JPRS-EST-88-012
30 NOVEMBER 1988

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JPRS Report

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FRG: BMFT Announces Subsidies for Thin-Film Technologies

3698M504 Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 482, 29 Jun 88 pp 6-7

[Text]

The Federal Minister for Research and Technology

Announcement of Support for Research Projects Within the Framework of the Key Funding Area 'Thin-Film Technologies' in the 'Physical Technologies' Funding Sector

Issued 30 May 1988

1. Objective and Goal of the Key Funding Area

The key funding area of Thin Film Technologies involves the treatment and layering of surfaces primarily by means of vacuum-, plasma- and ion beam-supported methods. Supplementary to this, support is also provided for methods of surface- and layer characterization as well as the procedural diagnostics. The goal of this support is through basic investigations into process engineering to demonstrate new opportunities for production and analyses of films and surfaces, which until now were unknown or not capable of being produced due to the lack of methods.

This will result in
—a long-term and lasting improvement in the international competitive ability of German industry in this area of technology and
—the creation of a broad and competitive basis of know-how through forward-looking and preparatory research in close cooperation with research installations and industry.

2. Subject Concentrations

The funding is concentrated on work in the following topic areas:

—Basic research into methods for processing and layering surfaces, such as:

- PVD [Physical vapor deposition] methods
- CVD [Chemical vapor deposition] methods
- Ion beam methods
- Plasma layering
- Plasma treatment

under special consideration of

- Modelling
- Simulation
- Layer science

—Researching the combination of layering and treatment procedures

—Researching methods of surface and layer analysis or measurement technology

—Researching methods for online diagnostic of layering and treatment procedures.

Delimitation:

The funding does not apply to methodology research and application which are supported by BMFT [Federal Ministry for Research and Technology] funding measures for microelectronics, sensor technology as well as assembly and interconnection technology.

Funding Conditions

Preference in funding will be given to joint projects, in which research installations and industrial enterprises work together purposefully and with division of labor.

—The BMFT as a rule participates with a grant for 50 percent of the project-related costs of the industry.

—The BMFT as a rule expects financial participation by the industry in the project-related costs of the research institutions, which are in conformance with

- the technical and scientific risk, meaning the fundamental character
- and the significance, above the company level, of the joint project.

The remaining share of the expenditures of the research institutions is carried by the BMFT.

4. Information and Advice

Additional information, documents and organizational advice may be obtained from the project executor:

VDI-Technology Center
Physical Technologies
Graf-Recke-Strasse 84
4000 Duesseldorf 1

Contact person:

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Tel: 02 11/62 14-5 72/4 01
Dr R. J. Peters
Tel: 02 11/62 14-2 63/4 01
Bonn, 30 May 1988
423 - 7108 - 7/88

The Federal Minister for Research and Technology

On behalf of Dr. Widdershoven

AEROSPACE, CIVIL AVIATION

Materials for Hermes Spaceplane Discussed

36980003 Paris L'AERONAUTIQUE ET L'ASTRONAUTIQUE in English No 3, 1988 pp 30-35

[Article by D. Chaumette: "Hermes Materials"]

[Excerpts] The objective of the Hermes program is to be able to launch into low earth orbit a crew of three and a payload of some tons. Two types of missions were considered: autonomous scientific missions, transport of personnel and supplies to a space station.

Hermes is launched by an Ariane 5 rocket. Contrary to the U.S. Space Shuttle, Hermes is not itself a launcher, but a vehicle used only when the presence of man is necessary.

The Hermes program is a European program by CNES under ESA supervision.

In the industrial organisation, Aerospatiale is the industrial prime contractor, and Avions Marcel Dassault/Breguet-Aviation the delegate prime for aeronautics. To this effect the company is responsible for all the atmospheric reentry, and in particular of the aerodynamic design of the airframe, of the design of the structure and the thermal protection system.

Thermal Protection and Hot Structures

Status of the development of high temperatures materials.

Since the period of the U.S. Orbiter design, there was few improvements on high temperature metallic materials usable as skins. They can be divided in two categories:

—oxydation resistant materials: nickel, chromium and cobalt superalloys and dispersion strengthened alloys;

—refractory metals with anti-oxydation coating: molybdenum, niobium, tantalum.

These metallic materials were not chosen for Hermes (excepted as fasteners) due to their limited properties at temperatures, their high weight, and the problem induced by their high coefficient of thermal expansion.

A real breakthrough is the development of ceramic composites, essentially the production of SEP: silicon carbide fibre in a silicon carbide matrix SiC-SiC (or Cerasep) carbon fibre in a silicon carbide matrix C-SiC (or Sepcarb-inox). Figure 3 shows a comparison of the strength of these materials (there in bending). The interest of ceramic composites is obvious.

On this figure are also presented results of carbon-carbon composites (carbon fibre in a graphite matrix). This material, an older one, was used on the nose cap and leading edges of the Orbiter. It is manufactured in

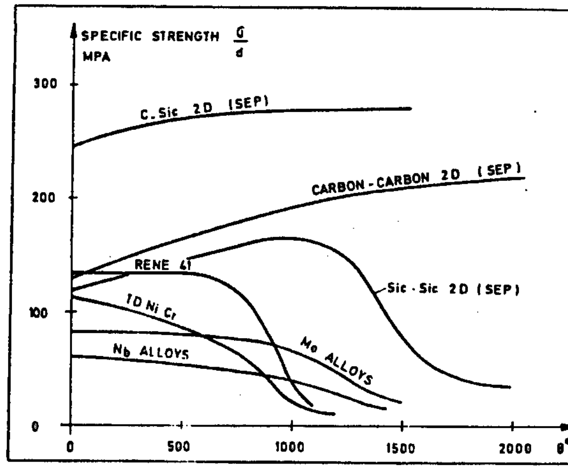

Figure 3 - Specific strength in bending

France by two companies: SEP (for examples for brake discs) and Aerospatiale Aquitaine Division, using different processes. Compared to ceramic composites these materials have also a good strength in the fibre direction, but have two serious shortcomings:

—the necessity to use a reliable oxydation protection;

—a low interlaminar and translaminar shear strength which limits the possible weight savings.

Within the frame of the Hermes program SEP is concentrating on SiC-SiC and C-SiC which are considered a baseline solution, and Aerospatiale is working on an oxydation protected carbon-carbon solution, which may be a possible solution for the hottest parts.

Hot structures and thermal protection systems

Several solutions were considered in the Hermes preliminary project studies. When the active cooling and ablative solutions are abandoned because of weight, reliability and reusability, two kinds of solutions remain for consideration:

—cold structures with an external insulation;

—hot structures.

Cold Structures With External Insulation

Three solutions are considered for Hermes.

The tile solution This is the solution of the U.S. Orbiter. Rigid silica tiles, with a density of about 150 k/m^3 are bonded to the structure through strain insulation pads. This system has given serious maintenance troubles due to the water ingestion risks and to the low mechanical strength of the first generation tiles. These characteristics have been largely improved since then.

For the Hermes program, the Desmarquest Company has developed silica-aluminia tiles of much improved properties (about one order of magnitude in delamination strength).

