as heat exchangers. The water coming from the mixed beds is used for feeding boilers, for producing steam and as cooling fluid in closed cycle for continuous casting moulds. 3. *Cooling and recycling systems of technological processes*

The following treatment units are installed inside the plant: clarifiers, pressure sand filters, recycling pump stations, mud treating plants, chemical product proportioning plant, etc.; they are used for cooling the following technological plants:

- pipe mill
- finishing lines
- continuous casting plant
- steelmaking shop.

The evaporation cooling towers are located adjacent to the outside walls of the building. The fin fan heat exchangers are located on the roof. 4. *Effluent treatment*

Effluents coming from demineralization plants are cascade treated by reverse osmosis plant and by a crystallization plant. 5. *Heat recovery*

Water-to-water heat exchangers are installed in parallel with fin fan heat exchangers for heat recovery and transfer to the plant heating systems (as an alternative to same fin fan heat exchangers).

Power Distribution

The plant is power supplied by the national electric mains through a primary distribution system made up of three substations: the main substation, the pipe mill and the auxiliary service substation.

The main substation feeds the electric-arc furnaces by means of a 220 KV-33 KV system and through a compensation and electrostatic filtering system; the other two substations supply power to all other plant users.

Automation

The automation system equipment is organized according to three hierarchical levels, as indicated in the diagram D10.

—First level, supported by microcomputers and/or programmable controllers to control process variables and to implement operating sequences. Reference variables are set and the main sequences are initialized by the operator from a data display console or from a control desk.

—Second level, implemented by microcomputers to control the technological processes and/or to manage the information concerning the products.

—Third level, to program the plant production.

More specifically, the second level is equipped with the following:

- a coordination system for the steelmaking and continuous casting area, with the following purposes: guiding the operator to monitor the area, steel tracking and controlling of the required power for melting;

- a process control system for each electric-arc furnace, aimed at charge calculation, at controlling melting and at calculating ferroalloy refining;

- a process control system for each continuous casting machine aimed at product tracking, quality control, cooling and cutting control and at guiding the operator;

- a system to monitor the bloom reheating furnace, with a mathematical model for the optimization of fuel consumption;

- a two-computer system for the pipe rolling mill, aimed at calculating rolling parameters and at tracking production;

- a system for the management of the intermediate warehouse (raw pipes);

- a system for the production tracking in treatment and finishing lines;

- a system to manage the finished product warehouse;

- a back-up system to remotely control the plant electric network and aimed at monitoring and guiding the operator;

- the third level includes a computer whose functions are: to schedule monthly production, to track products, to control production progress, to perform quality controls and to print data.

Conclusions

At the end of 1988 the new Volzhskij pipe plant for the production of 720,000 t/y of seamless pipes up to 16.3/4" (according to PPM/MPM process) will be put into operation in USSR.

It will be the largest and most modern plant of this kind, provided with all the most advanced technological solutions and constructed by Italmimpianti on a "turn-key" basis.

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Italian Achievements, Prospects In ESPRIT Programs Outlined

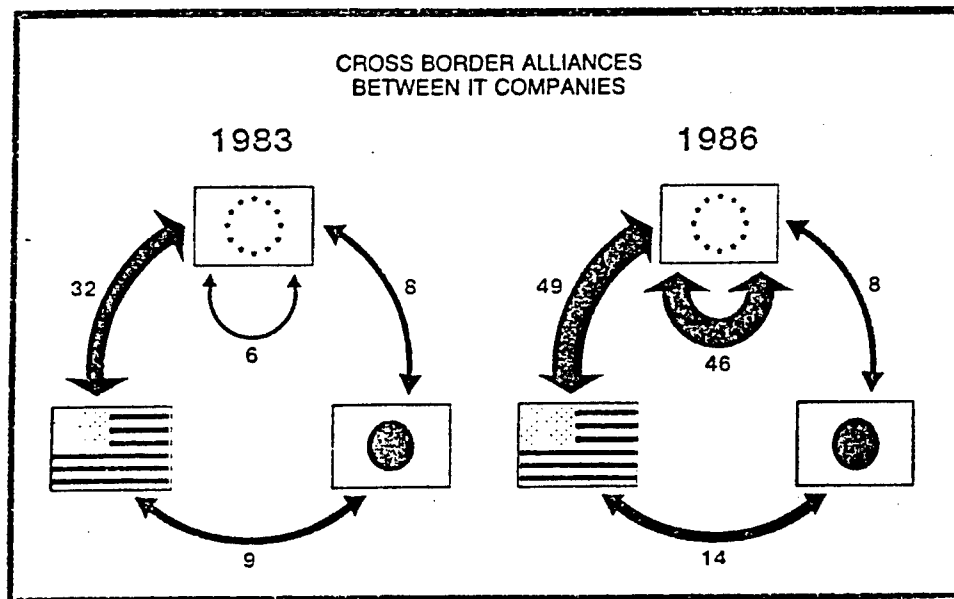
3698M222 Turin *MEDIA DUEMILA in Italian* No 1, Jan 88 pp 32-33

[Article by Nicoletta Castagni concerning the prospects for phase two of the European research program ESPRIT: "ESPRIT, Chapter Two"]

[Excerpt] Rome—The second stage of ESPRIT, the European program for precompetitive research in "information technology," has started ahead of schedule and with certain changes in the proposed development areas.

From 1983 to 1986, ESPRIT's investment totaled 2.25 trillion lire, 50 percent of which was provided by the EC. A total of 957 proposals were submitted to the ESPRIT Commission over the same period, but only 227 (equal to 1.125 trillion lire) were approved. Italy has taken part in a total of 99 contracts, that is, 44 percent of the total number of contracts, with the involvement of 41 industries, eight universities, and 12 research centers.

During the meeting, ESPRIT director Jean Marie Cadiou emphasized the major achievement accomplished by Italy during the first phase of ESPRIT and repeatedly stressed the positive trend that Italy's electronics industry is experiencing. As Cadiou pointed out, it is no coincidence that Olivetti was the company with the highest development rate over the 3-year period 1984-6. However, ESPRIT 1 was a great success for all involved because it succeeded in achieving the goals set. As Cadiou remarked, the available data show that in 1983 there were only six industrial cooperation agreements among European countries, as opposed to 32 agreements stipulated between European Community countries and the United States and eight agreements reached with Japan. In 1986 inter-European alliances climbed to 46, while the number of agreements stipulated with the United States and Japan did not change. Therefore, ESPRIT has contributed to the remarkable expansion of collaboration by various domestic industries, universities, and research centers with European partners, a relationship that has increased greatly and become extremely productive. During the meeting, Scientific Research Minister Antonio Ruberti stated that, in the



case of Italy, the incentive for international cooperation generated by ESPRIT 1 has made a substantial contribution toward making even medium-sized and small Italian companies less provincial. In Ruberti's opinion it is extremely important to take part in international programs, and participation in ESPRIT forms part of Italy's political strategy favoring a European approach. Italy has always supported the EC's commitment, but the willingness to cooperate shown by universities, industries, and research centers over the last few years has outstripped the political pace. Ruberti added that this is a new and highly reliable way to evaluate the qualitative level of research carried out by an industry or organization. Participation in one or more community or international programs automatically becomes synonymous with commitment and growth.

The minister stressed that at this point it is necessary to solve the problem of coordination between national and international programs in order to avoid dispersion and duplication. The greatest risk is the lack of communication between those working on national programs and those taking part in ESPRIT or EUREKA. The only form of coordination was implemented from the grass roots level, that is, by organizations dealing with specific projects which felt the need to expand their activity. Concluding his speech, Ruberti stated that the effort to create a joint ministry is simply the government response to this demand for coordination; once established, this ministry will make a significant contribution toward modernizing Italy's research system.

In connection with the CNR [National Research Council] and with what Minister Ruberti had said concerning internationalization and coordination, the managing director, Bruno Colle, described in detail CNR participation in phase one of ESPRIT, that is, in the five areas

of activity into which the program is divided (ESPRIT 2 will comprise three areas). Colle stated that: "The CNR takes part in 12 research projects and cooperates essentially with Italian partners, primarily with industry (79 percent) and with universities (21 percent). The CNR received financing of some 2.5 billion lire, and in accordance with the financial terms of ESPRIT, it also provided an equivalent commitment by making its own structures available for research. Area 1, dealing with advanced microelectronics, boasted the greatest unit impact, with reference to the Rome Institute for Solid State Electronics. The EC has acknowledged the institute's state-of-the-art work in microelectronics by making it the leading partner of an Anglo-French-Italian consortium. Another organization active in Area 1 is the Institute of Chemistry and Technology for Electronics Materials and Components located in Bologna. Area 4, dealing with office systems, has been fully covered by the Institute for Information Processing in Pisa, which has proved to be particularly active in this program and, together with IASI in Rome, is also active in Area 3 (advanced processing techniques). The Research Institute for Electromagnetic Waves in Florence, the Research Institute for the Dynamics of Systems and Bioengineering located in Padua, and the Institute for Machine Tools in Cinisello Balsamo will operate in Area 5 (factory automation systems). The CNR participation clearly reveals its interest in supplementing the work of its own agencies with that of other European organizations to ensure greater research profitability within its own organization."

ESPRIT's second stage, which is now operational, schedules an investment of 5 trillion lire, almost twice as much as the investment for ESPRIT 1. As reported by the president of ESPRIT's Italian management committee, Antonio Tomassi, this second stage will not neglect, at

precompetitive level, basic technologies such as micro-electronics that are aimed at generating new and more advanced systems for further development of the data processing industry. However, as a result of the demand-oriented strategy, phase two of ESPRIT will place greater emphasis than phase one on application technologies and technology transfer.

8606

Sciaky of France Delivers Flexible Assembly Line to USSR

36980269c Paris INDUSTRIES ET TECHNIQUES in French 1 Apr 88 p 12

[Article: "Two Truck Cabs Per Minute at Gorki]

[Text] A truck cab assembly line 330 meters long—such is the installation Sciaky is in the process of delivering to the G.A.Z. plant at Gorki, an enormous unit that employs 100,000 persons. In contrast, the Sciaky line will operate with just 20 persons to produce 300,000 cabs per year for "farming trucks." The technology borrows from that of automobile assembly lines. The installation features extensive flexibility, provided by its 120 Beta

robots (Russian made under Kuka license), which perform a large number of the 2,960 spot welds required for assembly of the 141 pieces comprising a cab. It is subdivided into 14 lines, each of which produces a subassembly. Only the doors are produced by entirely job-specific tooling, at the rate of 1,225 units per hour.

Initially, the line will assemble just one type of cab. But the necessary space is being allocated for the tooling that will be needed to produce a second model 4 to 5 years from now. In this operation, Sciaky is providing the entire prime contractorship throughout from the initial design of the system to its fabrication to its putting into service.

Sciaky's sole partner is SIETAM, for provision of the 3 kilometers of overhead conveyor. Use of the Russian robots was a condition imposed by the client. The value of the contract for Sciaky is Fr450 million. Renault RVI, picking up where the Sciaky line ends, will provide the assembly line for the upholstery. The in-service target date is 1989.

9238

CHEMICAL ENGINEERING

GDR's CASAF CAD System for Organic Synthesis Research Reviewed

23020008 Leipzig *CHEMISCHE TECHNIK in German No 1, 1988 pp 33-35*

[Report from the VEB Chemical Combine Bitterfeld, Research Area for Organic Chemistry and Plant Protection Products and the Main Department of the Organizational and Computer Center, Bitterfeld (1), and from the Central Institute for Cybernetics and Information Processing of the Academy of Sciences of the GDR, Berlin (2), by Rainer Moll (1), Peter Kemter (1), Uwe Lindner (1), Dietmar Schoenfelder, KDT (1) and Alfons Weise (2).]

[Text] Since the beginning of this decade, microelectronics and computer technology, and therefore the computer, have penetrated more and more rapidly into all areas of social life. This affects not only organizational, management, and production processes, but particularly science and technology. Chemistry has played a special role here (and continues to do so), since here computer technology was (and is being) used in the most various areas at a relatively early stage. Besides the collection, storage, and management of data (e.g. in the form of materials data bases or literature retrieval systems), one must here mention especially the use of CAD solutions in chemical production engineering and in technology (see, for example, [1]). But CAD methods are also increasingly being used in research, not only in the form of research and retrieval systems, to construct spectral data bases or to acquire and process measurement data (laboratory automation), but also for the direct support of creative processes. This means that the development of expert systems and the utilization of methods of "artificial intelligence" (AI methods) in the future will have a decisive impact on chemical research. As examples, one may mention computer supported synthesis planning and so-called "molecular modeling."

At the beginning of the seventies, the VEB CKB began to use the memory and retrieval system SPRESI in order to build up the substance and findings documentation base WIFODATA, and to utilize methods of quantitative structure activity analysis (QSWA), within the framework of materials research [2, 3]. Since August 1985, the CASAF system (Computer Assisted Synthesis and Application Research) has been built up on the basis of the above developments. This is a modular but simultaneously integrated CAD system for organic synthesis research. Within the framework, of developing an overall solution, intense collaboration is taking place with a number of cooperating partners, for example with the VEB Central Information Processing in Chemistry (Berlin) ZIC, the Central Institute for Cybernetics and Information Processing of the Academy of Sciences of the GDR (Berlin) ZKI, and the chemistry section of

Martin Luther University in Halle-Bitterberg. Figure 1 schematically shows the links of the individual parts and the position of the practical synthesis.

The components of the system will be presented below, the present status will be explained, and future developments will be sketched briefly.

WIFODATA

The WIFODATA system, as a substance and findings documentation base, represents a data base which stores chemical structures with bibliographical data, physical-chemical parameters, and test results of biological or other tests. The present stock of data comprises about 80,000 individual structures, which largely come from the fund of cooperating partners that are joined together in the WIFODATA Association. One can retrieve information according to the following criteria, among others:

- individual structures,
- substructures and fragments,
- biological and other data,
- specification of internal significance (e.g. originator, time of preparation, etc.).

Since the structure and content of the system has already been reported several times [2, 4], further details can be dispensed with in the present context. Among the significant improvements which have been achieved in recent years, one must mention the transition from batch operation to interactive operation, the construction of a memory of known substances, and the expansion beyond materials research to other application-oriented synthesis areas.

QSWA

The connections between chemical constitution and biological activity are still inadequately known, despite the most intense efforts, so that goal-directed syntheses frequently are not possible. For this reason, trial and error methods and mass screenings are used now, as before, although they are becoming increasingly uneconomical and less successful. The attempts to make materials research more efficient include the application of mathematical-statistical methods, e.g., in the form of quantitative structure-action analyses (or in the broader sense structure-properties-analyses). By means of these methods, one tries to relate empirical data, e.g., biological test results with molecular properties (e.g., physical-chemical parameters), in such a fashion that one can make predictions concerning potentially active structures and can derive specific synthesis proposals (for more details, see [5] and [6]).

Within the framework of research on plant protection products, such methods have already been used successfully for some time in the VEB CKB (compare, for example, [7]). Originally conceived as part of the WIFODATA system [2], they now represent a separate system

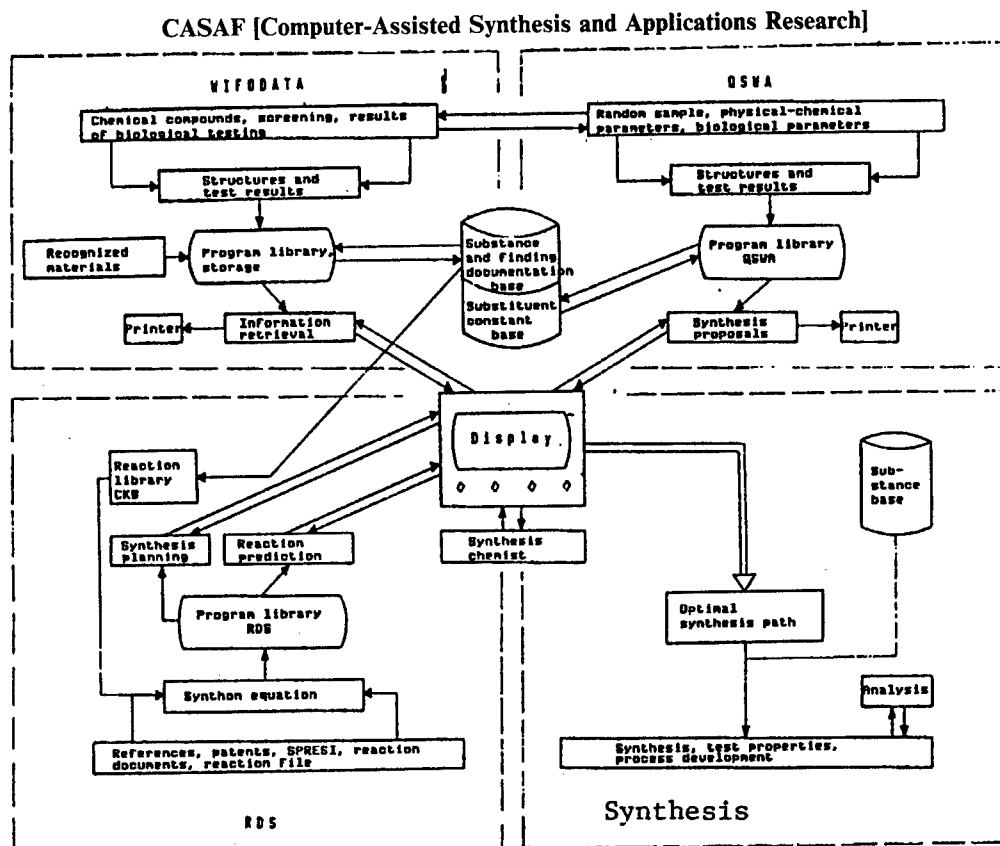


Figure 1: CASAF - Overview of the system

component based on the expansion of the spectrum of methods and of the program library. Its utilization, based on the data stored in WIFODATA, and interacting with practical synthesis, is well established. In connection with this, an extensive memory for substituent constants has been built up, and a special program module was worked out.

Synthesis Planning

The synthesis chemist tries to develop the most successful possible synthesis conceptions and strategies to achieve his objectives. In the context of materials research, proposals derive from the factual material of the WIFODATA fund, e.g., by means of QSWA methods, increasingly represent an efficiency-enhancing factor. Another possibility to increase efficiency is the application of computer-supported synthesis planning. For already more than 20 years, an attempt has been made to use computers for synthesis-planning tasks, and to develop suitable programs (for a review, see [8] and [9]). Besides the so-called information-oriented systems, whose most familiar representative is the LHASA program [10] (for other systems, see [8]), the purely mathematical-oriented planning programs are also available. These work without an information base, by means of

purely formal criteria (e.g. IGOR [11] and a first version of EROS [12]). Already, since the beginning of the seventies, the development of programs for computer-supported synthesis planning has been pursued in the GDR. Here, a synthesis between information-oriented and formally-oriented systems is being striven for conceptually [13, 14]. On the basis of the previous version AHMOS, the program system RDS [Reaction Design Software] was developed at the ZKI. Since April 1986, it is available in the form of a dialogue variant, as a central component of the CASAF project in the VEB CKB.