The shingles and multi screens insulation solutions. In this solution the two functions: aerodynamic surface and insulation are separated, permitting the use of ultra light insulation using reflective screens. A prototype of this insulation is the Protecalor from Bronzavia in 1972. Figure 6 shows that such insulations are vastly superior to titles (Li 900 in the figure). On the other hand the weight of the shingle and supports must be added to the weight break down. Such a solution was studied by AMD-BA in 1972 using Td Ni Cr dispersion strengthened alloys (Figure 7). This sample withstood 100 simulated reentries at 1 200°C. But the metallic solutions are too heavy, limited to lower temperatures, and have severe problems of expansion seals due to the high thermal expansion coefficients of metals.

On the other hand the solution of ceramic composite shingles leads to attractive weights for all the hottest zones.

The flexible external insulation
This insulation is made of a quartz fibre mat enclosed in two fabrics, treated with water repellant, and bonded on the structure.

This solution was used on the Orbiter. It remains the most efficient in all the lower temperature zones, in places where the aerodynamic surface roughness is not very important.

The Hot Structure Solution

The concept is to have the load carrying structure working at outside temperature.

This solution was used on the carbon-carbon nose and leading edges of the Orbiter. It is an interesting solution for the hottest zones by allowing lower temperature of the hot spots by internal reradiation. For example this effect allows a 200°C reduction on the temperature of the nose.

Making use of the good high temperature strength of the ceramic composite materials, it will be interesting to extend the concept to all structures not containing equipment to be protected. Thus saving the weight of the insulation.

The Choice of Solutions for Hermes

The choice is not yet frozen.

The nose, leading edges, fins and elevons are hot structures (baseline ceramic composites, back-up carbon-carbon). Some elements have already been manufactured. Figure 12 is a photography of a section of a SiC-SiC leading edge manufactured by SEP. This leading edge was successfully tested through limit and ultimate load tests at 1200°C and 1400°C, after an ageing and oxydation test under ambiant pressure at these temperatures.

The other zones are cold structures.

The hot zones, namely undersurface and front fuselage are protected either by composite ceramic shingles with a multilayer insulation, or by Desmarquet bonded tiles. The ceramic shingles solution is the baseline. But the tile solution is still considered as a partial or total substitute as a result of ongoing studies.

The lower temperature zones on the upper surface are protected by flexible external insulation.

Improved Materials for Cold Structures

The primary cold structure of Hermes is made mostly of carbon-resin composites, for two reasons: weight saving and absence of thermal expansion. But the better fully developed and available materials such as IM6-5245C are not usable beyond 170°C. And to reduce the thickness and hence weight of the insulation, it would be interesting in some parts of the so called "cold structures" (which are in fact much hotter than common aeronautical structures) to be able to go up to 250°C. To this effect, a research program was initiated on 4 candidates materials.

This program is directed jointly by Dassault and Aerospatiale, within the first phase the participation of two European firms, Sonaca of Belgium and Casa of Spain.

The four materials studied all use the same high performance fibre, Toray T800.

Four matrices are considered, all thermosetting: three BMI: Narmco - BASF 5250; Ciba 564; Ferro 2268;—one of PMR type: Larc 160 Ferro 2237.

Thermoplastic matrices were not considered, being too low in temperature in their present state of development (and also not very interesting for the specific usage in Hermes).

The feasabiliity is studied, also the performances on notched specimens and assemblies, made of the different materials at different temperatures after an hygrothermal ageing representative of Hermes missions.

At the end of the ongoing phase, one or two of these products will be selected for complete qualification, and full scale feasability tests. In that second phase, the different tests will be shared between the different European companies chosen to produce the cold structure for Hermes.

BIOTECHNOLOGY

Belgian Firm Produces Genetically Engineered Beets

3698A241 Groot-Bijgaarden DE STANDAARD in Dutch 5 May 88 p 8

[Unattributed article: "Genetic Transformation Produces Resistant Sugar Beets"]

[Text] Ghent—Plant Genetic Systems [PGS], a private company specializing in the biotechnological manipulation of agricultural crops, has succeeded in improving the genetic characteristics of sugar beets, making the plants resistant to a major herbicide.

Sugar beets have a slow initial growth phase and consequently face fierce competition from weeds. Depending on the developmental phase of the beets and on the principal weeds expected to grow on a particular plot of farm land, a mixture of several herbicides is used—a complex and expensive technique.

Using new biotechnological techniques, PGS has developed sugar-beet plants resistant to phosphinotricine; this is a typical new-generation herbicide that is safe for humans and animals, quickly degradable, and thus easy to eliminate from the environment. Until now, this herbicide could only be used for nonselective applications, destroying the crop itself, as well as the weeds.

PGS researchers have successfully developed phosphinotricine-resistant sugar beets by implanting a bacteria-derived gene in the genetic material, producing an enzyme that recognizes phosphinotricine and neutralizes it.

According to Dr Jan Leemans, director of PGS' biotechnology department, this development will make weed control in sugar-beet cultivation much easier.

This technological breakthrough opens up prospects for further improvements in sugar beets. PGS is currently investigating ways to make the plants resistant to viral diseases and to improve their quality during storage. The company has already succeeded in biogenetically improving other crops, such as tomatoes, coleseed, potatoes, tobacco, and poplars.

COMPUTERS

Hungarian Software Houses Seek Benelux Partners

3698A260 Amsterdan COMPUTABLE in Dutch 3 Jun 88 p 14

[Article by Yvette Cramer: "Major Hungarian Interest in Benelux—Many CAD/CAM and Courseware Packages Presented"; first paragraph is COMPUTABLE introduction]

[Excerpt] "In fact, the Netherlands and Hungary have the same asset: few inhabitants and a lot of brains," says A.S. Toperczer, manager at Softinvest, one of the five companies represented at the Hungexpo stand in the Juliana hall [in Utrecht]. The Hungarians' goal is obvious: to market their expertise in the Netherlands.

The image of a backward country was dismissed during meetings with representatives of Softinvest, Szamalk, Interag Software Service Office, Megoldas, and AMT, five of the seven East bloc exhibitors represented at the Europe Software Fair. The software houses and businesses are strongly oriented toward the Western market, especially the IBM-PC market. The products are mainly related to CAD/CAM, courseware, and "manpower" or know-how.

Hungarian computer specialists have a thorough knowledge of all current programming languages, ranging from COBOL to C, and artificial intelligence is their specialty: "PROLOG was indeed developed in Hungary," says Toperczer. However, the gap in the area of data communications and telecommunications is striking. According to C. Salamon, foreign trade manager at Megoldas, there is as yet no basis for telecommunications: "Networking is in a very bad shape in Hungary; we have no expertise in this field." Softinvest, a joint venture of 10 Hungarian software houses and three ministries, is specializing in products for IBM-XT and -AT compatibles. According to Toperczer, products for the PS/2 are "in the pipeline." The company, founded in 1985, has a staff of 1,500; its turnover in 1987 amounted to 250 million forints (approximately 10 million guilders).

Showpiece

The company's showpiece is the Babel package, an electronic dictionary intended for language training in primary and secondary schools. In addition, the company supplies software development tools.

Szamalk is one of the larger software houses active in systems and application development. The company has a great expansion drive and has created branches in the FRG and the UK. In the Benelux countries, Szamalk is now represented by PC Choice from Amsterdam, but the company still aims at further expansion. The products intended for the Netherlands market are mainly software engineering tools, CAD/CAM, and documentation. The company's most eye-catching product is an expert system shell. Dubbed Genesys, it can be used in medical diagnostics, education, administration, geology, and other applications.

One of Hungary's largest merchant houses—representing among others the interests of Shell and Dupont in Hungary—is Interag. Interag previously had a monopoly on all foreign trade, but recently other companies have also been able to apply for export licenses. As for software, Interag represents a number of system houses specialized in CAD/CAM products running on MS-DOS PC's and Macintosh. The distribution rights for the Macintosh CAD/CAM programs have been assigned to the Belgian company Lipe. T. Popovics, an Interag sales representative, says that the company, whose software division generates 8 million guilders in revenues, is interested in cooperating with European system houses.

Serious Overtures

A company that is also making serious overtures toward the West is Megoldas Cooperation. Megoldas, which means "solution" in Hungarian, is focusing on a wide range of activities, including computer technology and software. The company's computer activities involve the production of IBM-compatible machines and the development of systems applications. Megoldas is therefore better known as a know-how house than as a systems house. With a 45-million-forint turnover (1.8 million guilders), it exports expertise and hopes to interest small- and medium-sized companies, says company representative C. Salamon.

AMT, the second smallest company with respect to turnover (3.2 million guilders), was also represented at the Hungexpo stand. The company specializes in CAD-/CAM applications.

MICROELECTRONICS

Europeans Standardize Conformance Testing for OSI Protocols

3698A327 Luxembourg IES NEWS in English Aug 88 pp 21-23

[Unattributed article entitled "CTS-WAN" (Conformance Testing Services in a Wide-Area Network)]

[Text]

1. Introduction

The development and usage of a communications infrastructure (both global and local) is accelerating rapidly. As this trend continues, increasing reliance is being placed on the availability and capability of a stable communications platform.

Europe has long been a participant in the development of these communication facilities—one significant factor being the presence of national telecommunications monopolies. This development, both in Europe and worldwide, has unfortunately led to a proliferation of standards and national variations of these standards.

These problems have been recognised, and there are now two significant activities taking place that are attempting to provide solutions:

—the emergence of Open Systems Interconnection (OSI) and its related standards;
—the development of conformance testing services for OSI products that will provide reciprocal recognition of testing services produced in other countries.

The EC Commission is sponsoring a number of complementary initiatives in support of these objectives, the overall aim being to enhance the portability and interoperability of IT systems. Currently three initiatives stand out within Europe:

a) Promotion of Functional Standards;
b) Concept of European IT Certificate;
c) Support for the Provision of Harmonised Testing Services.

It must be remembered that implementations are derived from (and should conform to) complex, evolving, paper documents, making little use of any formal definition techniques. Existing standards largely rely on English descriptions of protocol and service behaviour, requiring implementors to translate these definitions into software and hardware. This translation process is formidable and subject to human error—simple mistakes and also misinterpretations of the intent of the standard. Indeed, the standards are often imprecise and self-contradictory.

It is clear that OSI can only succeed if all implementations are reliable, effective, consistent, and conform to the standards. Hence, conformance testing is essential to the realisation of Open Systems Interconnection.

2. CTS-WAN

The CTS-WAN program is part of a major European initiative launched by the Commission to provide harmonised conformance testing services in a wide-area network (WAN) environment.

This program has utilised Europe's major centres of technical excellence on communications testing.

The organisations involved in this program are recognised authorities in communications systems and testing, namely:

—British Telecom plc (BT), UK

—Centre National d'Etudes des Telecommunications (CNET), France
—Centro Studi e Laboratori Telecommunicazioni S.p.A. (CSELT), Italy
—Compania Telefonica Nacional de Espana S.A. (Telefonica), Spain
—Deutsche Bundespost, Fernmeldetechnisches Zentralamt (FTZ), Germany
—The National Computing Centre Limited (NCC), UK
—Statens Teletjeneste Telelaboratoriet (PTT-DK), Denmark.

The goal is early, consistent, cost-effective testing in Europe, and this achievement is only possible through the full and extensive collaboration of all contractors. CTS-WAN takes into account the fact that reliable techniques, knowledge, and experience of testing varies across the range of standards that comprise OSI. It has, therefore, defined six distinct but integrated technical areas to investigate testing in relation to:

- Network layer implementations
- Transport and session layer implementations
- Message handling systems
- File transfer access and management systems
- Teletex systems
- General methodology.

The methodology area exists to promote and encourage the following philosophies throughout all technical areas:

—use of a common testing methodology based on those defined by ISO in DP9646;
—use of common test specifications, so that the same abstract test specifications will be implemented on different test tools to enable technical harmonisation;
—use of common procedures governing test centre-user relationships amongst all European countries. This includes documentation for interfacing and policies for contractual arrangements and re-testing strategies;
—the best choice of architecture which permits the efficient testing of the relevant OSI products.

The Testing Services

In the very near future the following ten CTS-WAN harmonised testing services will be available within the EEC:

MHS Layers 4-7
MHS Layers 6-7
FTAM Layers 6-7
Teletex Layers 4-7
Teletex X-75 Layer 2
Transport
Session
Network X-21 DTE
Network X-21 bis Layer 1
Network X-25

These testing services are the result of work achieved in five carefully defined technical areas all of which incorporate a common methodology. The CTS-WAN contractors insistence on instigating and supporting a common methodology is an example of their determination to apply the highest standards of professionalism to this program.

In order to test a complete OSI product, several testing services may be used—depending on the products architecture. For example, to test a monolithic complete MHS product connected to an X-25 network would require the X-21bis, X-25/2-3, and MHS/4-7 test services. All of these can be arranged through a single point of contact.

The Testing Technology

Within CTS-WAN there is a choice of testing tools for use in most technical areas. This ensures that clients are not "locked in" to any one specific technology. However, the same abstract test specifications are implemented in all tools used for a particular testing service. All testing technology is demonstrated to be equivalent via the use of reference implementation.

Testing Technology

Technical Area	Test Tools
Network	MOSES (FTZ) TLX-21 (PTT-DK) OSITEST/X-25 (FITZ/Telefonica) NCT1 (CSELT)
Transport & Session	NCC T&S tester (NCC) RTLE-OSI (CNET/TITN/CAP)
Teletex	OSITEST/TTX (FTZ/DANET) RTLE-TTX (CNET/TITN/CAP) IDACOM (PTT-DK)
MHS	OSITEST/400 (FTZ/DANET) GENEPX 400 (CNET/SEMA/Marben)
FTAM	NCC FTAM tester (NCC)

The Reference Implementation

To ensure that different tools in geographically separated test labs consistently produce the same results, the CTS-WAN program has developed Reference Implementation (RIs) for each of the protocols covered. These RIs are configurable to be non-conforming in various ways and are used as the yardstick in assessing the correct performance of test tool technology and testing procedures.

Reference Implementation

Technical Area	Reference Implementation
Network	MOSES (FTZ) MPT (FTZ)
Transport & Session	OSIAM-C (Marben)
Teletex	PETRUS (FTZ)
MHS	CEMPS 400 (CSELT)
FTAM	FTAM RI (Bull)

Information and Public Domain Documentation

A catalogue has been prepared with information on the technical documentation available now from CTS-WAN. The catalogue is free but a charge (relating to the size of the document) will be made to cover duplication and distribution of all technical documents:

Below 50 pages	35 ECU
51-200 pages	50 ECU
201-500 pages	100 ECU
Over 501 pages	300 ECU

Technical documents will cover the areas Methodology, FTAM, MHS, Network, Teletex, Transport, and Session.