The functional relationships of the RDS system are shown in Figure 2. From the literature data bank of the ZIC (SPRESI funds; see [14] concerning content and structure), a library of reaction equations is generated in the form of a reaction file, which forms the basis for the so-called synthon library. In the CKB, further files were constructed by way of supplement, a basis reaction file comprising basic chemistry and a CKB reaction time file which was specially supplied from the synthesis efforts of the combine. The synthon library constructed from the files ("Information Base") consists of pure synthon equations, i.e. only the reacting parts of the molecules according to the principle of synthon substitution are considered for the planning steps ("formal base;" as regards the

term synthon, see [15], as regards the derivation of the synthon equations, see [16]). The RDS programs permit both synthesis planning in the actual sense—starting from target structures, their precursor (daughter) structures are created retrosynthetically, and thus synthesis trees are built up—as well as reaction prediction—starting from given starting molecules, possible reaction products are generated. To make the individual planning steps as efficient as possible, modules with special evaluation criteria and context information are currently being developed and tested.

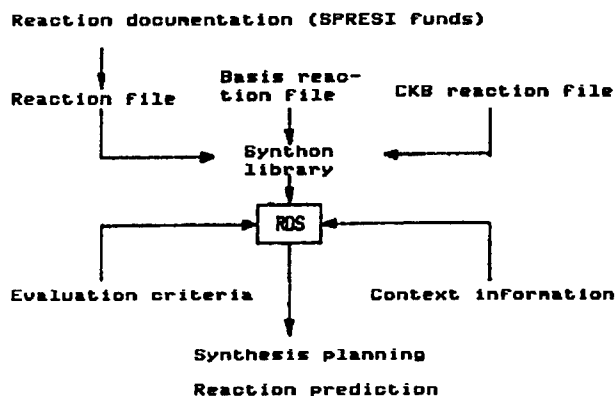


Figure 2. Functional Diagram of Synthesis Planning

Individual system components WIFODATA, QSWA, and RDS were implemented on the ES 1056 system of the CKB, and are used via the ES 7926 terminal (in remote setup). Smaller software packages are also available, e.g., for MO calculations, mathematical-statistical methods for file creation, and 2-D molecular graphics, which run on a powerful personal computer.

Future Developments

The system components that have been created up to this point form a solid foundation for the further development of the overall complex into an expert framework system of synthesis chemistry. Apart from the further completion of currently available components, the following objectives should be mentioned:

- development of suitable software for 3-D molecular graphics (for previous development, see [17])
- construction of special retrieval systems, e.g., by using the SPRESI fund,
- construction of special data memories (e.g. chemical verification fund),
- creation of defined interfaces to other CAD stations within the CKB, e.g., to production engineering and bioengineering research.

Finally, it must be emphasized that experience to date has shown the CAD systems to be applicable usefully also in synthesis research and to be able in the future to form an important factor for speeding up scientific-technical progress.

Now it already appears justified to speak not only of using computers in chemistry, but also of "computer chemistry" [18] as an autonomously developing discipline with its own methods, its own content, and independent information. The chemical industry has a rather significant share in this development and in the utilization of the results to complete the social reproduction process.

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8348

COMPUTERS

Hungarian Designed Plotter To be Marketed Locally

25020040a Budapest
COMPUTERWORLD/SZAMITASTECHNIKA in
Hungarian No 4, 24 Feb 88 p 1

[Unattributed article: "Hungarian Plotter"]

[Text] The Novotrade joint stock company has further expanded its commercial activity; a plotter now figures in its offerings. The signs indicate that this will be a successful business initiative, since there is increasing interest in medium price CAD/CAM peripherals. Novotrade has obtained the exclusive right to sell in Hungary the GraphiPlot plotter manufactured by FOK-GYEM [Precision Engineering and Electronic Instruments Manufacturing Cooperative], and since it has had an independent export right beginning in 1988, it also plans foreign sales.

The GraphiPlot is fully compatible with the Houston Instruments plotter model number DMP 42. With its aid one can make A/1 format drawings. The equipment receives the graphic commands through a standard V24 (RS 232) interface; these are stored by microprocessor controlled electronics, interpreted on the basis of the program therein, which then produces the signals operating the plotter mechanics. Stepping motors position and a magnet raises the pen.

The plotting precision of the GraphiPlot is surprisingly good; according to data from the manufacturer it is 0.1 percent for the entire surface. We could be convinced of this at a demonstration where the Columbia was drawn with AutoCAD. The good "restoring ability" of the equipment was demonstrated with the aid of a drawing broken down into its elements.

Another advantage of the GraphiPlot is its simple structure thanks to which the frequency of failure is slight. The plotting speed is only moderate (only 75 millimeters per second). Its biggest disadvantage is that one cannot make drawings larger than A/1.

The GraphiPlot can be connected to PC's, VAX and TPA computers and IBM, ICL and Siemens mainframes just as it can to a Commodore-64. Its program language is DM/PL, a description of which can be found in the

documentation coming with the machine. The plotter can be shipped from a warehouse and they provide service for it as well. Peter Etelkozi, representative of the vending firm, trusts that the 0.5-million-forint price of the machine will be very attractive.

8984

Components, Peripherals of Bulgarian Isot 1014E Computer

23020010b East Berlin RADIO ELEKTRONIK
FERNSEHEN in German No 3, 1988 pp 139-140

[Article by Graduate Engineer Valentin Lupov: "Bulgarian Computer Isot 1014E"]

[Text] In Bulgaria the new computer system Isot 1014E (EC 1037) has been produced since the end of 1986. It reflects the most modern results of computer engineering and corresponds to the international state of the art for computers of intermediate power.

The core of this computer system is the central processing unit Isot 2100E, which is part of the ESER Series 3. It is characterized by the following features:

Speed of operations	10 ⁶ operations/s (1 MOPS)
Main memory capacity	Expandable up to 16 Mbytes
Program memory	64 Kbytes
6 channels in the basic configuration	1 BYMPX, 5 BLMPX
Power consumed	3.5 kW
Operating system	VM/35

The entire unit including the keyboard with display terminal, printer, and power supply, is designed as a single-unit construction, so that it does not take up much room in the office.

The use of modern components has made it possible to realize the basic configuration of the central unit with only 14 plug-in units. The main memory (16 Mbytes) has been implemented with 256-Kbit RAMS.

Each of the channels is located on a separate plug-in unit and each can operate both in the byte multiplex (BYMPX) and in the block multiplex (BLMPX) modes. With the addition of other plug-in cards, the number of channels can be increased to 12. In the BLMPX regime, each channel has a transmission speed of 2 Mbytes/s.

Several powerful peripheral devices have been developed for the computer system 1014E. The matrix processor EC 2706 has a so-called flow-line organization for data processing and is especially suited to tasks that demand a high data throughput. It has its own operational memory, which can be enlarged up to 16 Mbytes. For tasks such as fast Fourier transformations the matrix processor operates with a speed of operations of 10⁸ operations/s (100 MOPS).

Especially important parts of the computer system Isot 1014E are the 317-Mbyte disk store and the magnetic tape store EC 5527/5027, which correspond to the latest state of the art in memory devices. The disk store consists of the newly developed control unit EC 5563, the control module 5663, and the non-removable fixed-disk storage EC 5063; the devices EC 5667 and EC 5067 (100 Mbytes and 200 Mbytes respectively) can also be connected to the control unit. In the magnetic tape memory the so-called group coding-recording method is used, which permits a transmission speed of 738 Kbytes/s with the central unit.

The system VM/35 was developed as the operating system. This is a virtual-machine system, which makes available to each user his own EDP facility with the architecture of the ESER Series 1 or 2. An integrated component of the VM/35 is the interactive system CMS, which gives especially advantageous operating possibilities to the individual users.

With parts of the computer system 1014E, multi-computer complexes can be established that have an especially high throughput capability.

With such a complex consisting of two central units 2100 E and a total of 32 Mbytes of main memory, eight matrix processors EC 2706, and 18 Gbytes of magnetic disk storage capacity, the speed of operations comes to 96 times 10^6 floating-point operations/s (96 MFLOPS). With matrix and vector operations, an operation speed of 320 MOPS (320 times 10^6 operations/s) can be achieved. Here the transmission speed between the matrix processors is 12 Mbytes/s.

The programming languages used are PAL (macroassembler) and FORTRAN 77, which are also part of the supplied software.

For other information, contact Isotimpex, Leipziger Strasse 60/6-2, Berlin, 1080, phone 2292902

12114

Hungary: Competition for Right To Produce PPC's To Continue

25020040c Budapest

COMPUTERWORLD/SZAMITASTECHNIKA in Hungarian No 4, 24 Feb 88 p 2

[Article by Gitta Takacs: "The PPC'88 Competition; To Be Continued..."]

[Text] The cycle of events or "serial" arousing the greatest response in our profession last year was certainly the competition for the manufacture of professional personal computers proposed by the OMFB [National Technical Development Committee], the Ministry of Industry and the National Materials and Price Office in the wake of the July 1986 decision of the Economic Committee. It is to be continued in 1988....

The results of the competition were evaluated in December of last year by a professional jury whose members included university and research institute experts in addition to representatives of the chief authorities involved. We have learned from an OMFB official that they felt that the state intervention in the manufacture of PPC's had a favorable effect on the domestic PPC [professional personal computer] market, that it aided standardization and a reduction in prices. About 4,000 personal computers were sold about 50-55 percent more cheaply compared to the 1986 average Hungarian price level. It is true that these machines reached users in larger numbers a good bit later than planned, only around September, because of administrative matters which took an extraordinarily long time. But a domestic "added value" made its appearance and manufacture of power units, some mechanical elements and printed circuit cards began.

On the basis of all this the professional jury and the chief authorities proposing the competition decided—and the Ministry of Trade agreed—that support for the manufacture of PPC's will continue this year in a manner similar to that of last year.

In 1988 also the "favored" manufacturers will be Videoton, the Proper Association, the Csepel Association and the association of small cooperatives, Percomp. For the time being they have signed with them a contract pertaining to the first half-year; in the summer those proposing the competition will make a new evaluation and decide about the second half. The manufacturing plan for the first half of the year calls for 3,320 computers of which Videoton will make 1,100, Percomp will make 1,000 the Proper Association will make 840 and the Csepel people will make 380.

Since users are now seeking higher power PPC's—partly because of the increase in network applications—they will make only 400 of the simple PC's; they will make 1,450 each of types compatible with the XT and AT. Naturally the division by type could change flexibly according to customer demand.

As for prices, there will be no significant change compared to what was established in last year's competition contracts. Depending on manufacturer and the delivered configuration the PC's will be sold for 90,000-115,000 forints, the XT's for 152,000-189,000 and the AT's for 208,000-263,000. (Prices are without state turnover tax.)

In addition the chief authorities providing the support hope that this year there will be some sort of cooperation among manufacturers in the manufacture of some sub-assemblies—such as keyboard, power unit and mechanical elements.

8984

GDR's Robotron Combine Exhibits New Products at Leipzig Fair

26020014 Warsaw WIADOMOSCI
TELEKOMUNIKACYJNE in Polish
No 10, 1987, pp 20-22a

[Article by Kazimierz Warchol: "Robotron at the Leipzig International Fair"]

[Text] The Robotron integrated enterprise exhibited a very wide range of products at the Leipzig Fair. The exhibits included various types of computers, image processing systems, production data collection and processing systems, electronic typewriters, and electronic measurement and control devices.

The Robotron A7150 Computer Work Station

This is a high-output 16-bit microcomputer—in which the K1810 microprocessor is used—suitable for application, among other things, as a CAD/CAM system. The Robotron A7150 is modular in its design and logic system. The individual logic modules operate with the standard international interface bus. Because the universal interface bus system and general-purpose components are used, the Robotron A7150 is in the category of open systems. That is, this system can be customized by users.

Various operating systems—compatible with systems widely used throughout the world—have been prepared for the Robotron A7150 computer work station. The output and extensive potential applications of the system are determined by the large memory capacity (896 kb), its graphic capabilities, and the possibility of connection to hierarchically superior systems. The main areas of application of this equipment are use as design and production engineer work stations (CAD/CAM) in the sphere of machinebuilding, electrical engineering, construction, etc, and also applications in the area of laboratory and measurement station automation, automation of office work, technical engineering calculations, research, in the area of accounting, invoicing, and planning, and in a variety of economic calculations. It should be added that the time required for developing and running programs has been reduced in this system. The groundwork has also been laid for compatibility with programs intended for future 16-bit personal computers.

Production Data Collection System

The collection and processing of data relating to production represent an essential problem in the production plant organization system as a whole. Rapid transmission of data to pertinent divisions and adaptation of these data to the specific features of a given problem are requirements which must be met by a system which operates fast and efficiently.

Solutions of this type also include the Robotron A5222 production data collection system, which allows the user to develop customized and cost effective programs of the CAM type. Because of the modern architecture, the universal hardware capabilities, and the extensive software, this system is used in many areas of industry and in management and scientific applications.

Two kinds of terminals are used; they represent an element integrating man, machine, and production process. The K 8913 data station is a monitor terminal consisting of a monitor and alphanumeric keyboard, and, when so requested by the customer, a serial printer. This terminal is suitable for use at production manager, dispatcher, and foreman work stations, and wherever the need exists for data retrieval.

The terminal situated immediately at the production station—a Robotron K 8901—consists of a 16-position alphanumeric display, a keyboard, and other optional subassemblies, represented essentially by magnetic identification card or punch card readers and K 6311 or 6313 printers.

The digital input/output port is of particular importance in this system. This port allows automatic collection of data relating to production. For example, equipment indicating measured values, weighing devices, and other subassemblies designed for input and output of production-related data may be connected to this port.

Electronic Typewriters

The Robotron integrated enterprise is a world-renowned manufacturer of typewriters. It makes more than 100 different typewriter versions. In addition to its well-known mechanical and electric typewriters, the firm markets modern electronic typewriter models offering large potential and meeting modern requirements. Some of them are discussed below.

In addition to easy and convenient error correction, the Robotron 6120 S aids in text layout through underlining of sections of text, centering, and use of special type fonts. **The Robotron S 6125 office machine** is a machine equipped with a correction memory having a capacity of 200 characters and a so-called permanent memory. Frequently recurring text portions can be stored in 10 memory areas having a total capacity of 1,050 characters. Pressing a single key allows rapid and error-free printing of a desired boilerplate text. A special 8-character display signals, among other things, errors in machine operation, the position at which the machine is situated, exceeding of memory capacity, tab stop position, etc. **The Robotron S 6130 electronic memory typewriter** has a 12-position signal indicator providing information on all machine functions performed. In addition to software proofing, the typewriter has the capability of full-page proofing (forward and backward). It also allows optimum formatting. Preparation of copies written in block form is also possible in printing of text.

Electronic Measuring and Control Equipment

The Robotron product range in this area includes the following product groups: **Equipment for Automation of Measurement and Control Processes**, represented by instruments used primarily in the electronics industry. The P 300 connection tester can be used to check unpopulated semiconductor circuits and wire connections, while the M 3003 circuit tester is used for automatic testing of circuits populated with appropriate semiconductor elements. The pulse measurement method employed here guarantees an extremely short measurement period. **Dynamometric Measuring Instruments**. The most recent Robotron instruments in this area are represented by a series of precision dynamometers with built-in foil elements which measure over the 100 N to 200 KN range with an accuracy of 0.03. Their main sphere of application is that of materials weighing and testing processes. The 1606 precision gage is equipment designed for measurement and estimation. It is microprocessor controlled and is distinguished by its high accuracy. It is designed for use in electromechanical calibrating scales. **Equipment for Acoustic Measurements and Measurement of Vibrations**. In this area Robotron markets the 00 080 sound dosimeter designed for regular measurement of worksite sound intensity and the M 1302 diagnostic measuring instrument, which is a portable instrument used to evaluate the condition of roller bearings.

It should be pointed out that Robotron has been cooperating with Polish firms for many years now. Its biggest Polish partners are the Metronex, Elwro, and Labinex enterprises. Robotron products are to be found in almost all areas of the Polish economy. Items which are well known and highly regarded on the Polish market are products such as electronic data processing equipment, automatic billing and bookkeeping machines, office computers, typewriters, drafting equipment, measurement and control equipment, and other products.

In November 1986, Robotron delivered to Poland 2 interactive image processing systems—the Robotron A 6471 and A 6472—together with peripheral graphic equipment. This system, which was delivered to the Wrocław Institute of Technology, links an image processing system to the work station of a production design engineer. A special feature of the system is that it can be used alternately for image analysis and for graphic purposes.

Two data processing systems, the Robotron EC 1055 M, have been set up for use in Poland. One of them is at the Ursus Machinery Plant in Warsaw, and the other at the Elwro Electronic Plant in Wrocław. The Robotron A 5220 data collection system is in use at the District Meat Industry Enterprise in Warsaw, at the Petroleum Industry Center, and at leather industry enterprises. A production data collection system—the Robotron A 5222, the first such system in Poland—was set up at the compact car factory in Tyche in November 1986.

Poland is a major supplier of many products to the Robotron integrated enterprise. In addition to close cooperation in the area of equipment for the Unified System, important items of peripheral equipment used in many electronic devices made in the GDR are imported from Poland.

6115

Robotron of GDR Introduces IBM-Compatible EC1834 Workstation

23020011 East Berlin NEUE TECHNIK IM BUERO in German Jan-Feb 88 pp 1-3

[Article by Dipl. Eng. D. Wiedemuth, VEB Robotron-Elektronik Dresden: "EC1834 Personal Computer—A Professional ESER Personal Computer From the VEB Robotron Combine"]

[Text]1. Introduction

The 16-bit ESER personal computer EC1834 belongs to the second generation of a successful VEB Robotron Combine initiative to provide modern workplace-oriented computer technology and is, at the same time, the beginning of a long-planned compatibility and development series. This development series has been coordinated with the CEMA countries. It is a component of the "Standardized System of Electronic Computer Technology" (ESER) and conforms to the document "ESER Professional Personal Computer Operation Principles." Compliance with these operation principles assures the operational compatibility of all ESER PC's according to the international trend and guarantees portability of program products between ESER PC's from various countries.

The EC1834 is functionally compatible with the IBM PC XT and with numerous similar PC's. Compared to the PC XT, the EC1834 delivers approximately 30 percent more computing power. A modern, efficient operating system that provides maximum support for the machine's functional capabilities has been developed for the series introduced with the EC1834. This DCP [disk oriented control program] operating system provides software interfaces that are fully compatible with those of the operating systems most frequently used internationally for this class of computers. With it the VEB Robotron Combine offers a foundation for making the wealth of existing user software for PC's quickly usable.

The DCP operating system also guarantees compatibility with the Robotron A7150 workstation.

With the EC1834, various possibilities exist for connection to other computers and for inclusion in LAN's (local area networks) and wide area networks. Specifically, a network interface is available which is as hardware-independent as possible and compatible with the international standard NETBIOS interface (Network Basic Input/Output System). Along with DCP, which itself

contains basic network functions, this interface forms the basis for the use of efficient LAN software products on the EC1834 and for its inclusion in various types of LAN's. In the following, the most significant features of the EC1834 PC are briefly introduced. Other articles will deal with individual aspects of this development.

2. Features and Structure of the EC1834

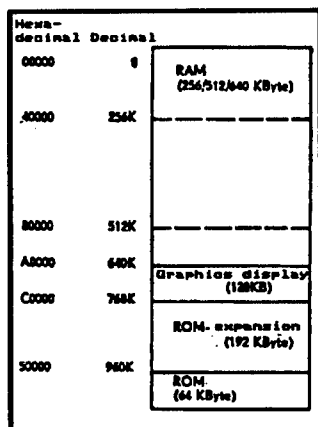
In the development of the EC1834, the objective was to provide a tabletop machine for broad mass application which, on the one hand, can be produced cost-effectively in large quantities and, on the other hand, offers the international standard operation and performance required for demanding professional work.