The Standards

European Functional Standards, CCITT Recommendations, and ISO Standards Relevant to the CTS-WAN Program

Technical Area	Functional Profiles	ENV	CCITT Recommendations & ISO Standards
Network	T/31 T/41 T/421 T/422	41107	CCITT X-25 CCITT X-21, X-21bis
Transport & Session	T/31	41104	ISO 8073, 8327
Teletex	A/221	41203	CCITT F-20 T-60, T-61, T-62, T-70, T-64, X-75/2, X-21, X-25
MHS	A/311 A/3211	41202 41201	CCITT X-400 X-401 X-408 X-409 X-410 X-411 X-420 X-400 Series Implementors Guide (Version 5) X-224 X-225
FTAM	A/111 A/112 A/13	41204	ISO IS 8326 and 8327 ISO IS 8224 and 8225 ISO IS 8822 and 8823 ISO IS 8649 and 8650 ISO IS 8571

First Phase of BICMOS Project Ends

3698A261 Amsterdam COMPUTABLE in Dutch 3 Jun 88 p 24

[Unattributed article: "First Phase of ESPRIT's BICMOS Project Completed"]

[Text] Eindhoven—In late May the first phase of the ESPRIT BICMOS project was concluded with a meeting at the Philips Physics Laboratory in Eindhoven, during which the functioning of a 14,000-transistor chip was demonstrated.

This ESPRIT project aims to develop a single chip combining bipolar and CMOS transistors. BICMOS technology combines the advantages of bipolar circuits (including high speed and good analog gain characteristics) and CMOS circuits (low energy use and compactness).

The project began on 1 April 1985 as ESPRIT I Project No 412 and was scheduled to last 5 years. The first phase lasted 3 years and involved 90 man-years at Philips and 30 man-years at Siemens. The Universities of Dublin and Stuttgart also collaborated in the project. The total cost of the project is estimated at ECU 31 million (approximately 75 million guilders).

Meanwhile, the project participants have already signed an agreement for the second phase: 60 man-years will be provided by Philips and 20 by Siemens. The first phase dealt with the application of 1.5 micron lithography techniques; the second phase will also focus on submicron structures.

Bull CEO on Europe's Technological Future

3698A259 Groot-Bijgaarden DE STANDAARD in Dutch 23 Jun 88 p 16

[Unattributed article: "Bull CEO Jacques Stern: 'United Europe Can Become the Cradle of New Humanism'"; first paragraph is DE STANDAARD introduction]

[Excerpts] Information science is a key factor in the development of a new business culture in Europe—a new humanism, as it was called by Jacques Stern, CEO of the French computer manufacturing group Bull, during a meeting with the press at the group's brand-new headquarters in Brussels. As Stern put it, "a strong Europe can exist only if it gains technical and industrial mastery over processing technologies. There is no reason why Europe, once the mainspring of humanism, could not assume this role again and generate a new kind of humanism based on the use of information and knowledge. This will require a combination of expertise, willpower, decisiveness, and courage." The Bull president thinks that cooperation among European information specialists is the best guarantee for a successfully united Europe. However, there is still a long way to go.

ESPRIT

The trend toward internationalization of the telecommunications and data processing markets highlights the importance of international standards, says Stern. That is why in 1983, Bull and 11 other manufacturers founded SPAG [Standards Promotion and Application Group], which is to develop an international standard for computer communication networks and help introduce CCITT-ISO [Consultative Committee of International Telephone and Telegraph— International Standards Organization] standards. The X/Open Group is using a similar procedure for applications running on the UNIX operating system.

In addition, computer users are demanding more specialist applications: engineers, physicians, lawyers, small- and medium-sized company managers, executives, etc. Thus, solutions geared toward the user's specific requirements are needed now more than ever.

European industry has a lot to gain from this cooperation. It must ensure that the cooperation is based on our cultural values: respect for the freedom of others and harmony in diversity. "Indeed, who can understand Europeans better than the Europeans themselves?," asks Jacques Stern rhetorically.

However, technological cooperation must be linked to commercial cooperation. Stern attributes a major role in this regard to the ESPRIT program, since it caused a profound change in industry's attitude, which is now more disposed to cooperation with universities, research centers, and users.

In Stern's opinion, the existence of standards opens up new markets and stimulates joint product development and, possibly, manufacturing. Moreover, it enables EC member countries with less developed industries to catch up with the rest. Stern believes that "the existence of standards will put an end to the formation of industrial monopolies."

Training

Stern also defines a chore for European politicians. He rules out any form of protectionism, but urges the European Community to demand reciprocity from its commercial partners. Europe has succeeded in becoming a world leader in digital electronic communications, data transmission, and videotex. Stern calls for the development of regulations, a set of standards applicable to all countries with a private sector active in those areas. In this respect, he advocates the introduction of a European supranational institution responsible for elaborating these regulations and ensuring their application.

Stern also wants to capitalize on the enormous potential of human knowledge in Europe through a European institute of higher education, where students and professors can develop without restrictions. An "alternative learning" process is the obvious solution, he believes. Research and development must be combined, and students must have access to advanced technological tools throughout the learning process.

Europe is well on its way to become a major data processing power, Stern concludes. This movement should gain momentum and depth, not to protect us within new borders, but to improve European firms' competitive position within the European market.

Belgium, FRG Cooperating in Advanced Microelectronics

3698A258 Groot-Bijgaarden DE STANDAARD in Dutch 27 Jun 88 p 6

[Article by G. B. O.: "Flanders and Baden-Wuerttemberg Form 'Technology Axis'"; first paragraph is DE STANDAARD introduction]

[Text] Stuttgart—Minister Gaston Geens [leader of the Flemish Regional Government], together with members of the Flemish Council and representatives of the business community, have visited the capital of the West German federal state of Baden-Wuerttemberg to discuss technological cooperation. "Flanders seeks to expand its technological contacts with other European regions and to cooperate with nonmember states and the Third World," said Geens in announcing that an initial cooperation agreement had been reached between the Flemish chip manufacturer Mietec and the Stuttgart Institut fuer Mikroelektronik [IMS].

The 50 or so Flemish delegates attending this first Baden-Wuerttemberg/Flanders Technology meeting were shown the Stuttgart-Pfaffenwald technology center. They saw demonstrations of automated chip testing, heavy high-frequency equipment, optical sensors, composite materials, high-power lasers for steel-plate cutting, and other technical marvels.

Martin Herzog, regional minister for science and economy, mentioned the influence of Ghent, Bruges, and Antwerp on the economic and technological development of Baden-Wuerttemberg over the past 150 years and said that this joint technology day was a result of this historical development. Gaston Geens, too, regarded this day as part of an ongoing evolution, namely the "Third Industrial Revolution in Flanders (DIRV)."

Flanders wants to export its DIRV program. It aims to play a major role among the European regions, and Geens was anxious to tell the Germans why: Flanders has the highest export rate per capita in the world, exporting goods and services worth DM475 million per day. "Although we do not export raw materials or energy, our exports per capita are five times that of Japan and seven times that of the United States," Geens said.