2.1 Basic Features Pursuant to the Operation Principles

The "ESER Professional Personal Computer Operation Principles" prescribe the operational interfaces of the hardware which can be utilized by the operating systems and by other programs. In addition to the list of processor commands, these include address space utilization, I/O address structuring, interfaces for connection of I/O devices, basic functions for accessing I/O devices, code tables, and data carrier formatting.

Conforming to the Operation Principles, the K1810 circuitry with the K1810WM86 16-bit microprocessor and the K1810WM87 arithmetic processor was selected as the basis for the EC1834. This makes available a powerful list of commands and a 1-megabyte address space.

Figure 1 shows the basic distribution of the address space. The EC1834 can be equipped with 256 K, 512 K, or 640 K of memory. This memory is available to programs with the exception of approximately 45 to 50 K, which is occupied by the operating system depending on the configuration. The EC1834 uses the top 32 K for ROM.



This ROM section contains diagnostic programs, which check operability and configuration each time the machine is turned on, and the so-called ROM-BIOS (BIOS = Basic Input/Output System). The ROM-BIOS can be construed as the core of the operating system. It contains the basic functions for operation of the computer which can be invoked by the interrupt command using an interface which is a de facto standard. It is precisely the use of this interface for the EC1834 which assures the operability of all internationally existing programs which do not bypass this interface. Furthermore, special provisions in the design of the computer guarantee the operability of the majority of the remaining programs, which run directly on the hardware. The interfaces for the connection of I/O devices and other components and for external links defined in the Operation Principles, are closely related to the requirement for modular construction of PC's. The extensive use of highly integrated circuits in the EC1834 permits producing self-contained electronic function complexes on separate circuit cards.

The basic computer includes a horizontal system base with the central electronics of the computer and the system bus prescribed by the Operation Principles. The central electronics includes, among other things, the processor, the interrupt system, the I/O controller, the clock, 256 K RAM, 16 K ROM, and the keyboard controller. As many as 8 so-called adapter cards can be plugged into the system bus, which has a 32-bit data path. These adapter cards are usually circuit cards with the electronics to control a specific class of I/O devices (e.g., to control floppy drives).

The EC1834 is thus a modular system in the sense that its components only work together using the prescribed system bus. Components can be added or exchanged without problems. This modular nature of the hardware is mirrored by that of the operating system, specifically by applying the principle of the so-called installable peripheral drivers.

2.2 Structure and Components of the EC1834

The EC1834 is a tabletop machine that consists, as a rule, of the following components: the basic computer, low-profile keyboard, monitor, and printer. The basic computer includes, along with the system base and the adapter cards, a power supply module, a fan, and space for 4 memory drives (e.g., 2 floppy drives and 2 hard disks).

The following adapter cards are available or planned for the EC1834:

- for memory expansion (384 K),
- for monochrome alphanumeric monitor,
- for monochrome and color monitor (graphic and alphanumeric modes),
- for connection of floppy drives,
- for connection of hard disks,

- for printers,
- for serial communication for both synchronous (BSC [binary synchronous communication], SDLC [synchronous data link control]) and asynchronous operation with two V.24 interfaces (RS232C, switchable to IFSS-interface),
- for connection to controllers of the EC7920.M screen system,
- for the ROLANET1 local area network (IEEE protocol 802.3),
- for extension of the system bus with an expansion unit that can accept additional system components,
- for the X.21/X.25 interfaces.

For the EC1834 the following I/O devices will be available or connectible:

- low-profile keyboard with the international standard layout,
- dot-matrix printer,
- monochrome alphanumeric monitor (25 lines x 80 characters),
- monochrome monitor (640 x 480 pixels, 25 lines x 80 characters),
- color monitor (640 x 480 pixels, 25 lines x 80 characters),
- floppy drive (720/360 K),
- hard disk (approx. 30 to 50 MB),
- K6313 and K6314 printers with graphics capabilities,
- K6405 graphics tablet,
- plotter.

The adapter for serial communications allows two connections. Here, such units as a plotter, a digitizer, a second printer, and other I/O devices can be connected. Naturally, providing such an extensive assortment of adapters and I/O devices presents a sequencing problem which will be solved by the fact that from the very beginning EC1834 systems are available which are suitable for professional work. The modular construction of the system makes it possible to meet increasing demands by adding onto the configuration.

3. Software for the EC1834

The functional capabilities of 16-bit PC's represent a new quality of computer technology in the workplace. Its appropriate and convenient use must be assured by a corresponding new quality of software, especially of the operating system. Thus, there has been no carry-over and adaptation of the well-known and proven SCP operating system, whose structure and functions were determined by the limited capabilities of 8-bit technology and which made the best use of them. On the contrary, following the international trend, the DCP operating system, which is fully compatible with the operating system most frequently used internationally for this class of computers, is the primary operating system for the EC1834. Also, an operating system of the MUTOS type is being prepared for the EC1834. Conversion to this system, which will demonstrate its real significance only on more powerful

hardware, will be facilitated by its many similarities to DCP 3.2 and by conversion aids. Both systems will exist side-by-side, since even DCP has a forward-looking design and will be enhanced.

3.1 The DCP 3.2 Operating System

The basic DCP system (Footnote 1) includes:

- the control program system,
- the system utilities,
- the user diagnostics system,
- the program development tools and other tools.

The control program system includes three components which work together closely and form the basis for all other programs:

—The BIOS component transforms the ROMBIOS interface into a simple and uniformly accessible logical level. It contains the peripheral driver routines for all standard I/O devices as well as means for configuring the system, especially for inclusion of installable peripheral drives.

—The DOS component contains routines for numerous basic functions of the operating system. This includes approximately 100 system calls, which are largely compatible with the corresponding UNIX calls and significantly simplify development of program products. Also included are familiar system calls from SCP, which are still used by some programs.

—The COMMAND component, the command processor, includes routines for many frequently used internal commands and the means to execute external commands or programs, even in the form of powerful batch processing requiring no user intervention. Internal commands exist, for example, for displaying the time and date in addition to directories and files and for copying, erasing, and renaming files.

Among the utilities (external commands) are programs for copying and comparing diskettes, for formatting and checking diskettes and hard disks, for sorting files, and for many other purposes. Also included are installable peripheral drivers for working with SCP diskettes and to set up virtual drives in the RAM.

The user diagnostics system includes a shell program and a number of component-oriented test routines.

Among the program development tools and other tools are:

- a line editor,
- a full-screen editor,
- a macro assembler,
- a cross-reference program,
- a program linker,
- a library,

—a symbolic debugger.

These tools also form the foundation for program development based on higher level programming languages. Compilers and other tools for higher level languages are not actually part of the DCP operating system, but do use its basic functions. For the EC1834, as for the A7150, international standard programming languages are being prepared such as BASIC, C, PASCAL, FORTRAN 77, Modula 2, and COBOL.

Along with proven basic concepts, already familiar from SCP, DCP includes primarily a few important concepts familiar from UNIX:

- a hierarchically structured file system,
- rerouting of input and/or output,
- filters,
- pipes,
- configuration files (installable peripheral drivers),
- background processing.

Directories of files may be structured as trees. This provides the capability of placing files which belong together because of content or are assigned to a specific user in separate directories. This considerably increases the manageability of the file system and largely prevents naming conflicts—which can easily lead to accidental destruction of files.

Rerouting of input/output, filters, and piping of programs are closely related. Standard input for a program normally occurs from the keyboard, standard output to the monitor. Without intervention in the program, there is a simple provision for having input read from a file or output written to a file. Filters are programs which read the standard input, process it in specific ways, and write it to the standard output. Examples of this are the DCP utilities for rotated display of files, for file sorting, and for searching for lines containing specific character strings. In piping of programs the output of one filter or program automatically becomes input for another filter or program.

During initialization, DCP can process data from a configuration file and configure itself automatically. A specific part of this process is the inclusion of installable peripheral drivers, programmed according to a prescribed interface.

Basically, this provides the capability for functional expansion of the operating system without intervention in the operating system.

DCP is not a multitasking operating system. It contains only a few basic functions for that which are used, for example, to print files during normal work on the system.

3.2 Standard Software for the EC1834

Standard software's primary advantage is that a great variety of users can perform routine workplace activities cost-effectively using the computer. For the EC1834 with the DCP operating system—just as for the A7150 with DCP—program packages are being prepared which match and sometimes even surpass the international standard. Examples of such program packages for engineers, designers, technologists, and specialists in a great variety of fields include:

- various high-level text processing systems, including the TEXT 30 text processing program which has proven reliable with all previous office, workplace, and personal computers from the VEB Robotron Combine;
- the REDABAS-3 databank system for medium-sized databases;
- the MULTICALC spreadsheet program;
- the AIDOS information research system;
- integrated systems with text processing, databanks, spreadsheets, and business graphics;
- mathematical statistics;
- arithmetic;
- speed optimization;
- CAD program packages.

New program products, even for more specialized tasks, will continue to be developed and offered. Other articles will deal specifically with these issues.

4. Connection of the EC1834 With Other Computers and Formation of Local Area Networks

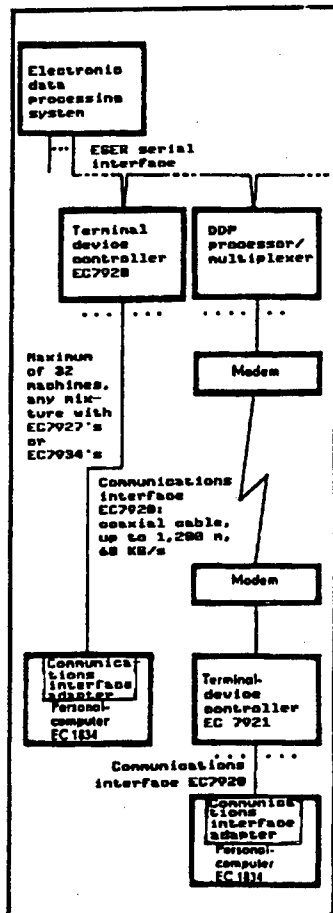
The EC1834 is suitable for autonomous use in the workplace and certainly will be used primarily in that way in the beginning. With application to a great variety of tasks, experience shows that demand will grow for being able to access the resources of other computers, especially central ESER computers such as the EC1057.

Using the serial communication adapter and appropriate emulation and transfer software, the level of file transfer familiar with office computers with means for distributed data processing will be available. Another program product will permit transfer of files between office computers or PC's and the EC1834 via the V.24 interface. This specifically permits solution of the problems of file transfer from the office computer to the EC1834.

The connection of the EC1834 to controllers of the EC7920.M screen system will constitute a significant advance, especially in the local circuit.

Figure 2 shows the basic design of the connection to a central ESER computer. In the local circuit, data can be transmitted over a distance of 1,200 m at a rate of approximately 60 KB per second. With appropriate file transfer and emulation software, hard disk areas of the central computer can be used by the EC1834 practically as if they were hard disks in the EC1834. Even direct access to databanks of the central computer will be

increasingly integrated into software products for the EC1834. Emulation programs permit use of the EC1834 as a terminal.



The further integration of the EC1834 into networks, especially distributed data processing networks, is made possible by the above-mentioned adapter. In a local area network, specific computers which are equipped with especially large disk capacity or with printers are assigned file or print duties which can be used by the other connected computers. Furthermore, the transfer of information between all computers in the network is supported. The international standard NETBIOS interface is used with appropriate emulation programs for the network adapter of the EC1834. On this basis, the above-mentioned services are available with a network program and DCP, which already includes basic networking functions.

Footnote

1. F. Wendler: "Brief Description of DCP," NEUE TECHNIK IM BUERO, Vol 31, No 6, 13 Jul 87, pp 173-179

NTB 3670

12666

FACTORY AUTOMATION, ROBOTICS

New GDR Flexible Manufacturing Systems Seen At 1988 Leipzig Fair

Systems From 'Fritz Hechert' Combine

23020013 East Berlin FERTIGUNGSTECHNIK UND BETRIEB in German No 3, Mar 1988 pp 136-138

[Article by Dr. Eng. G. Krahnert, KDT, VEB Machine Tool Combine "Fritz Hechert" Combine, Karl-Marx Stadt]

[Text]0. Introduction

The trend towards using flexible automated production equipment has recently grown considerably in scope internationally among users for small, medium, and large-scale production. This growth has been based on product innovation. With the majority of users, the characteristic trend is to begin automated solutions with smaller production systems, tailored to the foreseeable requirements of flexibility. The personnel and the technical content is then developed step-by-step to the next higher level. The need here extends over the entire spectrum from small parts about 100 mm to large parts around 2000 mm edge length. The profile of the newly developed and further developed products of the VEB Machine Tool Combine "Fritz Heckert" corresponds to this trend, especially by the completion of the construction series of processing centers and production cells in the enterprises VEB Machine Tool Factory Saalfeld and VEB Machine Tool Factory UNION Gera as well as the compact system of the combine's parent enterprises.

Production automation requires reliable and powerful processing modules. The questions of reliability become all the more important the more complex the production processes are designed. In the combine "Fritz Heckert," therefore, the testing and tryout of subassemblies to detect early failures and to discover weak points is greatly emphasized in the preparation and production process. This concerns both the functional mechanisms as well as the microelectronic subassemblies, for example, in view of the increasing use of the compact control CNC 700 of the VEB NUMERIK "Karl Marx." These principles are reflected in the exhibition program.

1. Flexible Production System FMSP 500/1-2

In dependence on differentiated manufacturing tasks, the combine has recently created various technical solutions for flexible manufacturing systems (FMS) to process prismatic parts ranging from 400 to 2000 mm edge length. The most recent development in this area of manufacturing means is the FMSP 500/1-2 from the parent enterprise.

Explanation of the machine designation FMSP 500/1-2:

- FMS — flexible manufacturing system;
- P — the work piece assortment that is to be processed (prismatic parts);
- 500 — size of the dimensions of the machine palette (500 mm x 500 mm);
- /1 — development stage of the FMS (developed variant);
- -2 — number of machine tools.

(According to the guideline of the industrial branch WMW "Terms and Definitions as well as the Labeling and Identification of Products which are Related to Flexible Automated Production.")

The flexible manufacturing system for prismatic work pieces with maximum lengths 500 mm x 500 mm x 500 mm consists of two modified horizontal processing centers CW 500 and an oval work piece storage unit with 12 palette stations, where the latter simultaneously takes over the tasks of the transportation system for the work pieces.

The two processing centers are disposed opposite one another at the storage unit. Compared to the standard design, the tool storage capacity at the centers was increased from 40 to 60 tools, so that 120 tools are available in the system. By means of these, a large number of form elements can be manufactured. Each processing center has available its own disposal equipment and its own supply of auxiliary materials. The processing modules are controlled through a freely programmable CNC 600-3. By means of this, the functions for checking the work piece and the tool (measurement sensor, lifetime monitor, tool breakage detection, selection of replacement tools, monitoring of main drive power) are implemented, guaranteeing an operation that requires little service. The processing programs are entered through photoelectric paper tape readers. The processing centers are connected together on the control side. One of the two CNCs can optionally take over the control of the transport motions between the oval storage unit and the processing centers and thus the control of the entire manufacturing system.

A mounting station for mounting, resetting, and unmounting the work pieces is disposed at the front of the oval storage unit. The parts that are mounted on palettes are automatically cycled to the work stations without operator intervention. This function is implemented by an extension of the PMC adapter control of the CNC 600-3 and additional circuitry for additionally activating the auxiliary drives. The oval storage unit/transport system is operated by way of a control board situated next to the mounting station. The following can be selected as operating modes: **Automatic Operation:** Constantly repeated cycle of the transport system corresponding to a prescribed working sequence. **Set-Up Operation:** Positioning the transport system to mount,

reposition, and unmount the work piece. **Manual Operation:** Controlling all functions of the transport system for service and maintenance operation.

The system has available 14 palettes with variable station coding. The processing programs are associated therewith and can be processed at each of the two machines. The complex drilling and milling work is performed in one mounting, and only one repositioning is required for complete processing.

One operator is needed to run the flexible manufacturing system. Depending on the total manufacturing time of all the parts, however, work pieces with longer processing times require little or no operator intervention.

2. System Elements

According to the above-mentioned guideline for "Terms and Definitions," the following holds: "System elements (the term system modules is also permissible) are self-contained subassemblies or products which can be joined into a flexible automated manufacture." The processing centers, which have manufacturing cells, which can also be used separately, are the most important system elements and thus are the basic components of flexible manufacturing systems. The VEB Machine Tool Factory Saalfeld is presenting a new development in the processing of prismatic and plate-shaped tools with its manufacturing cell FCW 250. This closes the product series of processing centers/manufacturing cells of the combine towards the bottom, so as to handle construction sizes with the smallest palette dimension. This makes it possible to process economically work pieces with a maximum edge length of 250 mm and a work piece mass of max 100 kg.

Subassemblies with high rigidity are a precondition for qualitatively high manufacturing precision which will also remain uniform over a long period of time. The FCW 250 has a rigid machine bed, in which the functional subassemblies are disposed in a stable linkage. The core of the manufacturing cell is the horizontal working spindle. Taken up in high precision bearings, and combined with the use of a convection cooling unit to stabilize the oil temperature for gear lubrication and for cooling the spindle, speeds up to 6500 rpm become possible. The vertical table arrangement permits unimpeded outflow of chips and coolant through the drainage funnel in the machine bed into the flat-top conveyor that is situated below. The entire machine is encased for the sake of environmental protection.

The work piece storage unit is designed for four palettes with a size of 250 mm x 250 mm, and is connected with a preparation station for loading and withdrawal. The change of palettes between the processing station and the storage units is programmed in the manufacturing sequence as a function after completion of the processing steps. Rinsing of the work piece and cooling of the tools requires 100 l/min coolant.

The continuous path control CNC 700 is used as the control. Associated with it is a complex of monitoring and diagnostic equipment. This guarantees rapid troubleshooting.

The vertical processing center CS 400/4 was extensively further developed by the VEB Machine Tool Factory Auerbach. The process-oriented product with flexible manufacturing is distinguished with respect to its predecessors particularly by the improvement of parameters that are decisive for productivity, by an increase of the automation level, by higher concentration of the subassemblies so as to create a more compact machine, by effective measures for environmental protection, and the like. Compared to the CS 400/3, this unit features e.g.:

- a spindle speed of 5000 rpm
- fast motion 12 m/min
- coolant equipment at 100 l/min
- tool storage capacity 40 stations
- improved cable protection
- full encapsulation of the working space.

The process center has a modular structure so that the different variants can optimally correspond to the respective technological requirements in small and medium production. For example, the design with automatic work piece change is to be regarded as one of the variants of the work piece support. Palettes with mounting surfaces 500 mm x 630 mm are used here. But the CS 400/4 can also be adapted in chained form as a processing station of flexible manufacturing systems. The microprocessor control CNC 700 of the VEB NUMERIK "Karl Marx" is used simultaneously with the complex of introducing variable machine parameters. Associated with this are also measures for monitoring the process as well as the deployment possibilities of an inductive measurement sensor, axis-related and path-dependent control of the central lubrication equipment, or measurement of the bearing temperature with automatic switch-off if a limit value is reached. The VEB Machine Tool Factory UNION Gera also developed further the assortment of system modules for large parts. From this assortment of offerings, the processing center CBFK 130/2 with extended functionality is exhibited as a new development.

Housing-shaped or plate-shaped and fancy-figured work pieces up to dimensions 1250 mm x 2000 mm and max 6000 kg mass, with high precision requirements, circumscribe the technological basis for its application area. The requirements are met through a series of new design solutions. For example, the main bearing was designed for high rpms and was provided with lifetime grease lubrication. The spindle is mounted in precision rolling bearings. With 3000 rpm, it is significantly improved compared to the predecessor product. An oil cooling unit assures uniform work precision by stable temperature regulation in the spindle stock. For this product, too, the continuous path control CNC 700 was used for the first time. When circular milling is done on a work piece up to a diameter of 300 mm, a 0.025 mm form deviation from

circularity is achieved. The processing center is equipped with a palette changing unit that acts in the x direction, where all the motional steps take place automatically. The movement of the palettes is initiated by a dc-motor and is continued through runners. The palette changing cycle is called by auxiliary instructions in the work piece program through the CNC or from the operating console. The machine is designed in principle with operator protection. In the variant with tool/work piece cooling equipment (up to 200 l/min through jet pipes), equipment is available which completely shields the working room. As an option, infeed of coolant to the tool via the spindle is also offered.

3. Universal Strength Testing Machine UFP 400

A favorable weight/performance ratio and high reliability are criteria which apply both to the investment branch and to the consumer goods branch. Modern materials testing technology is a prerequisite for this, in order to optimally utilize the limits of the structural materials and in order to be able to investigate materials specimens as well as the stress on components and complete modules made of various materials. Starting from this, decisions can then be made for a proper choice of materials and optimal dimensioning.

The newest product of an economical material testing technology is the Universal Strength Testing Machine UFP 400, a typical representative of the construction series of hydraulic universal strength testing machines (UFP) 200 to 1000 kn, from the VEB Materials Testing Machines Leipzig. It is suited for standardized static and low frequency dynamic studies in the tension-compression and bending areas with all appropriately derivable test methods. It can be used in research laboratories and for production monitoring. By means of an integrated minicomputer with a monitor, efficient evaluation of standard tests is guaranteed. The UFP is furthermore characterized by such criteria as:

- force application to the test specimen that is suitable for testing purposes
- high measurement accuracy
- a wide adjustment range of the stress rate
- display of the instantaneous course of the stress parameters
- digital display of test variables (force, stress, elongation limit, elongation path, etc.)
- certifiability of the test data
- variable equipment level corresponding to customer wishes, through modular structure
- expandable through compatible supplementary or expansion peripherals
- low physical and psychological stress on the test personnel.

Compared to conventional testing technology, the number of individual parts could be drastically reduced. This further increased availability and improved maintenance friendliness. The complex of new, enhanced use properties also includes the vibration-insulated erection

of the machine, i.e. no foundation and no anchoring on the erection surface is required. A reduction of the forces transmitted to the ground when the specimens break is a consequent result, which also has a positive effect in terms of reduced interference with the environment.

Machine Tools From '7 October Combine'
23020013 East Berlin FERTIGUNGSTECHNIK UND
BETRIEB in German Nov 3 1988 pp 139-141

[Article by Eng. H.J. Barth, KDT, VEB Machine Tool Combine "7 October" Berlin]

0. Introduction

The various newly developed and further developed products from the VEB WMK (Machine Tool Combine) "7 October" Berlin demonstrate flexibility and productivity.

Flexibility in the sense of rapid conversion to new processing tasks refers to the efficient use of CNC machines and production cells in small-scale and medium-scale manufacture. These include e.g., the production cell FC DAMF 6 x 160 CNC, which was developed on the basis of a CNC-controlled six-spindle automatic lathe, the hobbing machine ZFWZ 03 CNC for producing straight-toothed and slant-toothed spur wheels, the single-spindle high-power lathe DFS 1 CNC, and the chucking grinding machine SR4 I-CNC.

The above-mentioned CNC machines and production cells can be delivered in various expansion stages.

They facilitate the design of production processes with little operator intervention. They are suitable as modules for flexible manufacturing systems.

Productivity associated with high quality requirements is emphasized in the exhibited rolling bearing processing machines for large scale and mass production. These involve grinding machines that were exhibited for the first time

- an automatic cylindrical surface grinder with a roll bearing, SAW 4, and the
- automatic grinder with a lipped inner race, SIW 5/1-I.

The production lane for the grinding and finishing of cylindrical rolls demonstrates the possibility of tailoring highly productive solutions to specific customer wishes even for extreme precision requirements.

The scope of achievements of the VEB WMK "7 October" Berlin also includes export of systems. Long years of experience make possible optimal utilization of production cells, flexible manufacturing systems, and production lanes, from small scale production up to mass production. These achievements extend to

- consultation to solve processing tasks, especially concerning the introduction of rotationally symmetric work pieces

- the planning and delivery of complex technological solutions
- the managing of equipment installation and start-up of the production equipment.

Below, some details will be given concerning interesting exhibition objects of the combine.

1. Production Cell for the Automatic Processing of Chuck Parts FC DAMF 6 x 160 CNC

The VEB Lathe Works Leipzig is exhibiting a CNC-controlled six-spindle automatic chucking lathe, equipped with a work piece input and output device and a work piece storage unit. By using the CNC 700 from the VEB NUMERIK "Karl Marx" with 16 CNC-controlled axes, the flexibility of the production cell is significantly increased. New application areas are opened up, especially in the domain of medium scale manufacture.

The high productivity of the multi-spindle automatic lathe and the completeness of processing remain preserved. Some characteristic features of this production cell are e.g.:

- complete processing in one mounting with little operator intervention
- processing a changing assortment of parts in the diameter range from 50 to 160 mm
- the saving of special accessories and supplementary equipment
- the use of standard tools
- a considerable reduction of set-up time
- an increase of processing precision by correcting the spindle positioning errors
- easy programming and easy program input.

2. Processing Center for Chucked and Centered Parts C DFS 4/1 CNC

The VEB "8 May" Karl-Marx Stadt has further developed the high-power lathe DFS 4/1 CNC into a processing center.

Its application area is single-, small-scale- and medium-scale-production. The 12-fold tool carrier can accept not only turning chisels but also driven tools (mills and drills). Transverse borings, grooved milling, and eccentric longitudinal borings make possible the complete processing of shaft and chuck parts. The compact construction type of the proven inclined bed turning lathe, its high drive power and long-term precision as well as special software guarantee higher productivity. The machine is equipped with the CNC 700 from the VEB NUMERIK "Karl Marx" as a matter of standard.

Technical Data:

Turning diameter about bed	710 mm
Turning length	1250 or 2500 mm
Drive power	50 kW

3. Chucking Grinding Machine SR 4 I-CNC The newly developed SR 4 I-CNC from the VEB Tool Machine Factory Berlin does justice to the international trend towards complete processing.

A manually loaded equipment variant of the new modular system for chuck grinders is shown. The inside, outside, and flat surface processing can take place in one mounting with high work piece precision. By means of an extensive assortment of machining means, it is possible to process a parts assortment with manifold shapes on the SR 4 I-CNC.

The application area of this flexible machine is predominantly in small-scale production.

Other equipment variants permit the use of several grinding spindles and upgrading with handling technique (portal robots) to production cells, and therefore their use as modules in flexible manufacturing systems.

The application area of the exhibited machine is characterized by the following technical data:

Grinding diameter, inside	5...250 mm
Grinding diameter, outside	10...250 mm
Rotary diameter, max	430 mm
Grinding length	250 mm.

The machine manufacturer has worked out special software for the SR construction series. With an optimal grinding strategy, this guarantees efficient loading of the machine and thus high utility for the user. The SR 4 I-CNC is equipped with the CNC 700 from the VEB NUMERIK "Karl Marx."

4. Automatic Cylindrical Surface Grinder with a Rolling Bearing, SAW 4 PC

This newly developed, microelectronically controlled automatic grinder from the VEB Grinding Machine Works Karl-Marx Stadt permits effective processing of rolling bearing rings in the diameter range between 28 and 160 mm with a maximum ring width of 63 mm. This involves the medium construction size of a new generation of automatic cylindrical surface grinders with rolling bearings. Designed in a frontal mode of construction and with full covering, this automat can be advantageously used in roll bearing production lanes in the area of medium scale and large scale manufacture. Some important features are:

- circumferential speed of the grinding body: 60 m/s
- guide shoe acceptance with optional magnetic or non-magnetic mounting
- electrical infeed axis, electronic two-point measurement-control, automatic work piece change equipment
- pressurized-jet flushing equipment
- PC-controlled with a diagnostic system for troubleshooting.

During the plunge-cut grinding of raceways at roller bearing inside rings, the new development makes possible an improvement in the processing quality by about 15 percent and an increase of productivity of more than 10 percent as compared to previously produced automatic grinders.

5. Production Lane for Grinding Cylinder Rollers FS WK 434

The exhibited production lane involves a top of the line product of the VEB Mikrosa Leipzig from the manifold program of its roller bearing production lanes.

The FS WK 434 makes possible the precise finishing of the sheath surface of cylinder rollers with a cylindrical and crowned profile. This production lane consists of the centerless automatic cylindrical surface grinder SASL 125/1, the newly developed super-honing machine SZZ 3, a measuring station, a roller conveyor, and a work piece storage unit. High productivity and high precision make possible its use in large scale and mass production within the roller bearing industry.

Extensive diagnostic equipment reports on, for example, a deficiency of work pieces, wear of the stone, plugged filters, deficient oil pressure, etc.

6. Gear Hobbing Mill for Cylindrical Toothings ZFWZ 03 CNC-EZ

The highly rated ZFWZ 03 CNC-EZ was further developed by the VEB module Karl-Marx Stadt. Upon the customer's wish, the CNC control was adapted to the Sinumerik 3 M (Siemens Company). Equipped with "electronically constrained movement" (EZ), one can do without indexing and differential change gears. The roll coupling between the work piece and the tool as well as the differential coupling with slanted toothings are implemented in the electronic constraint motion by the control.

The advantages are:

- reduction of set-up times by about 20 percent,
- a gain in machine time,
- equally good quality, and
- increased operating and maintenance convenience.

The ZFWZ 03 CNC-EZ permits the economical production of straight-toothed and slant-toothed spur wheels, worm gears, crowned and tapered gear wheels, as well as other rollable profile shapes in small scale and medium scale manufacture. The maximum work piece diameter is 315 mm and the maximum module is 8 mm.

The ZFWZ 03 CNC-EZ can be upgraded with robots, work piece monitoring equipment, and a work piece storage unit to form a production cell. It thus fulfills the presupposition for production with little operator intervention.

INDUSTRIAL AUTOMATION

GDR's Robotron PHM50 Freely-Programmable Industrial Robot Described

23020006 East Berlin NEUE TECHNIK IM BUERO in German No 6, Nov/Dec 1987 pp 164-166

[Article by Dr. R. Baudisch, W. Kreisel and R. Langmann, VEB Robotron-Rationalisierung (Efficiency Improvement) Weimar: "Freely-Programmable Industrial Robot Robotron PHM 50"]

[Text] 1. Fields of Application

The freely programmable industrial robot robotron PHM 50 is a modular system designed according to the swivel arm principle. Its configuration can be adapted to the specific user requirements. The PHM 50 is primarily intended for the following applications:

- Automation of assembly tasks related to the manufacture of precision and electronic instrumentation
- Automation of insertion operations in prefabrication, testing and other processes where several three-dimensional points have to be approached or where the workstation has to be retooled quickly due to small lot sizes.

This system yields the following economic benefits:

- It increases the dynamic effectiveness in the product renewal process
- It ensures great production flexibility
- It increases production quality
- It can be used in complex automation solutions and ensures production with few operators
- It reduces the proportion of manual, monotonous assembly and testing processes.

2. System Concept

The PHM 50 system consists of a basic machine and a number of additional assemblies adapted to the specific application which the user can order according to his specific needs.

The basic machine consists of the gripper guide drive (GFG) with four freely programmable axes and the controller with the operating system. The controller for the basic machine includes a magnetic cassette tape and a problem-oriented teach-in and operator keyboard. This configuration together with a manual assembly (gripper tool with control elements) is fully functional for automatic operation.

Figure 1 shows the system design and its various options. The large number of different input and output devices ensures comprehensive process communication and the processing of essential sensor information occurring in automated processes.

3. Gripper Guidance Gear

For optimum joining operations which are primarily vertical the gripper guidance gear of the PHM 50 was designed as a swivel arm with DSDD-structure.³ (Figure 2, not reproduced here).

The movements of the individual degrees of freedom are set as follows:

Swivel joint 1	approx. 330 degrees
Lift unit 2	285 mm
Swivel joint 3	approx. 330 degrees
Swivel joint 4	n x 360 degrees (any n)

The gripping tools (linear gripper, three-finger gripper) are operated via a pneumatic cylinder, the holding magnet gripper is supplied with voltage via appropriate lines.

To ensure reliability the individual moving units are driven by stepper motors whose movement and position is controlled by flanged transducers, model IGR 2. This results in a position resolution at the motor shafts of 1/32 motor step (joint 1, 2, and 3 3 degrees:32, joint 4 3.75 degrees:32). Due to the transmission ratios and depending on the position of the GFG, resolutions of .01 to .03 mm can be obtained.

Implemented drive concept: **Joint 1:** 2 stepper motors with M_{max} .8 Nm each, and braced spur gear $i=36$ **Joint 2:** 2 stepper motors with M_{max} .8 Nm, braced spur gear $i=6$, movement transmission via steel belt. **Joint 3:** 1 stepper motor with M_{max} .8 Nm, braced spur gear $i=36$, drive torque transmission to rotating axis via steel belt. **Joint 4:** 1 stepper motor with M_{max} .15 Nm, adjustable and braced bevel gear/spur gear drive with $i=18$.

The controller drives the stepper motors in the RUN mode (continuous robot operation) synchronous with the preset characteristic curves for acceleration and deceleration; at the same time, the phase angle is monitored by the measuring systems. The following maximum speeds are possible: **Joint 1:** ω_{max} = 200 degrees/s
Joint 2: v_{max} = .8m/s
Joint 3: ω_{max} = 200 degrees/s
Joint 4: ω_{max} = 500 degrees/s.

Since the nominal speeds have little effect on the work cycle lengths where usually short distances are involved the use of dual motors in the main drives results in fast accelerations and thus short start-up and deceleration times. Compared to the PHM 41, cycle times are reduced by up to 40 percent.

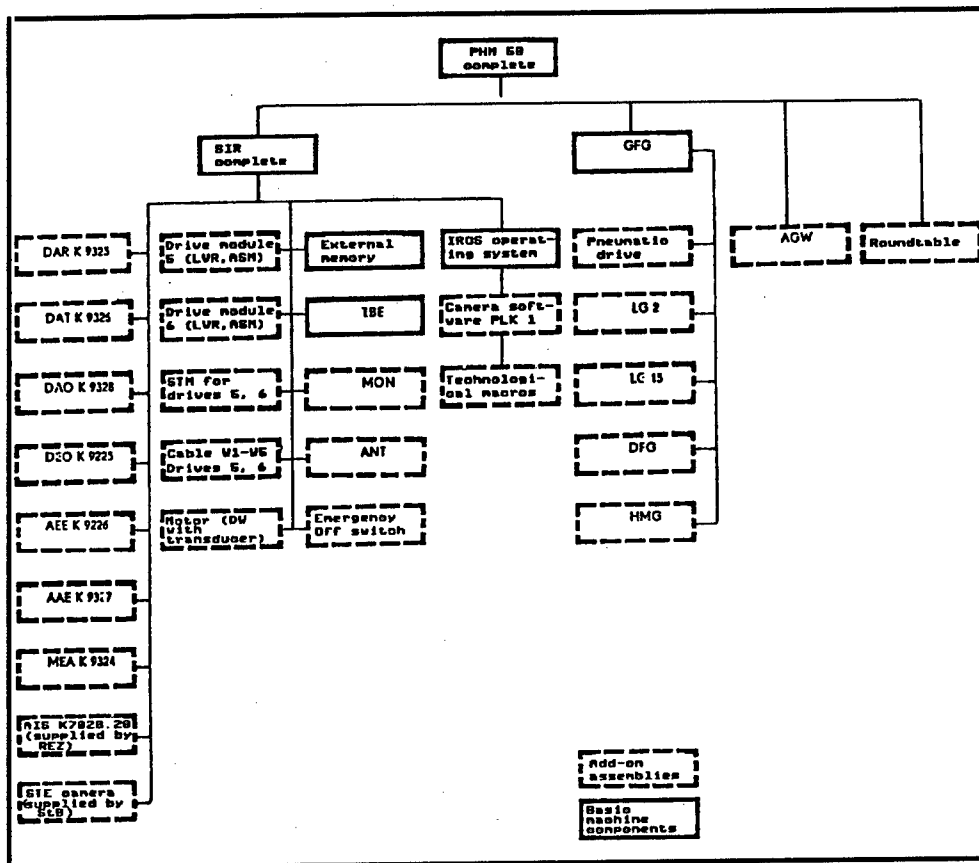


Figure 1. Summary of PHM 50 Options (For Abbreviations see Table 1)

The measuring system concept requires adjustment of the GFG when the machine is turned on. For this purpose, an adjustment device is attached above the drive motors of joint 1 in which the lower arm is fastened while the lift unit is in its locked position. Due to a balancing system in the interior of the lift unit the complete GFG can easily be moved manually when the motors are turned off. This allows insertion into the adjustment position, but also direct teach-in and therefore very efficient programming.

Depending on what the user orders gripping tools including a gripper change system are provided from a standard selection for the standardized gripper flange.

4. Controller

4.1. Hardware Design

Figure 4 shows the basic controller hardware design. An 8-bit multicomputer system supported by a 32-bit arithmetic processor is used as a control computer. In the process computer, programming and operation is done in the control off-line and on-line mode including generation of movement commands. This computer also processes the sensor informations as well as digital signals from the process periphery. An arithmetic processor module with 2x U 8032 is connected via a

memory coupling to support the real-time tasks. Thus, a complete coordinate transformation for a four-axis swivel arm robot, as is required for on-line sensor guidance, takes approximately 12 ms.

When using analog sensor or process signals a sensor processor is connected to BUS 1 via a switching memory. To implement on-line programming of the control (interpreter principle) or for use in the teach-in mode, a function-keyboard with an 8-digit dot matrix display is connected via a serial standard interface (IFSS). The keyboard and display functions are implemented using an EMR UB 8820. The drive computer contains a fast 8-bit CPU (UA 880), a 16K-RAM, and a DMA-coupling logic to BUS 1. This computer is used for position control, operation and monitoring of a maximum of six drive modules. The drive modules consist of a motor control, a power amplifier and the motor transducer assemblies. The design of the motor control and power amplifier plug-in circuits has been adapted to the K 1520 system. The drive modules are coupled to BUS 2 via I/O gates. The process computer is used for error monitoring and automatic error diagnostics. The process computer is monitored by hardware via a special control logic.