Flanders possesses major high-technology research centers that have achieved internationally recognized results. Geens reminded his audience that Professor Montagu of Plant Genetic Systems in Ghent, and his colleague Professor Schell, director of the Max-Planck Institute in Cologne, recently received the IBM award for pioneering European research.

Mietec

According to the president of the Flemish Executive Council, cooperation with Baden-Wuerttemberg must focus on microelectronics, biotechnology, and advanced materials. In these areas both regions can be equal partners, since they possess institutes that complement each other. The Stuttgart technology center that the Flemish delegation visited has extensive experience in transferring application-oriented research results to small companies in particular. This kind of experience could be useful for Flanders.

It became clear that this cooperation was already producing effective partnerships at the close of the day, when Geens announced that an agreement had been reached between the IMS from Stuttgart and Mietec from Oudenaarde.

Mietec was founded in 1983 by Bell Telephone and the Regional Investment Authority for Flanders. The company, employing some 280 people, is particularly well equipped for developing new VLSI (Very Large-Scale Integration) technologies and CAD (computer-aided design) software.

The IMS is a public institution with a permanent staff of 65. It performs subcontracted application-oriented microelectronics research and develops chip prototypes.

Contacts between the Flemish Organization for Robotics and Automation (FLORA) and the Fraunhofer Institute for Production Technology and Automation are expected to lead to cooperation in the field of robotics.

SCIENCE & TECHNOLOGY POLICY

FRG Research Association's Plan Presented

3698A245 Paris CPE BULLETIN in French Apr-May 88 pp 29-32

[Article by Roger Bluzat based on a report by Cristophe Jeandel of the Scientific Service attached to the French Embassy in Bonn: "Medium-Term Plan of the German Research Association"; first paragraph is CPE BULLETIN introduction]

[Text] The DFG [German Research Association], in its "Grauer Plan" (Gray Plan), has outlined its plans for medium-term research and financing. Several thousand scientists were consulted, resulting in an in-depth picture of the situation in almost every discipline and highlighting major plans for future research as well as current inadequacies.

On the whole, the DFG considers that:

—support for young researchers is a priority;
—the technological revolution has led to new questions concerning the content of research and to higher prices for materials;

—new research structures have become necessary, particularly in the life sciences and in medicine, due to the growing interdisciplinary nature of these disciplines;
—the promotion of applied research threatens the freedom of research when it is used as an excuse for failing to promote general research.

Despite the increase in government funding for universities in recent years (DM22.4 million in 1986), DFG allocations to universities, according to scientific evaluations, have decreased considerably in relation to outside financing: from 48.3 percent in 1980 to less than 40 percent in 1985. If this trend continues, the threat to the independence of university research from outside interests will have to be taken seriously.

Funds given by the government to universities, either directly or through the DFG, to specific programs and objectives are not permanent grants. Over the past 4 years, these grants have quadrupled (DM92.2 million in 1987), whereas overall funding of nonspecific research has increased by only 10 percent, to DM973.2 million. The DFG estimates that overall funding of research and of priority research areas (SFB) will increase by 5 percent in 1988 and by 5.5 percent in 1989 and 1990.

In the coming years, the DFG expects an increase in university-initiated projects meriting a subsidy: They increased from 7,100 in 1979 to 8,600 in 1986. Concerning the SFB's, which have been extraordinarily successful (157 projects financed as of 1 January 1987), the DFG insists that they be carried out at one specific location.

Biomedical Sciences

Biological and medical sciences are progressing at lightning speeds, according to the DFG, which continues to encourage interdisciplinary projects. Specialized service centers will increasingly be entrusted with equipment supply, maintenance, and management. In the coming years, the DFG will allocate substantial resources to biochemical research, either for biologists in clinical and theoretical medicine or for genetic engineering research.

- The DFG has noted a lag in the area of toxicology: Research will primarily focus on the interaction of bacteria, fungi, and fungal secretions with the host organism.
- In virology, many questions remain unanswered: The DFG will finance research into pathogenic viruses; persistent viral infections and AIDS will be studied in particular.
- In parasitology, there are some gaps to fill in the areas of immunological testing as well as in basic research into systematics and taxonomy. Although the FRG is moving ahead in photosynthesis research, this is not the case for the study of ecosystems, neither in botany nor zoology.
- The situation in neurobiology (membrane channels, genesis of functional units of nerve cells, the sensory system) is considered good.
- In immunobiology, the autotolerance of the immune system and the production of human monoclonal antibodies are the major themes that receive and will receive long-term funding.
- Research into proteins will play a dominant role in biotechnology.
- In anatomy and pathology, the DFG recommends that the effects on the entire organism of the findings of molecular and cellular research be taken into account.
- In physiology and pathophysiology, the DFG will give priority to the understanding of membrane processes in excitable structures, the transcellular and paracellular movement of fluids and matter, neuroendocrinology, the pathophysiology of tumors, and the study of the central nervous system and sensory organs.
- In pharmacology, the DFG emphasizes the need to carry out more thorough pharmacodynamic studies of complex systems and to develop clinical pharmacology.
- In human genetic research, the DFG will emphasize research into genetic risk factors for certain common diseases (e.g., diabetes) and on specific genetic defects.
- In clinical medicine, research will mainly involve the study of the vascular endothelium and the causes of cardiac diseases (systematic and coronary hemorheology).
- In clinical psychiatry, the current monocausal understanding of diseases will have to make way, if possible, for the simultaneous application of the methods and approaches of the exact, social, and behavioral sciences.

Exact Sciences

The DFG has observed widespread unease among the public regarding the undesirable consequences of discoveries in the hard sciences and biosciences; this is due to a lack of basic knowledge on the part of the general public, but also to the failure of scientists to present their work publicly. Ecology, for example, has brought to light the many questions that remain unanswered by science.

- The extraordinary progress in mathematics makes the study of nonlinearity a major challenge; however, the computers needed for experimental research in this area are rarely found today in universities. Complex problems in climatology and the engineering sciences need solutions that can only come from nonlinear mathematical methods.
- A new impetus has been observed in basic physics research (the theory of unification) and in multidisciplinary fields in which physics plays an important role, e.g., biophysics, medical physics, synergetics, the study of chaos, and the chemistry of complex reactions.
- According to the DFG, the FRG is now at the international level in solid physics, even if further research into amorphous semiconductors is needed

before photovoltaic cells can become a valuable energy source (new ideas are essential to progress in the rational use of energy). Considerable progress is expected in optoelectronics.

- Regarding chemistry, the possibilities offered by coordinated research are underutilized; this is why supraregional topical programs are being prepared, particularly for photochemistry, high-performance ceramics, and transition-metal-containing proteins and their complexes. The prospects for chemistry include the improvement of enantioselective synthesis of essential amino acids from easily obtainable and inexpensive sources; optical absorption and fluorescent yield of organic pigments; the improved utilization of data processing in spectroscopy; "self-strengthening" polymers, synthetic lenses, and theoretical research into catalysis.