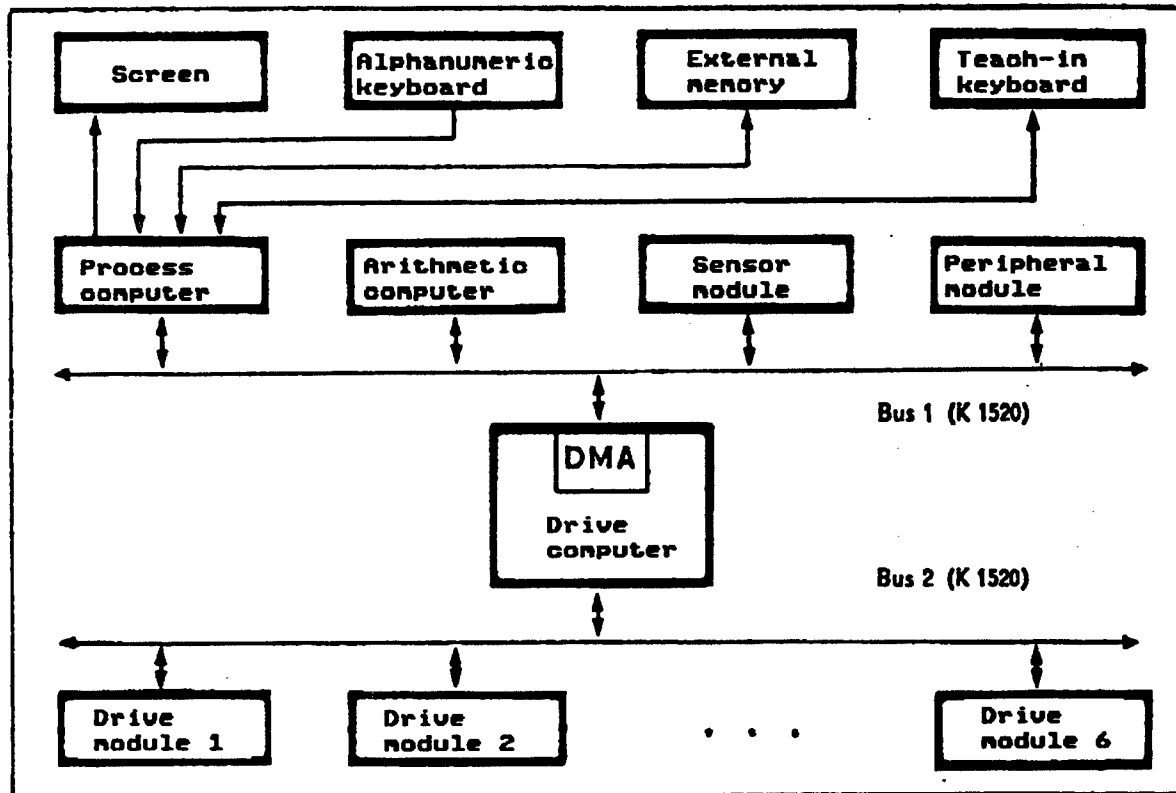


Figure 4. Basic Controller Hardware Design

Table 1. System Design Options

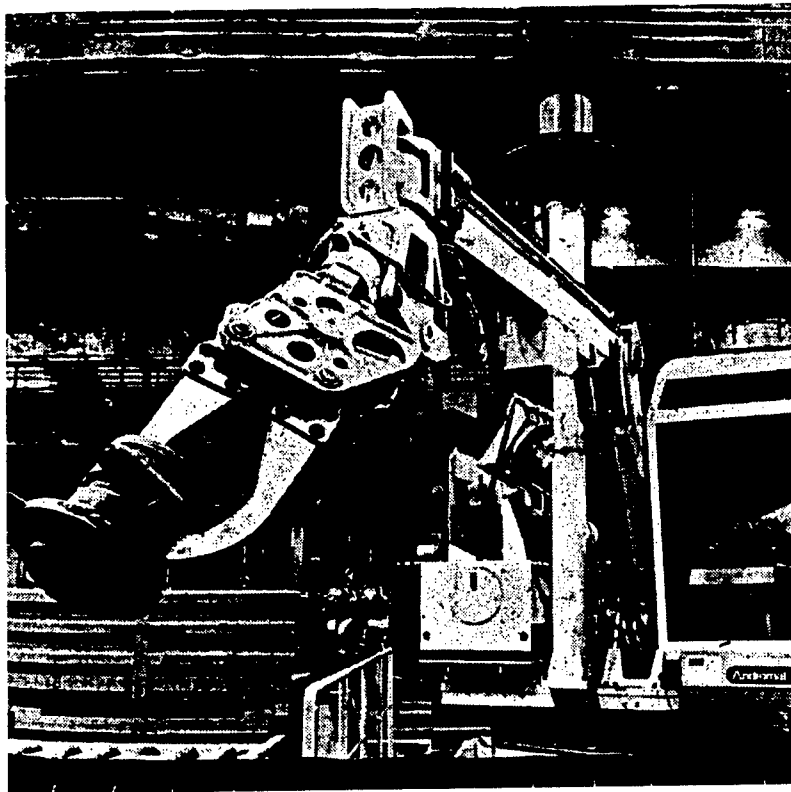
Abbreviation	Meaning
SIR	Industrial Robot Control
GFG	Gripper Guide Gear
TBE	Teach-in and Operator Keyboard
AGW	Automatic Gripper Change
MON	Monitor
ANT	Alphanumeric Keyboard
LG	Linear Gripper
DFG	Three-Finger Gripper
HMG	Holding Magnet Gripper
DAR	Digital Output Unit (Relay)
DAT	Digital Output Unit (Transistor)
DAO	Digital Output Unit (Optocoupler)
DEO	Digital Input Unit (Optocoupler)
AEE	Analog Input Unit
AAE	Analog Output Unit
MEA	Multiplex I/O Unit
ATS	Attachment for Serial Interface

Since a controller with many complex functions is required, an efficient real-time operating system utilizing the advantages of high-level computer languages has to be used. Therefore, the software design of the controller is based on the newly developed cassette-oriented

operating system IROS [Industrial Robot Operation System] which primarily uses the high-level language FORTH for programming. In addition to the advantages which are typical of other high-level languages as well, FORTH has several characteristics which make it particularly suitable for machine control.² In addition to very fast processing of completed programs/interpretation of compiled commands/ they include primarily the principle of open language syntax, which was included in the user language of the controller. The user language forms a system of language elements which serve as a basis for programming the individual applications. The instruction set is flexible and can be expanded according to user requirements.

The IROS operating system offers versatile interfacing with process peripherals and sensors; another major advantage is the fact that the user can easily generate technological macros by including them in the high-level language. Typical applications for a robot are, for instance, screw insertion motions or sensor-guided joining processes.

The user language ROPS [Robot Programming Language] which has been implemented is a structured language with 4 byte fixed-point numbers as a data structure. The drive position coordinates are used as equal data types. ROPS contains a number of generating



commands; they can be used to specify constant and variable operands and position coordinates, sensor processing functions and process peripheral interfaces as well as the type of integration into higher-level CAD-CAM-systems.

NTB 3605

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12831

Modernization at 'Raba' Machine-Building Plant in Hungary
36980225 Tselinograd FREUNDSCHAFT in German
18 Mar 88 p 3

[Text] Budapest—An increase in effectiveness and perfection of production is one of the main directions of the fulfillment of the national economic plans of Hungary. A

practically new molding shop (see photograph) is now in production at the "Raba" wagon and machine-building plant. After the reconstruction and modernization of facilities that was undertaken, progressive industrial technology is being successfully applied here. This is to the credit of the science center created in the machine-building giant of Gyor, which is promoting the more rapid introduction of the accomplishments of scientific-technical progress into production.

The products of the famous enterprise are in demand not only in Hungary. Among the enterprise's most important export articles for the fraternal countries are the completion set and running gears for means of transport. The Soviet partners are already traditional customers of the machine builders from Gyor.

12271

LASERS, SENSORS, OPTICS

Hungary: Magnetoresistive Microswitches
25020045c Budapest MAGYAR ELEKTRONIKA in Hungarian No 2, 1988 pp 26-30

[Article by Istvan Pinter: "Magnetoresistive Microswitches"]

[Excerpts] The article describes the operating principle, preparation and properties of a microswitch operating on the magnetoresistive (MR) principle which was developed at the Microelectronics Research Institute of the KFKI [Central Physics Research Institute].

Summary

In its characteristics the MR microswitch developed at the KFKI is competitive with the Hall microswitches of the most developed Western manufacture. On the basis of all these properties it is suitable for carrying out ignition control and other position sensing functions in the automobile industry and for use in polluted industrial environments where extreme temperatures, high moisture content, explosive gases, vapors and high mechanical demands (vibration, acceleration, etc.) occur.

Autobiographic Note

Istvan Pinter: I graduated in 1969 as a physicist from the Lajos Kossuth Science University in Debrecen. In 1970 I joined the magnetic bubble memory research starting at the KFKI and then performed domain physics studies on magnetic thin films. My chief areas of interest are magnetic based sensors, fast optical detectors, various sensors and thin film technology. I married in 1969 and have two children. In my free time I play badminton.

8984

Hungary: Metal-Glass Position Sensors

25020045b Budapest MAGYAR ELEKTRONIKA in Hungarian No 2, 1988 pp 21-25

[Article by Antal Lovas, Janos Szollosy and Gabor Vertesy: "Position Sensing Metal-Glass Sensors"]

[Excerpts] At the Central Physics Research Institute we have developed a magnetic position-sensing sensor in which a metal-glass ribbon is the sensing element. In the course of the development we kept in view primarily the needs of the automobile industry. The device is protected by patent.

Production of and Basic Properties of the Base Material for the Sensor

The base material of the position sensor, using the Barkhausen effect, is a metal-glass fiber made of $\text{Fe}_{80}\text{Si}_6\text{B}_{13}\text{C}_1$ which we produce by spraying a melt of suitable composition on the mantle of a quickly-turning copper disk; this cools there at high speed and flies off the disk as a result of centrifugal force. The cooling speed used is so great (a few million degrees Celsius per second) that the melt is incapable of crystallizing, so the structure of the melt is frozen in. Thus the product arising is a flexible ribbon without a crystalline structure. Its geometric dimensions are determined by the revolutions of the disk used and by the size and profile of the spray opening. Its thickness also depends on the rpm used and on the temperature of the melt. The basic physical characteristics of the metal-glass ribbon can be summarized as follows:

Saturation induction:	$B_s = 1.58 \text{ T}$
Permeability:	$\mu_0 = 473$ $\mu_{\max} = 23,800$
Coercive force:	$H_c = 0.115 \text{ A/cm}$
Curie temperature:	$T_c = 470^\circ \text{C}$
Crystallization temperature:	$T_x = 530^\circ \text{C}$
Saturation magnetostriction:	$\lambda_s = 36 \times 10^{-6}$
Ribbon width:	0.5 mm
Ribbon thickness:	25 μm

The ability to produce the larger Barkhausen signal needed for operation of the sensor depends to a large degree on the conditions of the fast cooling. These conditions also significantly affect the real structure of the otherwise X-ray amorphous samples (surface morphology, deviations from average cooling speed). In the interest of this we optimized the conditions of fast cooling in accordance with the given task. The circumferential speed of the disk used is 30-35 m/s.

The metal-glass ribbon becomes suitable for preparation of a Barkhausen sensor if it is suitably heat treated. We create a form memory in the metal-glass fiber by winding it to the given diameter, and by heat treatment in this state; this manifests itself when left to itself in the heat treated state, it remains at the diameter of the winding used during heat treatment.

Structure and Operation of the Sensor

We glue the heat treated metal-glass ribbon serving as the base material to a straight plastic strip and put it inside an air core solenoid. On the one hand the coil serves to detect the signal received; the pulses appear at its end points when rotating the magnetism. On the other hand, with the aid of the direct current released through it, we magnetically saturate the ribbon inside it (this is one of the stable magnetic states).

Opposite the coil containing the ribbon we place a permanent magnet which remagnetizes it—when its magnetic field reaches the metal-glass—in the opposite direction from that in which the current flowing through the coil magnetizes the metal-glass. At the location of the ribbon the field produced by the magnet is greater than the field produced by the current flowing through the coil, and this corresponds to the other stable magnetic state. The dimensions of the magnet are 8 mm x 3 mm x 2 mm; it is a rare earth metal cobalt permanent magnet magnetized longitudinally. The field created by it at the location of the ribbon is about 20 Oe. This safely surpasses the critical field needed to remagnetize the metal-glass.

A bell made of ignition-distributing soft iron, in which we have made gaps, turns in the air slot between the coil and the magnet. As it turns, when the iron part of the bell is in the sensor, it shunts the field of the permanent magnet. So at these times the field created by the current flowing in the coil tips the metal-glass ribbon into one of the stable states. When the cut-out of the bell reaches the

inside of the sensor the magnet has an effect on the metal-glass and tips it over into the other stable state. So the progress of the air gap induces a positive and negative direction pulse in the coil.

As the bell turns, an inductive signal is also produced in the coil, in addition to the fast pulse originating from the Barkhausen jump; the width and size of this depends on the rpm. In order to eliminate this interfering signal, we placed another coil around the sensing coil; a signal of the same size as that induced in the earlier coil is produced with a correct phase in this, but because of the smaller linkage the signal coming from the Barkhausen jump is much smaller than the signal produced in the inner coil. Subtracting the signals of the two coils from one another, only the fast signal change pulses remain.

The sensor is placed in a capsule made of aluminum; a front view of its outer form can be seen in Figure 1, while Figure 2 shows a side view cross section together with the bell inside of it. The figure shows the case where the iron part of the bell is between the magnet and the coil.

We fixed the coil and the magnet in the holes prepared for them with heat resistant synthetic resin filling.

A photograph of the device can be seen in Figure 3.

A Study of the Operation of the Sensor

When the bell turns, the sensor gives the signals which can be seen in Figure 4. The half-value width of the pulses is 20 microseconds; their form and rate of change do not depend on the rpm used in the range between 0.05 and 5 kHz. But the magnitude of the pulses does depend on the rpm. Under 10 Hz the amplitude is practically independent of rpm but above this it increases with the rpm, by almost 100 percent between 10 Hz and 5 kHz. In the low frequency range the magnitude of the pulses is between 100 and 130 mV.

The sensor is less sensitive to changes in the current flowing through the coil and position relative to the bell, as shown by Figure 5, where we have depicted the amplitude of the pulses as a function of the current flowing through the coil and the distance (x) measured from the edge of the bell, a definition of which can be read from Figure 2.

Thanks to the hermetically sealing, hard synthetic resin filling and the stable, massive aluminum housing the sensors are not at all sensitive to mechanical effects; they tolerate shock, and dirty, oily, gasoline or water environments do not harm them.

When mounting the sensor, the aluminum housing acts as a Faraday cage; that is, an electric field does not penetrate it, so parasite signals cannot be produced in the measurement coil by chance electric field pulses.

This is especially important when using it in an automobile since large electric field strengths can develop here which, lacking suitable protection, could interfere with the operation of the device.

The device is not shielded against magnetic fields. According to our measurements—presuming the most unfavorable field direction—only external magnetic fields exceeding a field strength of 700 A/m can cause interference with the operation of the sensor. If for any reason the sensor has to operate in an external magnetic field exceeding this value there could be magnetic shielding.

The sensor operates in a very broad temperature range. Cooling the device to minus 100 °C we found no change in its operation nor did we find any other damage. The upper limit of the operating temperature is plus 150 °C, but the device can also tolerate higher temperatures (180 °C) for a shorter time.

We also did fatigue tests according to which we found no observable change in the operation of the device after 3.5×10^9 switchings.

A Review of Further Development Possibilities for the Sensor

In our article we have described a position sensor, the operating parameters of which meet the demands made by modern microelectronics and the life span of which is expected to be great. A very noteworthy property of the sensor is the broad operating temperature range. Its wide use is aided by the fact that its production technology is very simple and cheap and only domestic primary materials are needed for its production. When developing the geometry of the device and determining its operating parameters the guide was the requirements of the auto industry, but the operating principle also makes possible development of position sensors for other purposes.

So we have described above a device which is entirely passive and consists of only two coils and one magnet. A current of a given magnitude must be put through it; in this case, when turning the bell, one can measure fast positive and negative pulses at the output. This device can be further developed and made pin compatible with commercial devices by building an active electronic circuit into the sensor housing which also processes the output pulses. In this way, pulses of suitable magnitude and form will appear at the output which are suitable for ignition control, for example. In this case the limits of the operating temperature will be determined by the semiconductor devices built in so we will lose the original parameters.

Autobiographic Notes

Janos Szollosy: I graduated from the Jeno Landler Communications Industry Technikum in 1964. I have worked at the KFKI [Central Physics Research Institute]

since 1969. In the beginning I did magnetic basic research measurements and then up to 1984 I worked in a target program for bubble memory research. At present I study the utility of equipment oriented circuits under especially harsh conditions at the Microelectronic Research Institute of the KFKI.

Gabor Vertesy: I finished my university studies in 1974 in the physics section of the Natural Sciences School of the Lorand Eotvos Science University. I have worked at the Central Physics Research Institute of the MTA since 1974. I earned my university doctorate in 1977; I studied Curie point processes in magnetic thin films. Later I participated in bubble memory research in the area of developing a measurement technology for magnetic garnet films. At present also I am studying the magnetic properties of garnets.

Antal Lovas: I finished my university studies in 1967 in the chemistry section of the Natural Sciences School of the Lorand Eotvos Science University. Since then I have worked at the Central Physics Research Institute of the MTA as a metals technologist. In the beginning I dealt with growing metal monocrystals and then with the preparation of thin alloys. Between 1972 and 1976 I participated in research on solid phase chemical reactions taking place in alloys and since 1977 I have participated in technological realization of fast cooling of melts. At present I deal with preparation for industrial use of metal-glasses and with the development of soft magnet devices which can be produced from metal-glasses.

Figure Captions

Figure 1, p 23. Front view of the position sensor.

Figure 2, p 23. Side cross section of the position sensor with the bell turning in it.

Figure 3, p 23. Photograph of the device.

Figure 4, p 23. Signals produced by the device (the vertical axis has a division of 50 mV and the horizontal axis has a division of 20 ms).

Figure 5, p 24. Dependence of the signals produced by the position sensor on the current flowing in the coils (parameterization according to position in the bell).

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GDR Scientists Present Work in Optoelectronic Sensors

23020012 East Berlin FEINGERAETETECHNIK in German No. 3 1988 pp 133-134

[Article by Dr Eng W. Schwarz]

[Text] On 1-4 September 1987 the Second Conference on Optoelectronic Sensor Systems was held as part of the Days of Science and Technology at Wismar Engineering

College. It was organized by the Electrical Engineering/Electronics Technology Section, especially by the Fundamentals of Electrical Engineering/Electronics Area. This area's research focuses on automated measuring and testing technology and specifically on the development and use of optoelectronic sensor systems for visual testing processes.

The program of presentations was divided into three theme groups:

- A. Imaging
- B. Signals processing
- C. Applications of optoelectronic sensor systems

The 59 contributions presented new results not only from basic research (theme groups A and B) but also from direct applications in production. These include some solutions of considerable technical and economic interest. The degree of interest in these subjects in industry and research institutions is demonstrated by the fact that 260 participants attended from the GDR and abroad. The theme groups were preceded by four plenary presentations of more general nature:

- Prof Dr W. Wilhelm, Dr Saedler (ADW [GDR Academy of Sciences], ZKI): Image Processing with High-Performance Systems;
- Prof Dr H. Fueller (Friedrich Schiller University, Jena): Image Processing in the Visual Systems of Animals and Humans;
- Dr Chr.-M. Westendorf (ADW/ZKI): Information Structures in Automatic Recognition;
- Prof Dr M. Roth (Ilmenau TH [Technical College]): Data Processing—The Driving Force of Knowledge, Scientific, and Social Integration.

1. Theme Group A: Imaging

The program in theme group A included 13 presentations ranging from infrared and 3D laser imaging to illumination requirements of optoelectronic sensor systems to special uses and extended applications. Problems of infrared imaging were the subject of talks by Herrmann (Humboldt University, Berlin) and Stock-/Sandring (Dresden TU [Technical University]). Imaging in 3D was discussed by Theska (Ilmenau TH) and Eigler et al. (Mittweida IH [Engineering College]). Also of interest were the presentations on extending the range of applications in border areas by:

- Hess (Humboldt University, Berlin): Extending the Application Range of CCD [Charge Coupled Device] Sensors by Operation at Very Low Temperatures;
- Schielicke (University Observatory, Jena): Optical Sensors for Weak Intensities;
- Baerwald (ADW/IfK Berlin): On the Use of CCD Line Cameras in Aerial Imaging;
- Lux et al. (VEB ZFT Dresden): The ICZ 2000 Intelligent CCD Line Sensor;

- Borowska (Szczecin Polytechnic, Poland): Investigation of Magnetic Garnet Films as Materials for Optoelectronic Devices;
- Hantke et al. (ASMW [Office for Standardization, Measurements, and Goods Testing], Berlin): Investigations into the Use of Optoelectronic Sensors.

These presentations demonstrated that the use of optoelectronic sensors will make it possible to perform many tasks that in the past were difficult to carry out by visual means.

2. Theme Group B: Rapid Signals Processing

The 18 presentations in this theme group dealt primarily with hardware problems in signals processing in image recognition systems. In tests requiring rapid decisions in determining the parameters of test objects, the need is to effectively and drastically reduce the flow of data from the optical sensor to the processing system. On the other hand, classic image processing functions such as image restoration, filtering, segmentation, noise cancellation (which require very complex algorithms) are less important in industrial applications of sensor systems. This came out in the presentations. For sensor systems in industrial processes, it is often sufficient to capture and process binary images and to determine corners or measurements or the position of relatively simple patterns. However, the trend toward gray scale value processing is also unmistakable. This, however, increases the need for signals processing capacity to meet real-time requirements. The following trends can be identified:

- the creation of modular hardware structures for preliminary data processing;
- parallel execution of time-critical procedures in the processing;
- higher processing widths;
- higher clock frequencies.

The goal of all this is to so increase the quantity of data in the signal area that the object is adequately represented.

3. Theme Group C: Applications

There were 28 presentations in this theme group. It was clear from the number of attendees from industry and from the participants in this theme group how great the need for sensor-aided automation techniques is. The range of topics was extremely broad and ranged from optoelectronic sensors based on punctiform photoreceiver configurations to fiber optic sensors and CCD line and matrix devices in industry, to applications in medicine. Of particular interest were the presentations on sensor systems already in use in firms and combines.

Current problems in surface testing using visual sensor systems was discussed by Schmidt (Wismar IH).

Franke (Ilmenau TH) made some observations on a system used in production for inspecting round bottles. This system employs three CCD line cameras to perform various tasks within the overall system. A good picture of the problems involved in operational applications was provided by Kiessling (VEB Werk fuer Technisches Glas, Ilmenau) in his presentation "Operational Experiences with Optoelectronic Measuring and Testing Sensor Systems." He discussed the measurement of wall thickness for transparent media and a sensor system for determining the mass of drops. Grumpelt (VEB FER Magdeburg) presented the UOS 01 sensor system by discussing applications already in use.

Mueller (Wismar IH/VEB Landmaschinenbau Guestrów) presented an installation already in operational use, along with the environment in which it is employed. The same method was used by Jawinski (Wismar IH/VEB Kombinat Schnittholz) in discussing a device for the wood industry. Both depend on line-oriented processing in the camera cycle.

From successful applications it was clear that a sensor system cannot simply be installed in an existing layout but that the sensor's entire environment must be considered and included in a total solution.

These and other contributions proved that optoelectronic sensor systems are now being installed for the first time for routine use in technical and industrial operations and that wider applications can be expected in the near future. A clear view was provided of the perspectives opened up for the economy by this new sensor technology, which has been made possible by the development of microelectronics and optoelectronics, even though the technology is still just in its infancy. Somewhat further along are developments in laboratory measuring technology. The greater part of these presentations involved sensor ideas in the laboratory stage or measurements under laboratory conditions. R. Christoph (Friedrich Schiller University, Jena) presented a hardware device to increase resolution in length measurement systems with CCD line. This uses amplitude information to ascertain corner locations even between two image points. This results in a considerable increase in resolution compared to pure binary-image length measurement. M. Stieber (ADW, Central Institute for Electron Physics) used optoelectronic structural members to illustrate the use of CCD line cameras in laboratory measuring technology. Several uses for light-emitting structural members were presented. J. Redenz (Wismar IH) presented a programmable power source and path measurement with CCD line for use in oscillation analysis technology and for the study of mechanical and dynamic reliability.

Held in Wismar at the same time as the optoelectronic sensor system conference was the second international conference on "Computer Analysis of Images and Pattern" (CAIP'87). Arrangements were made with the organizer, the WGMA [Society for Measurement and

Automation Technology], so that CAIP participants could also attend presentations at the optoelectronic sensor conference, while the CAIP "Applications" group was open to all optoelectronic sensor system conference participants.

The extracurricular program was the same for both conferences and included a round-table discussion entitled "Artificial Intelligence" (led by Prof Dr Kempe, ADW/ZKI), reception for speakers, boat trip, visit to the shipyards, and concert.

Summaries of most presentations at the optoelectronic sensor system conference were printed in Wismar Engineering College's WISSENSCHAFTLICHE BEITRAEGE (number 3/87 and special number 3/87, parts I and II). A few copies are still available through the college library.

The third conference with this title is planned for September 1990.

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MICROELECTRONICS

Hungary: Economist Calls for Legalized Western Computer Trade

25020041 Budapest

COMPUTERWORLD/SZAMITASTECHNIKA in
Hungarian No 4, 24 Feb 88 p 9

[Interview with Margit Racz by Laszlo Lonyai: "Time Is Dearest For Us Now!"]

[Text] At a number of events recently I have heard Margit Racz, a chief scientific worker at the World Economic Research Institute of the MTA [Hungarian Academy of Sciences], and she has always been a success. At least with the audience, because the representatives of various chief authorities were not always happy about her frank opinions. It is a fact that when she talks about her research—on the status and possibilities of the domestic use of electronics—no one can remain indifferent.

The domestic status of electronics is slowly becoming similar to Hungarian soccer—almost everyone is up on it, many make a living at it, many argue much about it, and still we fall farther behind. The fact is rather well known, so what is there to do research on? Our interview began with this rather provocative question.

Margit Racs: Electronics here is not developing on the basis of a central program. If we are to know what effects are operative, what carries forward and what holds back the cause, what freedom of movement we have and what we must do to reduce our backwardness, or at least keep it from growing, this all requires basic research work.

COMPUTERWORLD/SZAMITASTECHNIKA: I do not entirely understand. We have a government program for electronics which is still valid today, according to my best information.

Margit Racs: Of course, but electronics, and technical progress in general, doesn't give a rap for government programs! And in addition the various interest groups here interpret central decisions according to their own taste. The furor surrounding last year's PPC [professional personal computer] competition is a good example of this. The OMFB [National Technical Development Committee] wanted it and got an import allotment for it; other groups did not like this, and they almost torpedoed the whole thing. But wherever we look there is a clash of interests and counter-interests. So there is a need for an independent organization, one which does not belong to any interest group, which can do its studies objectively, with scientific methods. Only in this way can we hope to recognize the real trends. In this way we can help them make effective decisions. It is true, only if they take our research results into consideration.

COMPUTERWORLD/SZAMITASTECHNIKA: What you say sounds very logical, only we are a following country. Everything that happens here is something which has happened already for those preceding us. Let us think only of environmental pollution, the traffic or housing problems, and I could go on. In a word, it is enough for us to take out the results of research in West Europe a few years ago and we will find what the Hungarian future looks like.

Margit Racs: It would be good if that were true! Not because we could get results without work but rather because we might trust in Hungarian electronics catching up. Unfortunately the reality is quite different. We must recognize that ours is a backward region, which is set up to copy others, which is increasingly difficult.

COMPUTERWORLD/SZAMITASTECHNIKA: This is not too reassuring, but luckily there is a contrary example. Taiwan or South Korea were no farther along a few years ago than we now. Quite the contrary! Still, they followed the leading United States well and have already outdistanced it in the manufacture of professional PC's. There have been similarly successful adaptations in a number of southeast Asian countries. So why should we not succeed?

Margit Racs: Because there are a few important differences. First in regard to capital strength. The Asian countries did not achieve their successes entirely on their own. Foreign operating capital helped the development with gigantic investments. Together with this they got developed management, marketing and a powerful export orientation. They exploited the advantages offered by a cheap and very disciplined labor force and by a high ratio of state support and created an industry manufacturing parts and integrated circuits. This was followed by assembly, first in shacks, and then in ever

larger plants and factories. Naturally a concentration took place too. Only a few "big ones" make the main units, for example motherboards. More make the interface cards, and there are virtually innumerable small "firms", often based on a single family, which only plug the cards together and thus manufacture finished products. It is very important that production was always export oriented and it was forced to progress together with the world level.

COMPUTERWORLD/SZAMITASTECHNIKA: Forgive me for interrupting, but a good part of this can be said about us too. So what is the crucial difference?

Margit Racs: That such things do not exist here, it only appears that they do. Let us take export orientation as an example. If we look only at the numbers all is in order, a respectable part of production finds customers abroad. But the Taiwanese export to the United States and West Europe while we export to the Soviet Union and the other CEMA countries. Should I now begin to explain what the gigantic difference is? User demand has a fundamental influence on development. There is no competition on our export markets, so nothing forces the manufacturers—primarily large, state enterprises—to develop.

But this is not all. We have no capital, and foreign capital is not rushing to come in—in part because of our outmoded regulations and excessive bureaucracy. Powerful state support is lacking, primarily in deeds. Last but not least the embargo is also an inhibiting factor; let us not forget, they make the developments in the United States and Japan, skim off the extra profit and then hand the mass manufacture to the Asians. With whom could we have such a division of labor?

COMPUTERWORLD/SZAMITASTECHNIKA: I am convinced. We really cannot use a recipe proven elsewhere, because the conditions are different. But what sort of conditions do we have?

Margit Racs: Interesting and unique ones. We also began with a shack period, but the manufacture of professional PC's did not continue with the factory industry. Modern technology here—not only in the PC category—is represented by the small cooperatives and research institutes. It appears that large industry, reared on the socialist market and made comfortable by it, cannot take the competition. Videoton, the largest domestic manufacturer, got into PPC manufacture only with powerful state encouragement; and for us such manufacture practically consists of renaming the product. But there is real manufacture and development at some of the small cooperatives and research institutes—a unique Hungarian peculiarity.

COMPUTERWORLD/SZAMITASTECHNIKA: And is all this good for us?

Margit Racs: Although the question is a short one there can be only a long answer to it, and let me add it will not be unambiguous. It is good that these organizations are very flexible and mobile. They have well trained engineers, also well paid in the small cooperatives; so they are capable of fast copying—if they get the parts. And this is the weak point in our model. Domestic manufacture is based almost exclusively on Western parts, and cannot be built on anything else. Computers today can be put together out of parts which can be obtained in commercial trade. But in their new developments there are more and more special circuits which cannot be copied and which do not get into commercial trade for the time being. We get them by various maneuvers or the problem can be gotten around by a clever idea, but this is not a real solution. If we want to remain in competition with the West—and no other goal can be considered—then we must soon switch from hammering away in shacks to large series, technologized manufacture. Which presumes that the necessary parts will always be available in suitable, even quality.

COMPUTERWORLD/SZAMITASTECHNIKA: How would you do it, you, the researcher?

Margit Racs: Really, that's a hard question! If I listened to my heart I would say, take up the gauntlet and let us manufacture, cost what it may. But money by itself is not enough. Nor is the embargo the biggest problem, for in today's world you can get anything, at most it costs more. We ourselves are the risky factor! We can get into the competition only if we can invest and manage in a way radically different from the present practice.

COMPUTERWORLD/SZAMITASTECHNIKA: Might you say what you are thinking of?

Margit Racs: Development is terribly fast in semiconductor manufacture. The life span of a technology is at most 4-5 years. During this time not only does the product become obsolete, the producing equipment does too. A new technology is needed for a new part, and the old can be thrown out. And we are not talking about two cents here, the costs can be measured in billions. The question is, can we invest so quickly that the factory will not only produce its own price during its short life but also provide capital for a new one. This is impossible in advance with the present withdrawal practices. And who can decide what is worth manufacturing in a plant which might be built? Since this is a small country we might manufacture at most one or two types of circuit; we would not have the strength for more. And the real profit comes not from semiconductor export but rather if we sell them assembled into a computer.

COMPUTERWORLD/SZAMITASTECHNIKA: And couldn't this be a problem? A good many organizations are manufacturing computers, allegedly quite good ones.

Margit Racs: A computer is good if it can be sold in the West. And there are a number of obstacles to this today. The most important—the others are dwarfed by comparison—is that a good part of the western contacts of our enterprises are illegal. This is not only our fault, it is not even primarily our fault; the embargo has forced it on the Hungarian enterprises. But it must be seen that one cannot legally export a computer put together out of illegal parts.

COMPUTERWORLD/SZAMITASTECHNIKA: So the circle has closed? We can do nothing else, we have to wait until the embargo eases?

Margit Racs: God forbid! We can do anything but we cannot wait! Time is dearest for us now! But we must see that this cannot be solved by a state organ, be it some sort of coordination committee, program office or even the OMFB. They must watch the interests of too many lobbies, and they have no direct risk, so they can decide well at most by chance. Western contacts must be referred to the enterprise level, and they must be given decision authority and responsibility too. They will then find the gaps into which they can move, develop the forms of cooperation which will be legal, and make export possible. And in the meantime they will learn what sort of semiconductors it is worth manufacturing, for which they can get in exchange the other necessary parts.

But if something is to come of it all the regulations must be changed, there must be an end to the present foreign exchange and foreign trade authorization monopoly. I believe that we can agree that proper decisions must be made as soon as possible—and not only where Hungarian electronics is concerned!

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SCIENCE & TECHNOLOGY POLICY

Hungary: Cut in Research Funds Shocks Scientists

Deterioration Since 1987

25020044 Budapest DELTA IMPULZUS in Hungarian
No 4, 27 Feb 88 pp 14-15

[Article by A. V.: "Stormed-Tossed But Not Sinking; Annual Conference at the Academy"]

[Text] There was a full house at the orientation conference held for the leaders of the Academy research institutes. The comments following the introduction by First Secretary Istvan Lang expressed all views existing today.

The situation is worse than it appeared last year at this time. The strict measures aimed at stabilizing the quickly deteriorating economic and moral situation sensitively affected the Academy as well, the first secretary said in

his introduction. But perhaps the budgetary curtailments do not represent the real problem but rather the degradation process lasting about 10 years as a result of which the acquisition of new scientific information has been gradually devalued in social and political judgment.

The total budgetary support of the Academy comes to 1.8 billion forints, which was decreased in the past 2 years by a total of 8 percent. Since there are expenditures which cannot be economized upon, this meant an average 15 percent curtailment at the institutes, which had to be implemented in a differentiated way—10 to 30 percent in the natural science areas and 11-27 percent in the social science areas. Without the effect of the general turnover tax the investment allotment received from the budget is 350 million forints, 80-100 million forints less than expected. From this we plan reconstruction of the nuclear reactor, building construction, instrument acquisition and development of the data processing infrastructure. The value of the instrument inventory is falling further in an unfortunate way. The budgetary curtailment this year and last totals 160 million forints.

The OTKA [National Scientific Research Fund] has gotten into a relatively favorable position. Only 7 percent is missing from the 2 billion forints prescribed for 1986, 1987 and 1988. This is not a base curtailment so in principle there is hope that in the next 2 years the OTKA will also get the missing sums. Naturally the OTKA also is losing value due to inflation. Investments are decreasing alarmingly. The actual investment between 1971 and 1975 at current prices was 2.5 billion forints; it was 3.4 billion between 1976 and 1980; and it was 2.9 billion between 1981 and 1985. In the first 3 years of the current 5-year plan the budgetary support was 1.1 billion forints. The basic problem is not the 160 million forints of budgetary support withdrawn in the past 2 years but rather the degradation process which has affected scientific research for a long time.

University research work may be in an even worse situation. Where there is no possibility for supplementary income they must look to personnel, although an obligatory reduction in force is not prescribed. A reduction in expenditures is ordered and often this can be realized only by reducing personnel expenditures. It would be very good to exploit this difficult situation by getting the institutes to free themselves of the clearly unproductive stratum. A qualitative selection is becoming necessary. Since the budgetary restrictions affect the university sphere as well the possibility for cadre movement is very limited. Under all circumstances the personnel doing basic scientific production, the researchers, engineers, technical assistants and administrative workers and those creating lasting value, must be preserved.

A scientific community or a scientific workshop producing something truly lasting is not like a big family with many members, some less clever or less diligent than others. Yet the cohesive force of the large family protects even these rather stupid, rather lazy family members,

guards and cares for them. It was never thus in true scientific workshops; rather they kept the interests of science in view. Naturally every employee has legal rights, and great care must be taken to realize these. But this should never be confused with the internal developmental tradition of scientific communities. In the course of the year we can expect measures which may affect the areas of higher education, research and technical development to some degree. The most varied reports have been spread and the well informed speak of new research guidance organizations with the most varied profiles.

There really are different opinions and ideas, but the supreme leadership has not yet committed itself to any variant. Certainly there will be a decision this year. We say that before a decision a hearing should be given to those most interested, to the opinion of the scientists leading and creating the scientific schools, those determining the achievement of research results. The opinion of leaders working in the apparatus is very important too—and I include here my own position—but it would be good if in the deliberations the leadership relied mainly on the opinion of personalities working in the creative scientific workshops. We hope that this will be so. Ultimately scientific accomplishments are born only in the scientific workshops, and this includes individual scientific accomplishment, the first secretary continued.

In the opinion of the presidium of the MTA [Hungarian Academy of Sciences] the organizational system must be modernized so that the Academy should remain the nationally responsible guide of scientific research, primarily basic research.

Within a short time we must think through what structural and organizational changes might be justified in the Academy research network. Should there be institutes operating in an enterprise management system or should every institute remain in the budgetary system with differentiation on the basis of interest in what remains or interest in what is produced? It is possible that it might be useful to combine institutes, or move them in the direction of association within the Academy. We must answer these and similar questions this year—as soon as possible. Today there is greater willingness for open relations with universities than a year ago. There is also greater openness among university leaders and leaders of the interested faculties, a greater desire than earlier for cooperation based on mutual interests. We can hear about the results at the May general assembly. We must seek new forms for cooperation. Probably associations will be most suitable. A total of 46 academicians work in leading positions in the four science universities and the Economics Science University, 14 in the medical universities, 8 in the agricultural universities and 14 in the technical universities. A significant number of the retired academicians undertaking work are tied to the universities as well.

The new banks offer a possibility for supplementary sources; they undertake to support research aiding technical development. One of the pillars of research work

being done in the Academy is the analysis, evaluation and sometimes measurement of results; questioning them, publicizing them and showing their socio-economic effects and aftershocks. Science can expect a better political judgment and more material support only if the results and achievements are evaluated realistically and if the selection starts on the basis of this evaluation. The Academy would like to be an example in doing this, because today it is not at all characteristic in the area of research and development that expenditures are accounted for by having the magnitude of the expenditure and the quality of the accomplishment be clear before broader professional circles. The Academy would like to urge at every forum that a measure of the effectiveness of research become general in other areas as well.