Environmental Studies

The geosciences are exemplified by their international cooperation programs. For example, the International Geosphere-Biosphere Program (IGBP-GC), scheduled to begin in 1990, will carry out a study of the physical, chemical, biological, and geological processes that interact and control the "geosystem." A SCAN center devoted to geosciences will be built in Hannover. Lastly, attention should be drawn to the KTB continental deep-drilling program begun in September 1987.

However, the FRG lacks high-performance neutron sources for the analysis of crystalline structures in mineralogy; moreover, more projects should be initiated in isotope geochemistry, geochronology, and petroleum prospecting. The GEOMAR marine geosciences institute, which the DFG had proposed, is in the process of being established.

In naval research, the major topics are ocean-atmosphere interaction and the cycles of chemical bodies. The North and South Atlantic and the polar regions are important fields of study for FRG researchers, who will examine marine biotopes and the influence of toxins on them.

Engineering Sciences

The DFG has noted a trend toward basic research in engineering sciences. In materials research, the most frequently studied areas are the structure of boundary layers, composite materials, the mechanical behavior of materials, fatigue processes, complex stress resistance, and high-temperature corrosion. In synthetic materials technologies, research focuses on the structural characteristics of certain categories of materials, physical-mathematical models of various processes, assembly techniques, composites behavior, and polymer recycling.

- In ergonomics, interdisciplinary projects are beginning to succeed in construction techniques; the DFG is conducting six research projects on materials-handling techniques that should lead from "isolated" to integrated solutions.
- In architecture, urban studies, and land development, the emphasis will be on ecology, man's needs, the decisionmaking and decision-implementing processes, urban restoration, and construction in the Third World.
- In electronics and electrical engineering, the DFG has observed increased interactions between data processing and telecommunications on the one hand, and data processing and energetics/automation on the other. Universities are increasingly helping industry solve its problems.
- There are many major topics for future research in data processing: artificial intelligence and knowledge-based systems, pattern recognition, robotics, software engineering, networks, computer graphics, factory and office automation systems, modeling, performance evaluation, the reliability of data processing and data storage systems, man-machine interaction, and new computer architectures.

French Participation in Recently Approved EUREKA Projects Noted

3698A330 Paris RECHERCHE TECHNOLOGIE in French Jun 88 pp 2-5

[Unatributed article: "EUREKA: Sixth Ministerial Meeting"]

[Excerpts] [French Research Minister] Hubert Curien held a press conference on 22 June 1988 in which he outlined the results of the EUREKA sixth ministerial meeting held in Copenhagen 15-16 June.

France participates in about half of the EUREKA projects (102 out of 213), and the share of the projected investments assumed by French companies represents more than a quarter of the overall total (Fr 9.6 billion out of Fr 33 billion).

France will maintain this level of participation, playing a role in 21 of the 54 projects approved for EUREKA at Copenhagen (see table).

Redirection of Procedures and Initiation of Ancillary Activities

Reinforcing EUREKA's success in promoting European cooperation, it is now possible to build on the previous 3 years' experience to redirect procedures and initiate or bolster ancillary activities.

Accordingly, project selection will be redirected in favor of projects with a high technological content and offering the best prospects for industrial development and cooperation. Thus, projects that appear the most likely to lead to the development of marketable products or procedures and those that represent long-term industrial cooperation will be given preference.

Introduction of Complementary French Initiatives

The participants at the Copenhagen ministerial meeting emphasized that the stakes in European technological cooperation are not limited to financial matters, and they restated the importance of the additional promotional measures approved in the 1985 Hannover declaration. Complementary French initiatives will thus be undertaken that will include:

- A greater awareness, on the part of standardization authorities, of industrial innovations resulting from EUREKA projects. It will be particularly important to ensure that the lack of adequate standards does not prevent the marketing of new products that meet consumer demands;
- Advice to small- and medium-sized enterprises (PMIs) in drafting their industrial property agreements. Regional industrial and research directorates (DRIRs), the National Institute of Industrial Property (INPI), and the National Agency for the Promotion of Research (ANVAR) will be making some suggestions to this end.

Distribution by Sector of the 213 Projects Approved for EUREKA on 22 June 1988

Areas of Activity	Total Projects	Projects with French Participation
Information Technology	35	15
Automated Production, Robotics	46	26
Materials	21	10
Transportation	11	5
Ocean, Environment, City planning	12	4
Biotechnology and Medicine	40	16
Lasers	13	7
Energy	10	6
Communications	11	5
Microelectronics	14	8
Total	213	102

French Participation in EUREKA

	Projects with French Participation			Projects without French Participation		Total EUREKA Projects	
	Number	Total Cost (million Fr)	French Share (million Fr)	Number	Total Cost (million Fr)	Number	Total Cost (million Fr)
Hannover (Nov 1988)	7	2,063.5	586.5	2	239.8	9	2,303.3
London (Jun 1986)	38	17,354.3	6,220.0	19	1,228.1	57	18,582.4
Stockholm (Dec 1986)	15	3,222.6	1,325.7	22	1,323.4	37	4,546.0
Madrid (Sep 1987)	21	2,629.8	914.4	35	2,555.9	56	5,185.7
Copenhagen (Jun 1988)	21	1,385.1	577.0	33	1,290.8	54	2,675.9
Total	102	26,655.3	9,623.6	111	6,638.0	213	33,293.3
		or3,807.9 millionECU	or1,374.8 millionECU		or948.3 millionECU		or4,756.2 millionECU

List of Projects with French Participation Approved at Copenhagen

	Name	Scope	Prinicipal Companies	Cost	Duration
EU 123	Medium for industrial culture of animal cells	R&D for methods of nutrition and purification for optimal growth and control of large-scale production of mammal cells	LBE (Sp), IBF Biotechnics (Fr), Diosynth (Nl), APP (UK)	Fr 26.1 million; French share: Fr 10.5 million	4 years
EU 237	Synthesis of complex sulphated oligosaccharides (research phase)	Development of sulphated oligosaccharides for the prevention of veinous thrombosis and development of new synthesis methods in the field of glucides for other applications.	Choay Institute(F), Organon International (Nl)	Fr 42 million; French share: Fr 21 million	3 years
EU 238	Samovar (feasibility phase)	Development of a pilotable aerospace module (MAP) for the transport of heavy, voluminous loads (houses, etc.). Cooperation within the EUREKA framework focuses on the resolution of technical problems linked to air-skin material, aerodymanics, and MAP maneuverability.	Phenol Engineering (Fr), High Performances Fibers (Nl)	Fr 5.3 million; French share: Fr 2.8 million	1 year
EU 240	Tasque	Development of a set of tools to forecast, test, and evaluate the quality of software under development.	CEP (Fr), Tuev Hamburg (FRG); interested in project: NCC (UK), ENEA (It)	Fr 36 million; French share: Fr 14.8 million	4 years
EU 241	FAMOS: Arcade	Automatic assembly facility for clutch components of private cars (disks, housings, etc.)	Valeo (Fr), Dea (It)	Fr 131.6 million; French share: Fr 72.3 million	4 years
EU 242	Space Bio Separation: SBS	Development of a more effective technique for the purification of biotechnology products. Validation and refinement of the technology on earth and in space.	Biospace Technology (Bel), Esclat (Sp), Matra (Fr)	Fr 176 million; French share: Fr 70 million	6 years
EU 247	Creation of varieties and organoleptic qualities	Biochemical quantification of the major characteristics of fruit flavors to avoid "qualitative accidents" in production that create marketing difficulties.	Biosem (Fr), Vioryl (Gr)	Fr 9.8 million; French share: Fr 3.8 million	4 years
EU 249	Laser manufacturing technology	Development of a database on CO_2 and YAG laser applications; development of YAG-specific machines for particular applications. The aim of Air Liquide is to master cutting and welding techniques through greater knowledge of the influence of auxiliary gases on the beam-material interface.	Anyak Industries(Sp), Air Liquide (Fr), Osai (It), Lunomics (UK)	Fr 140 million; French share: Fr 26.9 million	5 years