Views of Institute Heads

The following should be noted from among the comments following the report. **Denes Berenyi (ATOMKI [Nuclear Research Institute], Debrecen):** The science erosion process is about 10 years old and yet the dramatic situation of fall was necessary for us to see it with new eyes. We, for example, stopped publication of institute communiques and stopped having a night door-keeper. I suggest that we look at a number of things with new eyes. For example the interpretation of the right of agreement, the necessity of route reports for foreign trips and the possibility for simplifying travel given by the new passport. It would be useful to resolve the bureaucratic character of the National Scholarship Council. The Academy "Acta" was started 30-40 years ago. Today the situation is entirely different; it is impossible not to deal with this question. **Tamas Szekely (Natural Science Research Laboratories):** The Academy also should be part of the social changes. Finding the actual connection between basic research and practice might contribute much to this. I recommend that the Academy organize a conference on this question. **Istvan Kovacs (Legal Science Institute):** I am certain that despite every difficulty the Hungarian Academy of Sciences will survive; indeed, if we approach the problems well our prestige may even improve. Now would be the time to have a science law which might define the position of the Academy and of scientific research. From the viewpoint of autonomy the regional committees of the MTA are very significant. The general assembly should touch on the real problems of society and take part in modifying the constitution. **T. Ivan Berend, president of the MTA:** We stand before a dual task. On the one hand we must defend with all our possibilities the conditions for scientific research, especially in the really good workshops. The positions of the Academy are not bad, it has a century-old background behind it and the achievements thus far (material and moral) represent a pledge for the future as national property. At the same time we must debate with those who emphasize the constant loss of status of the Academy. The 1985 general assembly, at which we rang the alarm bell, can be counted as a gain for the MTA. The creation of the OTKA and better material recognition for

scientific degrees count as additional small breakthroughs. Of course, all this is only the beginning of a process. Tamas Sarkozy prepared proposals for the transformation of governmental work and one could draw alarming conclusions from this regarding science leadership. Since then a new proposal has appeared from the pen of the same author—the debates were not in vain.

We got a promise that the fate of the Academy would not be decided without us. An anti-science mood can be felt from the opposition between the universities and research institutes, which is fed by the fact that the basic research press is very bad. Neither public opinion nor those making decisions know the achievements. I call upon the leaders of the institutes to see to this managerial task. If all this is to succeed there is need for a vigorous internal renewal. The managerial and the entrepreneurial spirit must be strengthened in the institutes. We must face up to the 40 year-old obsolescence of the institutional system. A new attitude and approach could produce new research sites. The worst thing would be to do the same thing under worse conditions. This would give the impression that we are incapable of renewal. The link with the universities is absolutely necessary, the committee network must be transformed in the spirit of the age, and a renewal of the qualifications system could be built on this. But unity is indispensable for survival with integrity. **Gyorgy Varallyay (Soil Study and Agrochemical Research Institute):** It would be good to live through this critical period without irreversible damage. Support for science filters through very many fine tubes which require much maintenance, and the danger of getting plugged up is greater than if a thicker pipe were the source. **Dezso Kiss (KFKI [Central Physics Research Institute]):** There is no need for a reorganization requiring structural change. But without money there is no research. If there are long-range prospects then a man can tighten his belt temporarily. Experimental basic research is in a pitiful state. It would be good if basic research were to regain its old rank. **Szilveszter Vizi (KOKI [Experimental Medical Research Institute]):** The restriction on basic research is an error which will become obvious in 10-15 years. The degree of freedom needed for research does not exist now, it is only possible to maneuver for survival. Judging employment abroad is a contradictory question. Those who stay there represent a great loss. And the reduction in force at our institute will be nearly 30 percent anyway. **Sandor Bokonyi (Archeological Institute):** If the man-in-the-street is anti-science, something can be done about it, but if this happens at the official level, then it is a dangerous trend. We can kick the ball in basic research in certain areas, because the results pay off much more quickly. It shows the importance of the OTKA, for example, that archeological sites can be excavated only with OTKA money. The museums also must be brought into the cooperation along with the universities and institutes.

At the end of the conference **Istvan Lang** responded to what had been said: Our economy is in a very difficult position, our goal is reduction of the debt. Originally

they wanted to reduce the Academy budget by 10 percent, and since we did not accept this, it became 4 percent. Under the present circumstances it was not useful to take this before parliament, because they would have voted it down. I would like to dispute the judgment concerning the place of basic research. Basic research must dominate in the activity of the Academy, but there is also need for applied research. The proportions must be established as occasion demands. For example, the national economy profit which can be hypothesized for the Academy development work in regard to the new Martonvasar wheat strains and modernization of the safety system at the Paks Nuclear Power Plant—1.1 billion forints—approximates the budgetary support given to Academy research institutes.

Research is a forint well spent, a truly good investment. There are not really many researchers in Hungary, compared to international data. The 3 percent which can be spent on R&D is enough, but the proportion which can be turned to research must be established therein. There is need for a new style in Academy leadership, I can only approve of the measures taken at ATOMKI. I also very much agree with Istvan Kovacs that there should be a law about science. Let us begin to work out a draft. About the relationship between performance and practice I would like to say the following.

It is a 25-year-old practice for us to plan science, evaluating it only subsequently and superficially. We must reverse this process; evaluate first, and then plan. Public opinion judges science to be bad; a new strategy is needed to change this. It would be useful to form a great coalition between the Academy, the universities and the museums. I will take the initiative in reviewing the operation of the National Scholarship Council in order to simplify it. We also have ideas for changes in connection with the OTKA. It would be useful to standardize the competition system and the record keeping; competitions could be held every 2 years for a 4-year period.

On coming here I met with Gyorgy Rozsa, director-in-chief of our library, whose characterization of the present situation of our Academy I found very telling: "It is storm-tossed, but it is not sinking." This is my opinion as well.

Vamos Views on Money and Science

25020044 Budapest NEPSZABADSAG in Hungarian
16 Mar 88 p 5

[Interview with Academician Tibor Vamos by Szilvia Hamor: "We Must Be Open in Every Direction; a Meditation on Money and Science"]

[Text] The end of the millenium is within arms' reach. What will our place in the world be in the third millenium? This is judged differently by an everyday man than by a scientist who creates the knowledge from which the future is built. Perhaps this is also why he reacts more sensitively to the possibilities, limits and

contradictions of the present. How does he see our present from the viewpoint of the future? We talked about this with Academician Tibor Vamos, chairman of the institutional council of the MTA SZTAKI [Computer Technology and Automation Research Institute of the Hungarian Academy of Sciences].

Disturbing Signs

NEPSZABADSAG: "An optimist creates," this is how you characterized yourself in an interview. The title of your most recent article, "There is Still a Chance," supports this too. But now it appears that you are dejected. Why? **Tibor Vamos:** First let us be precise. The title I gave to that article was "There is Still a Chance (Too)." And time urges us on, because the chance dwindles day by day. And I feel that science, which should have a very great role in catching up, is sailing against the wind in just this critical period. Not only do I feel this, so does a large part of the Hungarian creative intelligentsia. The reason for being disturbed is that we are the first to feel the backwardness, we see clearly the trends and what effect the present measures will have within a few years.

NEPSZABADSAG: When you mention measures you are thinking of the reduction in the budget for research institutes? **Tibor Vamos:** That too, but I also consider it alarming that the freedom of movement for enterprises and their interest in innovation have not increased. Naturally all this has a bad effect on what they turn to technical development. And this means that the institutes (and the universities), which today get the overwhelming part of their operational budgets from contracts with enterprises, have gotten into an ever more difficult situation.

You know, there must exist simultaneously a number of views and interests in a society. There are social policy questions whose answer determine the future of generations. The viewpoints of technical development can embrace a horizon of 10-15 years; the horizon of economic interest is 5-10 years for us. And finally the shortest range view is the financial one. Whether something is short-range or not is not a value judgment in itself. For if an economy becomes insolvent then its prospects worked out for 20 years are in vain. But every viewpoint and interest must be present, must be realized in a society. At the same time, we, the technical people, feel that today the financial view dominates exclusively and alone.

A number of decisions have been made which can be justified only by fiscal considerations, and they have postponed those decisions which would realize the viewpoint of technical development. In this situation, when there are numerous objective reasons for anxiety, then—in my opinion—it is superfluous and harmful to upset the scientific world with ideas concerning the organizational and financing systems for science which are thrown out without being thought through.

NEPSZABADSAG: So you think that the present organizational system for research and development—which consists of the basic research institutes of the MTA and other chief authorities, of the universities, of the industrial-agricultural-technical development enterprises and of the technical development divisions of the enterprises—is suitable for us to keep up with the accelerated technical progress? **Tibor Vamos:** There is no optimal system. I would like to emphasize this. Even in countries much more developed than we they constantly agonize over what organizational system to use for doing technical development well and effectively. Arguments are always clashing and the scientific structure is constantly formed as a result of external constraints. As a result there develops a relatively flexible system which forms a basis for giving the green light to the best solutions possible under the given circumstances, for selecting the most suitable people.

NEPSZABADSAG: So at present we have the organizational conditions which make it possible for those worthy of it to stay on top in the midst of arguments and counter-arguments? **Tibor Vamos:** I see no better solution at this moment than the present divided, multi-channel system operating with checks on one another. In this area, much more than elsewhere, a readiness for flexible reaction and self-development must be the basic principle for selection. So I consider dangerous those ideas which aim to simplify this multiplicity. I do not doubt that there is a need to improve work, but this cannot be done by crude, outside intervention unacquainted with the content. A theme or a research area is born and dies not in a voluntarist way with authoritative decisions. In the final analysis the present situation makes possible the realization of various views. The interests of the Academy, of the National Technical Development Committee, of the ministries, banks and enterprises are all different. They have different perspectives, motivations and goals. This chain should not be truncated by cutting out this or that link.

Roulette and Research

NEPSZABADSAG: There has been talk of creating a ministry to deal with the affairs of science. According to many this would be the best solution so that the sums which can be turned to research and development should not be frittered away and should better serve long-term goals. How do you see this? **Tibor Vamos:** Activity to aid and support science and link it to social goals is a much more sensitive task than could be guided by the procedures customary in state administration. Research and development cannot be evaluated with simplified authoritative characteristics. If there is an area where centralization and bureaucratic guidance are dysfunctional then that area is research. And the idea that money is being frittered away.... However surprising it may sound this is the purpose of money in this area, within certain limits. In roulette you can bet on one number or

several, on odd or even. The smarter player is the one who tries to play several possibilities. To a certain extent research is such a roulette game.

NEPSZABADSAG: We have postponed decisions for years, saying that this psychological moment was not suitable for changing the status quo. You also have sharply condemned this behavior more than once. **Tibor Vamos:** If there is a real alternative to the situation which has developed that is different, then one must decide. But I do not yet see any functional alternatives here and I am afraid that "organizing moves" guided by selfish power ambitions will draw attention away from the essence, from research and technical development. And it is a condition for our link to the world that we be sufficiently prepared intellectually to accept the newest achievements. The role of this is more important today than ever before. Only cooperation with others will make our survival possible, and for this we must offer something to the other party. If we are incapable of this the rest of the world will lose interest in us and slowly but surely we will be isolated. Multilateral contacts require not only products and services which satisfy the needs of others, and a unique Hungarian culture is not enough. We must also contribute to the development of science, create scientific and technical values which can be exchanged. This is the entry ticket for cooperation; this is the pledge for survival.

Our Link to the World

NEPSZABADSAG: And the optimist still creates and even now, when according to reports our backwardness in relation to the developed industrial countries constantly increases more and more, you talk about our linking into the blood circulation of the world. What can we give the world, to Europe, in this hoped for integration? **Tibor Vamos:** Our stability, in the good sense of the word. About now Europe is beginning to stand on its own feet. A more independent and more united Europe is developing and it will demonstrate unique regional values. Both Europe and the balance of the world need this. And we will have a chance for development only if we can become a part of this Europe. We have certainly taken the first steps; we have begun to make our economy correspond to the European requirements. For better or worse we have introduced a European tax system, we are trying to make our products meet international standards. We have a good number of industrial articles there, if not in the front rank then at least in the middle field. Many say that there is a lot of capitalist technology, capitalist parts in these products. That is true, and this is part of integration.

NEPSZABADSAG: In-so-far as you are not talking about the slavish adoption of a 10-year-old manufacturing culture. For you yourself said in a speech that in many cases, in regard to the technologies received for jobwork, even the necessary upgrade has not been done. And you also said that as an average the equipment of our research and development network is a good 10 years

behind the international level. That was 3 years ago, and I fear that the situation in this area has not improved. **Tibor Vamos:** We are dancing on the edge of a knife. But we still have a chance to develop our own profile, of being, as a small country, a part of a larger whole. As I see it we might play the role of artisan to the international cooperation. To illustrate what I mean, if a large computer factory brings out a new machine then we must be ready to be the first to deliver software for it. Of course, the competition is gigantic and every day we will have to find those areas which will choose the values created by us.

NEPSZABADSAG: And all this requires that we also be clear about what is a value in the world. **Tibor Vamos:** We must be open in every direction. And we should open up people's brains too. We must be open to the values of others, including customs and views different from ours. If in the reform epoch of the last century the condition for survival of the nation was development of the Hungarian language and culture, then today mastering the culture and science of the world has become the indispensable condition for survival. We must become capable of adopting the culture and experiences of others, of respecting the ideas and intellectual works of others. Only in this way can we hope to recognize the needs of the outside world and meet the demands made of us.

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Development of Polish Telecommunications Through 1990 Profiled

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[Article by Andrzej Zielinski, director, Central Research and Development Program No 8.5: "Main Directions of Science and Technology Progress in the Domain of Telecommunications Under the Plan for Implementing CPBR [Central Research and Development Program] No 8.5 During the 1986-1990 Period"]

[Text] A basic condition for restructuring and modernizing the national economy is the spread of electronics. This is reflected in Resolution No 77/83 of 27 June 1983 of the Council of Ministers Concerning the Electronicization of the National Economy Through 1990, in the Decision No 57/84 of 5 November 1984 of the Government Presidium to assure the implementation of the above resolution, and in other documents relating to programming the development of the national economy and of international economic cooperation within CEMA for the period until the year 2000.

The basic directions of the spread of electronics throughout the national economy include telecommunications. The needed acceleration of growth of telecommunications until and after the year 2000 can be achieved owing to science and technology progress, i.e., owing to the:

- new production and operation of modern equipment and systems;
- introduction of new kinds of services;
- application of new technologies in industry and communications;
- application of new techniques for the maintenance of equipment and networks.

In addition, a longrange goal in developing telecommunications is the technical and subsequently service-oriented integration of the telecommunications network. A way of achieving this is the intensive introduction of digital equipment and systems into networks as of 1990. In this connection, it is necessary to create a basis for the accelerated quantitative and qualitative expansion of the telecommunications services provided by the ministry of communications, to be insofar as possible based on digital telecommunications systems.

Special priority should be given to the telephone system, it being the most common form of telecommunications services throughout the world and in Poland. In Poland this system is technically obsolete and quantitatively backward. This is reflected in telephone density, i.e., the number of telephones per 100 capita in this country — which is accepted worldwide as the indicator of the quantitative development of telecommunications. In Poland in 1982 this indicator amounted to 10.02 telephones per 100 capita, compared with the worldwide indicator of 12.7 telephones per 100 capita and, in, say, Sweden, 86.4 telephones per 100 capita or in Czechoslovakia, 20.4 per 100 capita. In this respect Poland is ranked close to the bottom in Europe.

Other domains of telecommunications in Poland, too, are backward quantitatively and qualitatively, e.g., radar, data transmission, etc.

The digitalization of telecommunications systems in Poland is chiefly linked to:

- development of time-dependent commutation systems;
- development of digital transmission systems;
- development of fiber-optics and radio systems;
- development of computerized information services;
- technical integration of telecommunications systems;
- use of up-to-date control and measuring devices and systems assuring the automation of the control, guidance, and operation of the telecommunications network;
- broad introduction of electronic integrated circuits with a high degree of integration and microprocessors into telecommunications;
- automation and roboticization of the manufacture of telecommunications equipment.

The broad introduction into telecommunications of new technologies based on recent achievements of microelectronics should assure:

- augmenting the multiplexing of teletransmission systems and the capacity of switching equipment;

- greater flexibility of systems and equipment owing to the possibility of altering their operating programs;
- introduction of new kinds of services;
- augmenting the durability and reliability of equipment;
- reducing the energy-intensiveness of technological equipment and processes;
- miniaturization of equipment and hence also reduction in the surface area of the premises housing telecommunications equipment;
- reducing demand for scarce materials such as steel, copper, lead, cement, etc.;
- reducing the numbers of the personnel needed to staff operations, construction, and industry.

Research Programs

The principal research, development, and application tasks in the domain of telecommunications for the 1986-1990 period are comprised within:

- Central Research and Development Program No 8.5, in the Chapter on Telecommunications;
- Nine government orders relating to the development of science and technology;
- 12 ministerial R&D programs;
- Central Basic Research Program No 02.16, in the Chapter on the Development of Data Transmission Technologies.

Central Research and Development Program No 8.5, which represents the core of research problems in telecommunications, handled mainly by the Institute of Communications, is divided into subprograms which in their turn are divided into targets to be accomplished. The structure of this program is formed by the following subprograms:

- digital telephony and telephones;
- digital teletransmission and fiber-optics electronics;
- radio communication, the spread of radio broadcasting, and digital television;
- telegraphy, computerized information services, and tele-automatics;
- technology of electronic systems for the needs of telecommunications;
- automation of systems control and maintenance within the telecommunications network;
- basic R&D work on digital networks.

The targets specified in the subprograms, are divided into:

- application targets, postulating the practical application of research results prior to 1990;
- preemptive targets, postulating the practical application of research results after 1990;
- cognitive targets.

Research under CPBR [Central Research and Development Program] Telecommunications has been under way since 1986. Some of the results achieved in 1986 are presented in the articles collected in this issue of PRZEGŁAD TELEKOMUNIKACYJNY.

Below are described the implementation target groups pertaining to discrete subprograms.

Digital Telephony and Telephones

This subprogram comprises:

- electronic commutation systems;
- electronic telephones.

Research topics pertaining to commutation relate to broadening the possibilities for producing the E-10 digital switching system under a license. It is expected that more modern electronic components will be incorporated at subscriber level, in central control groups and at central operating stations, and in addition that CCITT-recommended higher-order programming languages will be introduced. It should be emphasized, however, that the principal direction in which E-10 is to be improved has already been determined by the corresponding government order. Plans exist for developing an integrated digital link system for verbal information transmission with the object of introducing modern equipment for the operation and control of telephone networks and exchanges. In addition, local small-capacity (100-300 NN) exchanges with a digital commutation field and microprocessor control are to be developed for rural areas, along with digital communications terminals on subscriber lines, with the object of enhancing the use of subscriber networks, chiefly in areas with low telephone densities per 100 capita.

As for cognitive research, studies of selected longrange aspects of integrated networks are envisaged, chiefly with respect to the possibility of introducing the E-10 system and a standard switching system adapted to these networks within the framework of CEMA.

Other topics in this subprogram pertain to the development of a family of public electronic telephones and the introduction of pay telephones that accept credit cards as well as of telephones for persons with impaired hearing. Also envisaged is cognitive research into modern techniques of measuring the quality of telephone transmission and into a multipurpose subscriber network.

Digital Teletransmission and Fiber-Optics Electronics

This subprogram comprises:

- digital systems for signal multiplexing (120-fold, 480-fold, 1,290-fold, and 7,680-fold);
- digital lines along metal and fiber-optics tracks;
- testing, control, and service equipment;
- optoelectronic transmission and reception equipment for systems with capacities of 2, 8, 34, and 140 Mbits/s;
- optoelectronic passive elements.

The development of highly multiplexed digital teletransmission will make possible an improved utilization of existing and newly installed copper and fiber-optics cable lines, which should in its turn serve to activate a

greater number of telephone connections. Also expected is the development of equipment serving to link digital to analog networks (conversion terminals). The introduction of fiber-optics lines yields a number of advantages, including considerable savings of copper in the telecommunications networks and enhancement of the reach and multiplexing capacity of teletransmission systems as well as a marked reduction in the number of regenerators. As known, this concerns chiefly digital systems.

Work to develop new measuring devices is envisaged, chiefly those suited for operational needs, along with the development of optoelectronic passive elements (junctions, switches, couplings, etc.) minimalizing losses in optic fibers. Other research under this subprogram concerns enhancing the reliability and operating certainty of teletransmission systems and augmenting the resistance of equipment to outside noise. Broad cooperation under CEMA is envisaged, especially as regards the development of a fiber-optics line with a capacity of 140 Mbits/s.

Radio Communications, Radio Broadcasting, and Digital Television

This subprogram comprises:

- automated land-based mobile radio communication systems;
- digital radio broadcasts;
- digital and cable television;
- satellite radio broadcasting systems (based on digital engineering).

The principal purpose of the development of automated land-based radio communication systems is to create general-purpose radio-telephone networks for streamlining the administration of the state and the national economy. This purpose will be accomplished through cooperation within the CEMA framework.

The purposes of the development of digital radio broadcasting, digital television, and cable television are to be both the initiation of the production of equipment for the encodement and digital transmission of radio and television broadcasts and the introduction of a new service that would enable subscribers to receive not only several television channels but also various additional information such as teletext, video telephony, etc. This will make it possible to improve the techniques for the transmission of television signals, streamline the utilization of the frequency spectrum, and provide subscribers with new kinds of information. This will contribute to laying the foundations for implementing an integrated digital transmission network providing various services.

The development and introduction in this country of a system of satellite radio broadcasting in the 12 gigahertz range will make it possible to broadcast five television channels received with the aid of equipment adapted to WAIZ large collective-reception antenna installations.

Telegraphy, Computerized Information Services, and Remote Automation

This subprogram comprises:

- telegraphic transmission equipment integrated with ECTT electronic telegraphic-telecomputer exchanges;
- TgC-46M and TgC-92 multiplex telegraphy equipment;
- telex terminals;
- system and facilities for modernized ECTT-R telegraphic-information service exchanges;
- an operating system for arithmetic telegraphic-information service equipment and networks;
- analytic and conceptual work on telegraphic, telecomputer, and remote-automation systems and equipment for telecommunications networks.

Such research will result in introducing into operation modern telegraphic switching equipment providing users with access to new kinds of services and improving the accessibility and quality of services. It should be emphasized that the work on transmission, switching, and subscriber equipment for the domestic public commutated network of computer information services, as well as the work on the concept and structure of that network, will be comprised within a separate central research and development program, "National Telecomputer Network," which is currently being drafted.

Technology of Electronic Systems for Telecommunication Needs

This subprogram comprises the development of hybrid integrated circuits for the needs of fiber-optics systems as well as for other telecommunications needs. The initiation of the related research will, along with assuring the production of specialized integrated circuits for the equipment and systems to be manufactured by the communications equipment industry, make possible the application of modern design solutions, miniaturization of tele-electronic equipment, a reduction in the materials-intensiveness and cost of production, and an increase in the reliability of equipment.

Automation of Systems Control and Maintenance in the Telecommunications Network

This subprogram comprises:

- network maintenance systems;
- automated power supply units for telecommunications;
- digital metrology.

The principal objective of the work on systems maintenance is to automate the maintenance of telecommunications equipment and networks and provide the maintenance services with modern facilities and new measurement techniques assuring a tangible improvement in the quality of telecommunications services. Given a rapid development of the telecommunications network, and especially given its automation, the traditional methods for monitoring its condition must be

replaced with new techniques based on a broad use of microprocessor technology with analog-to-digital signal conversion, plus computer technology for the collection and processing of data.

Also envisaged is the development of a new generation of miniature, energy-efficient microprocessor-controlled power-supply devices.

The need for research into digital metrology is due chiefly to the large number of new types of digital measurement and testing devices introduced into operation. The related metrological research will be focused on developing and automating mensuration techniques, model instruments, and measurement stations.

Basic Research Into Developing Digital Networks

This subprogram comprises two main objectives:

- drafting the assumptions for a development strategy through conversion to a digital telecommunications network and integration of equipment and services as well as the development of longrange technical concepts and development plans for the telecommunications network based on rational engineering principles and economic and social realities;
- improvements in the existing techniques for computer simulation and programming of network development as well as development of new techniques, with the object of ultimately drafting broad technical-economic analyses serving to define the optimal development conditions for telecommunications networks.

Prerequisites

A prompt and complete fulfillment of discrete CPBR implementation tasks hinges closely on access to modern components and equipment and on the allocation of foreign exchange for purchases in Payments Area 2 [capitalist countries]. Such funds will be earmarked for, in particular, the acquisition of special-purpose highly integrated circuits, programmed semiconductor memories, optoelectronic elements, suitable computer equipment, control and measuring apparatus, simulation devices, etc. It also is necessary to assure sufficient numbers of highly qualified experts and adequate premises for housing the facilities.

Preliminary analytic-exploratory and design work on certain research objectives is in progress and it should, during the first stage of its implementation, serve to identify the actual prerequisites. This concerns certain pioneering research projects, such as those pertaining to highly multiplexed digital teletransmission systems and pay telephones that accept credit cards.

The implementation of the CBR will be based on bilateral and multilateral foreign cooperation — chiefly with the countries associated in CEMA. A major role will be played by the PRL [Polish People's Republic] as a

partner in the activities of CEMA's Permanent Commission on Communications (PCC) and Permanent Commission for the Radio Engineering and Electronics Industry (PCREE). Within the PCREE Polish cooperation pertains to the Uniform Digital Transmission Means System (UDTMS);, the Uniform System of Means of Commutation Engineering (USMCE), the Uniform System of Fiber-Optics Means of Data Transmission (USFOMDT), and the Uniform System for Mobile Land-Based Radio Communications (USMLBRC).

As regards the applicability of the research projects included in CPBR No 8.5, it can be basically considered assured, inasmuch as the organizations responsible for that applicability were initially consulted about the related R&D topics. It must be stated, however, that the current status of domestic facilities for the production of certain equipment, especially of technological and measurement equipment, is unsatisfactory. The great complexity of the modern means of manufacturing telecommunications equipment poses special requirements which are extremely difficult to meet. For this reason, imports of that equipment — chiefly from Payments Area 2 — are necessary.

The present article is confined to a brief discussion of the scope of the research comprised under CPBR No 8.5. It should be emphasized, however, that this research does not exhaust the entire spectrum of the telecommunications-related research work envisaged for the current 5-year period. The principal complement to CPBR No 8.5 is the corpus of government-placed orders relating to the development of telecommunications science and technology. These orders, which are closely linked to industrial applications, comprise topics relating to the development of both commutation (E-10, USMCE, ECTT) and teletransmission (USMDT, TN 2700, fiber-optics cable and fibers). Another major complement to this research is the ministerial R&D programs.

So far as basic research is concerned, some of it is included in CPBP [Central Program for Basic Research] 02.16, "Development of Data Transmission Technologies," and in CPBP 01.20, "Development and Utilization of Space Research" (more exactly, in Subprogram 01.20.5, "Satellite Communications," coordinated by the Institute of Communications). This research is a major complement to the whole of the research program in telecommunications.

It is worth noting that the program for research into telecommunications during the current 5-year period is broad and ambitious, and that its implementation would warrant the hope for a much more rapid than hitherto quantitative and qualitative development of the Polish telecommunications network and the Polish telecommunications industry.

TELECOMMUNICATIONS R&D

**Technologies, Products at GDR
Telecommunications Electronics Combine**
23020010a East Berlin *RADIO ELEKTRONIK*
FERNSEHEN in German No 2, 1988 pp 73-76

[Report from the Berlin Center for Research and Technology in Telecommunications Electronics VEB, by Dr rer nat Karl-Heinz Segsa, Graduate Physicist Horst Schulenburg, and Graduate Engineer Guenter Salewski: "Hybrid Technologies for Development and Small-scale Fabrication of Microelectronics Modules"]

[Excerpts] In this article a development and production assembly line for thin-film and thick-film hybrid integrated circuits is presented, with the emphasis of the discussion being the applied technologies and the related achievable parameters. Certain specific hybrid circuits, in particular those for use in telecommunications electronics, are given as examples.

Designing and Prototype Production of Hybrid Components at the Telecommunications Electronics Combine

The communications industry of the GDR is utilizing the advantages of microelectronics technologies in the design concepts for its products and in the further development of such products, with this being mirrored in the succession of generations taking place in the product lines offered in communications electronics. Here a broad range of microelectronic components is being materialized as hardware solutions.

The foundation stone for the development of hybrid circuits for the Telecommunications Electronics Combine (KNE) is the Hybrid Engineering Small-scale Production Center of the KNE's Center for Research and Technology in Telecommunications Electronics VEB (ZFTN). This center is using special technological equipment for the development and production of hybrid circuits and resistance networks in thin-film and thick-film engineering, which are made available in a hybrid configuration to the circuitry designer for the rapid realization of microelectronic circuits. The most important technological steps are listed in Table 1. Here the technologies now being applied are subdivided into a number of separate process steps, which must be carefully coordinated with one another in order to achieve the parameters demanded by the equipment developers.

Topological Design (CAD)

The basis for topological design is the circuit diagram tested by the equipment developer. In talking with the developer, decisions are made on the technology to be applied and the built-in components used. Criteria are the type of circuit, voltages, currents, and power dissipations of the component as well as the nominal resistance values and their tolerances.

On the basis of the determined basic technologies, a rough layout of the circuit diagram is worked out, and this is constructed as a fine layout on the Kulon computer-aided design work station (see Figure 1). An example of a layout so constructed is given in Figure 2. The layout data obtained are converted via the CAD system into technology-specific control data and documentation.

Coordinated design guidelines have made it possible to apply developed hybrid circuits and resistance networks to the production process at the Hermsdorf Ceramics Works Combine.

Production of Films for Thin-film Systems

At vapor-deposition facilities of the type B 55 of the Dresden High Vacuum VEB, special technological equipment has been created through additional installations that allow one to deposit CrNi and FeNi alloys as well as other materials on glass or ceramic substrates with a high degree of quality in using the vapor-deposition technique. Figure 3 shows a facility with such additionally developed equipment. Through a careful process control and subsequent pre-aging, the film parameters given in Table 2 are achieved.

Photolithographic Structuring

The thin-film systems are given the desired topologically prescribed structure by the use of special photoresists and suitable etching media. The photolithographic structuring of the thin-film substrates is done on facilities and equipment for resist coating, exposure, developing, and etching specifically designed for this purpose. Figure 4 shows a work station for photolithographic structuring. The structure widths of the thin-film systems are determined by the required electrical circuit parameters and the photo template quality.

The thick-film systems are fabricated by using photolithographically structured print screens. After covering the print-screen frame with metal screen netting and applying light-sensitive emulsion, the subsequent opening of the screen meshes takes place according to a predetermined topological structure.

Suitable screens are made for each printing paste used. The printed line widths are determined, among other things, by the mesh size of the screen material.

Printing and Firing of Thick-film Pastes

On the basis of existing paste systems Al_2O_3 ceramic substrates are being printed on by means of the screen printing process. Each thick-film paste is individually printed and fired according to a prespecified temperature profile. Through the use of multilayer printing pastes, it is possible to arrange on top of one another several conduction tiers.

Through topologically prespecified openings in the insulation tiers and subsequent fill printings, electrically conducting connections are made among the conduction tiers.

The printing pastes belonging to a certain paste system have differing film properties. The data for the paste systems being used at the ZFTN are given in Table 3.

In Figures 5 and 6, the work stations for the printing and firing processes are shown.

Balancing of the Resistances

With a modern programmable balancing device, both thin-film and thick-film resistances can be adjusted to the required nominal resistance value in a reproducible way in accordance with prespecified layout data. Precision resistor networks can be made to specific customer's needs while taking into account long-term characteristics.

Assembly and Enclosure of Hybrid Circuits

After the technological fashioning of the circuitry structures in the substrate unit, these structures are separated into individual circuits with the aid of scribing methods. In the assembly process, the given structures can be fitted with hybrid-type chip capacitors and transistors, enclosed semi-conductor components, and unencased monolithic semiconductor chips. Moreover, other special components can also be integrated into thin-film or thick-film circuits.

Available as assembly technologies are comprehensive procedures for fitting on a wide variety of built-in components, especially soldering techniques, chip gluing, chip bonding, and wire bonding, as well as press welding. Through in-process measurements and repair cycles the production of hybrid circuits is organized in a cost-favorable fashion.

The hybrid circuits are protected from environmental influences by various types of enclosure. Available for this purpose are dip coating with silicone rubber, encapsulation in metal pots, and sealing within quasi-hermetic metal or plastic housing. The type of circuit enclosure is determined by the built-in components, the electrical requirements, and circuit size and reliability requirements. The user-specific identification of the hybrid integrated circuit is made by means of four alphanumeric symbols.

Final Test Methods and Quality Control

In coordination with the equipment developer, the final testing of the encased and identified hybrid circuits is done with respect to important functional parameters by using application-specific test circuits.

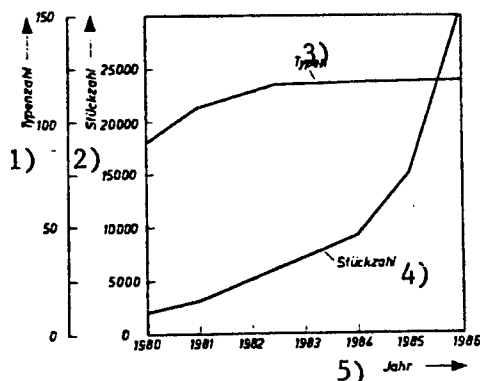


Figure 7: Hybrid Circuit Production at the ZFTN

Key:

1. Number of types
2. Number of units
3. Types
4. Number of units
5. Year

Good serviceability and quality for the developed hybrid circuits are achieved by quality-control measures within the production process. The ZFTN furnishes guarantees for the circuits it develops.

Output of the Hybrid Technology Small-scale Production Center

Since the establishment of the small-scale production center for hybrid technology a great number of hybrid circuits for industry have been developed, tested, and put to use in industrial production, with this being accompanied by a continuously increasing capacity and continuously improved technologies. Moreover the output of the small-scale production center has grown with the demand for circuits. Figure 7 shows the growth in its production with respect to number of types and number of units for the period from 1980 to 1986. It follows from the number of types that the fabrication of a certain circuit is done only in small lots for the purpose of development needs. On the cover picture of this issue an overview is given on the variety of thin-film and thick-film circuits for various enclosure types.

Hybrid circuits are also being developed for other industrial branches outside the telecommunications electronics combine. We can mention here in particular:

- Circuits for use in medical research,
- sensors for manufacturing of scientific instruments and consumer goods production [2],
- and hybrid circuits for applied research in other industrial branches and institutes and institutions of the GDR Academy of Sciences.

Hybrid Circuits of the Small-scale Production Center for Use Especially in Communications Electronics

We have already mentioned the chief areas of application of hybrid technology in communications engineering. This is mirrored in the particular areas of use of hybrid circuits that were developed at the combine in the years 1984 to 1986 (see Table 4).

Table 4: Hybrid Circuit Developments at the Small-scale Production Center of the ZFTN, 1984-1986

Area of Application	Number of Types	Fraction in Percent
Transmission technology		
PCM technology	23	59
PCM beam waveguide technology	30	
Broadcast studio engineering	10	11
Message switching technology	9	10
Mensuration technology	8	9

At the communications electronics combine, the first products with hybrid components for the sector of very-high frequency (VHF) radio engineering were conceived at the beginning of the 1970's. These devices are used in train radio telephony, mobile land radio, and transport radio for the state railway system of the USSR. Building on this traditional area of applications of hybrid technology, VHF devices are now being developed that have up to 2,000 channels.

A special form of customer-specific channel programming for channel numbers below 10 is being realized by way of a hybrid-integrated diode matrix (Figure 8). The use of this component in radio sets with a relatively small number of channels has economic advantages over using PROM's, such as a smaller power consumption, a more favorable heat balance in the device, and less material required. The once-only customer-specific programming is done by way of current pulses that lead to the breaking of the direct electrical connection.

For transmitting equipment, especially in radio-telephony systems, absorbers are used (10 W and 40 W) for the decoupling of several transmitters over one antenna. Figure 9 shows an absorber for 40 W with a heat sink. The 50-ohm resistive films have a reflection coefficient of 4 percent for the 10-W absorber and of 7 percent for the 40-W absorber in the frequency range from 0 to 5 MHz. The innovation shown is equal in its technical conception to typical applications worldwide that operate with cylindrical resistances on beryllium ceramic.

In recent years, hybrid techniques have found increasing applications in PCM [pulse code modulation] technology, which is used in transmission engineering for transmitting telephone and telex channels in cables. The development of PCM 30 to PCM 120 and then to the system PCM 480 required the broad use of hybrid technology. With the production of PCM 480 products now under way and with the 17 hybrid circuit types now

being used, a volume reduction is being achieved of 30 to 50 percent together with approximately the same costs and great operational reliability.

Message-switching technology with remote, local, and private-branch-exchange engineering represents another area of application, although the internationally common share held by this of 48 percent of the total percentage of hybrid technology in communications engineering is not being reached nationally. Another area of application is electronic measuring engineering, which necessitates the use of hybrid technology in order to avoid time-delay effects or when precision measurements are needed.

Devices and equipment in applied television engineering represent an effective addition to means of communication for the transmission of graphic information. Television cameras are being increasingly used in all sectors of our economy. The use by industry of 10 different types of hybrid integrated circuits has permitted an average doubling of the effective lifetime, a reduction by half in the illumination needed, an improvement in picture quality, and the realizing of other additional functions.

The transistor module for an X-ray detector can be classified as an example of the use of hybrid technology for situations where distinct printed circuit board or component technologies cannot be implemented. In this case, through a combination of a transistor and a thick-film resistance a multilayer configuration has been created with which the operating temperature of the transistor in a cryo-system can be optimally adjusted [3].

Figure 10 shows an application of hybrid technology for beam-waveguide engineering. Here the optical waveguide is coupled directly to the ceramic for a receiver module from the subscriber circuit of an waveguide communication network. For a size comparison, a coupling customary in optical-conductor technology is shown also in the figure [4].

Conclusion

The advantages of hybrid technology lie in its great flexibility, the short development times needed, and in an economical fabrication for small and intermediate

numbers of units. In telecommunications engineering the focal points of the future technology of hybrid techniques will lie mainly in multi-level circuitry substrates for bare chip assembly and the simultaneous integration of passive components, especially precision resistance networks. The possibility of functional balancing by hybrid circuits together with very great long-term stability for the resistors used explains the great value of hybrid technology to the development of new generations of equipment in communications engineering using new microelectronic modules.

Hybrid technology with its above-mentioned advantages is solidly established in the modern technologies of microelectronics, such as semi-customized and fully customized circuit technologies, as well as SMD engineering. In the future certain technologies that used to still be largely independent of one another will complement each other to a considerably greater degree for the purpose of overcoming problems that arise [5] [6].

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