List of Projects with French Participation Approved at Copenhagen

	Name	Scope	Prinicipal Companies	Cost	Duration
EU 260	Labimap 2001 (definition phase)	Development and marketing of a line of compatible robots to cover all the operations of molecular biology applied to the study of DNA functions.	Bertin (Fr), Amersham International (UK)	Fr 52 million; French share: Fr 26 million	2 years
EU 261	Europari (definition phase)	Project concerns aeronautics applications of CAPM [computer assisted production management]. The aim of the definition phase is to identify other industrial sectors capable of contributing to Europari-type projects and of utilizing the results.	Casa (Sp), Aerospatiale (Fr), Aeritalia (It), British Aerospace (UK); interested in project: MBB (FRG)	Fr 28 million; French share: Fr 7.8 million	1 year
EU 262	FAMOS: FAME	Research, development, and production of a versatile assembly facility for the manufacture of gas flowmeters.	Somel (Fr), Kromschoeder (FRG), Thorn-Emi (UK)	Fr 168 million; French share: Fr 56.8 million	5 years
EU 267	Sparkling and foaming beverages	Research into sparkling and foaming beverages in order to improve the quality of existing products and to develop new ones with well-defined foaming characteristics that appeal to consumers.	Moet Hennessy (Fr), Heineken (Nl)	Fr 23 million; French share: Fr 6.5 million	6 years
EU 278	Calies	Development of a system to restore the motor abilities of paraplegics through neurostimulation technology. The system includes implanted components (electrodes, electronic guidance modules) and external components (sensors, control modules, etc.).	Bertin (Fr), BHP laboratories (Irl), BTS (It)	Fr 88.7 million; French share: Fr 43.5 million	4 years
EU 280	Paciflor	Development of a heat-resistant probiotic, Paciflor, to be used, in lieu of antibiotics, as a nutritional additive to promote farm animal growth and economize on feed stocks.	Metall und Farben (Austria), Guyomarch (Fr), Kunath Futter (Switz)	Fr 6.4 million; French share: Fr 3 million	3 years
EU 281	New-generation low-lubrifying power fluid pump	Design and development of two types of pump that operate without oil: 1. high-speed centrifugal pumps for aircraft engine turbines, that use kerosene; 2. immersion pumps that operate in water of varying degrees of purity.	HEF (Fr), ABS Pumpen (FRG), Dowty Fuel System (UK)	Fr 5.8 million; French share: Fr 3 million	4 years

List of Projects with French Participation Approved at Copenhagen

	Name	Scope	Prinicipal Companies	Cost	Duration
EU 282	Ideha	New-generation electric motors that combine new materials with new electronic components to automate the operation of various types of screens in the home (shutters, gates, doors, awnings, etc.).	Somfy (Fr), Pavesi (It), EPFL (Switz)	Fr 60.5 million; French share: Fr 30 million	6 years
EU 283	Synthetic TV	Research and development of a system for the creation and exploitation of realistic artificial television backdrops. The system combines real-time three-dimensional image sythesis technology with computer-assisted photo technology.	Telson (Sp), TDI (Fr), Videotime (It)	Fr 55 million; French share: Fr 22.5 milion	5 years
EU 284	Famos: versatile refrigerator assembly plant	R&D and construction of a versatile refrigerator assembly plant.	ICI (Bel), Safel (Sp), Selnor (Fr), Cannon Crios (It)	Fr 60 million; French share: Fr 29 million	4 years
EU 285	FAMOS: versatile shoe factory	R&D and construction of a versatile shoe factory.	Inescop (Sp), Imbert (Fr)	Fr 43 million; French share: Fr 20 million	4 years
EU 287	Murex (definition phase)	Technical and economic research into an automated, modular system for inspection, maintenance, and repair of submerged marine structures. The system uses artificial intelligence to decentralize control and improve tool efficiency.	Subsea Industries (Bel), ECA (Fr)	Fr 7 million; French share: Fr 3.5 million	1 year
EU 290	Corn RFLP's	Genetic improvement of corn through RFLP technology (fragment length restriction polymorphism) to select qualitative characteristics (disease resistance) and quantitative characteristics (yields, rapid growth).	Biosem (Fr), Ami (It), Van der Have (Nl), KWS (FRG)	Fr 84.7 million; French share: Fr 12.3 million	5 years

TECHNOLOGY TRANSFER

COCOM Violations Discussed

3698A242 Amsterdam COMPUTERWORLD in Dutch 12 Apr 88 p 2

[Article by W. K.: "East European Interest in Second-Hand Computers: Major Part of Illegal Exports Does Not Violate Regulations"]

[Text] Haarlem—According to an Austrian official entrusted with monitoring compliance with COCOM regulations for the export of high-technology products to the Eastern bloc, a large part of the illegal exports is merely a result of neglect.

At a recent meeting organized by the Computer Brokers Exchange (CBE) in Rome of over 280 computer brokers from around the world, the official said that 70 percent of all cases of illegal exports detected would have been perfectly legal had the necessary permits been applied for.

CBE Director Peter Moree said he expected the second-hand computer market in the Eastern bloc countries to expand rapidly, because their business automation levels are still exceptionally low. "In Moscow, for instance, visual displays are hardly ever used in departments or in enterprises," he stated.

Liberalization

Moreover, export restrictions will be made less stringent this year. The maximum memory capacity allowed will increase from 3 MB to 8 MB for mainframes, from 875 MB to 1.75 GB for disk storage devices, and from 1,600 BPI to 6,250 BPI for tapes.

Soviet Embassy officials have visited the CBE offices in Haarlem on several occasions to learn more about the second-hand equipment market. In fact, Eastern bloc countries seem willing to pay for their computers in cash rather than resort to the so-called barter agreements needed for other products.

A new development within the brokers' world is the strongly growing interest of American colleagues who want to take advantage of the low dollar rate to increase their sales figures in Europe. Information on second-hand equipment in the United States is now available through the CBE network, which provides information on more than 3,000 large computers and peripherals offered by 200 U.S. and 300 non-U.S. brokers.

COMPUTERS

GDR's K1840 Superminicomputer Offers Expanded Capacities

Overview

23020022 East Berlin NEUE TECH. BUERO in German No 3, 1988, pp 65-66

[Article by Dr of Engineering R. Kempe, Graduate Engineer M. Lauermann, and Dr of Engineering S. Lindner, Dresden Robotron Electronics VEB; Dr E. Bernitz, E. Heiden, and Dr W. Schulze, Berlin Robotron Marketing VEB: "The RVS Computer System robotron K 1840—an Overview"]

[Text]

1. Introduction

With its new 32-bit computer system with virtual memory, the robotron K 1840 (RVS K 1840), the Robotron Combine is completing the transition from the 16-bit to the 32-bit architecture in the sector of high-powered minicomputers. Computers of this performance class are referred to internationally as superminicomputers.

In the SKR [System of Minicomputers] the class M32 has been created for these computers. As of now the RVS K 1840 is the most powerful computer of this class, and it is the logical extension of the 16-bit line of the SKR (CM 3, CM 4,...) in the 32-bit domain.

The RVS K 1840 is a multistation computer system with high-performance capabilities designed primarily for CAD/CAM applications that have extremely exacting demands. These application requirements were also the main reason for introducing another high-powered computer line in addition to the ESER [uniform electronic data processing system] technology used above all for processing large masses of data.

2. Chief Features of the New Computer Architecture

2.1. The Virtual Memory

The abbreviation RVS (computer system with virtual memory) already characterizes an important feature of this new equipment class. The virtual memory concept allows the user to write programs up to 1 Gbyte in size within the 4-Gbyte virtual memory space. The virtual memory represents the address area directly available for every user program, without it being necessary to take into account thereby the actually existing main memory or other users.

2.2. The Concept of a Process

The process is the basic unit of management for a task that is to be executed. Every process is managed by the operating system. It consists of the virtual address area for the program code and the data as well as a hardware context and a software context.

2.3. Instruction Set and Data Types

The 32-bit architecture permits an extensive instruction list with high-performance capabilities consisting of over 300 basic instructions that can be combined with 6 basic data types and 9 fundamental kinds of addressing.

Moreover there are also instructions for the manipulation of individual bits or bit fields of variable length. A large group of special instructions supports the organization of processes, the management of queues in the operating system, and so forth.

2.4. Other Features

In addition to these basic properties, the following features are characteristic of the RVS K 1840:

—The utilization of cache principles for the look-ahead providing of instructions, for address transformation, and for the accelerated providing of data contributes greatly to the high processing capabilities of this computer.

—Comprehensive diagnostic tools ensure a high data reliability.

—A high-powered I/O concept permits the connecting of large external storage systems and a wide range of standard and graphics peripheral devices.

The new architecture line also ensures upwards compatibility for the SKR computers K 1600, CM 3, CM 4, and analogous types by an implementing of the basic instruction set of these computers in the RVS K 1840.

The inclusion of the SKR unit bus permits the further utilization of peripheral components of existing SKR computers.

3. Overview of the Hardware

Due to the above-mentioned architectural features, in the RVS K 1840 an average speed of operations of about 1.1 million operations/s is achieved.

Thus the RVS K 1840, along with the new ESER computer EC 1057, is the most high-powered computer currently being made at the Robotron Combine.

In this connection the real-time capability of the RVS K 1840 should be emphasized in particular. Given the high processing capacity of this computer, in typical applications several users can work at the same time with one computer in such a way that it seems as if it "belongs to each user alone." Moreover this real-time capability is a prerequisite for process applications in the CAM sector.

The core of the RVS K 1840 computer consists essentially of the processor with accessory attachments, a real-time and a battery-backed calendar clock (date and time of day), the main memory with a maximum capacity of 16 Mbytes, and the I/O adapters. Moreover there are two types of adapters: The SKRBUS adapter and the MSBUS adapter.

The SKRBUS adapter (SBA) forms the SKR unit bus, called the SKRBUS for short, to which are connected via controllers the standard I/O devices, the graphics peripheral devices, and the magnetic-tape equipment. Up to 44 plug-in positions for the controllers are available in the computer, so that a large number of interfaces can be created. In the standard design the computer has 24 serial interfaces, individually selectable as IFSS or V.24 asynchronous, and in addition 3 synchronous V.24 interfaces and 3 parallel interfaces (IFSP, Centronics, or other). The upgrading possibilities are virtually unlimited.

The MSBUS adapter (MBA) forms the mass storage bus, called the MSBUS for short, to which primarily the fast disk storage devices are connected.

There is a wide range of peripheral devices that can be hooked up:

Work stations:
User work stations available include both alphanumeric video terminals robotron K 8911.80 and also graphics terminals such as the IGT robotron K 8918.

Personal and work-station computers:
Personal computers and work-station computers such as robotron 1715, A 7100/7150, and EC 1834 can also be connected up so long as they have a basic range of terminal-emulating functions. To that end a coupling and file-exchange program is being prepared.

Printers:
The printing equipment consists primarily of the fast parallel printers VT 27060 and VT 23600 from the Hungarian People's Republic. Dot-matrix printers of the types robotron K 6313/14 or K 6327/28 can be used both directly and also as hardcopy printers at the terminals.

Graphics peripheral devices:
At present the range of graphics peripheral devices includes not only the IGT K 8918 inclusive of the graphics palette robotron K 6405 and hardcopy printer but also the A2-plotter robotron K 6411 and the digitization device robotron K 6404.20.

Disk storage:
Large disk storage devices are an important feature of the RVS K 1840. At present a maximum of 16 disk storage devices of various types can be connected up. With that a total maximum disk-storage capacity amounting to 3.2 Gbytes is achieved.

Magnetic-tape equipment:
Because of the highly efficient and fast work possible by using disk storage devices, magnetic-tape equipment recedes into the background. It is used primarily as a backup and data-exchange medium.

Connection to local networks:
A local network controller robotron K 8681 with the transceiver robotron K 8602 is now in preparation; these will permit a hook-up to a local network of the type ROLANET2. This is a high-speed LAN [local area network] based on the CSMA/CD process, with a transmission rate amounting to 10 Mbits/s.

4. Overview of the Software

The extensive hardware options of this computer are supported by equivalent software products.

4.1. Operating Systems and Compilers

Two operating systems, SVP 1800 and MUTOS 1800 are available, which free the user from housekeeping and routine work, and which ensure that a number of users can work simultaneously and independently, while being protected at the same time from mutual interference. The operating system SVP 1800 is a high-performance system that supports batch processing, real-time processing, and multi-user work in the dialogue mode.

With the operating system MUTOS 1800, MUTOS programming is being implemented for another computer series of the Robotron Combine and thus a computer-independent operating-system interface is being made available to the users. For the operating systems SVP 1800 and MUTOS 1800 the compilers for FORTRAN 77, C, and MODULA-2 are currently being offered.

4.2. Data Base Systems

For the effective management of large blocks of data, two data-base operating systems (ALLDBS for SVP 1800, DABA 32 for MUTOS 1800) are provided that operate according to the relational data model. Both systems are multi-user systems for the interactive working mode and for batch operation.

4.3. Basic Graphics Software

For the time being, basic graphics and geometrics software for CAD applications is being provided only for the operating system SVP 1800. This includes the Graphic

Core System (GKS) and geometry simulators. In this connection the GKS 1800 implements the GKS standard on the basis of ISO 7942, Level 2c.

For various user groups different geometry simulators are available:
—Simulation system Geometric Construction GEKO 1800
—Geometry simulation system GEMO 1800
—Geometry Modular System GBS 1800 (in preparation).

GKS 1800 is operated as a graphics interface.

4.4. Network Software

For computer couplings in connection with remote data processing and for the establishment of local computer networks, the following network-software packets are provided:
—The packet SKRNET under SVP 1800 for local and remote computer couplings and for the local network ROLANET2
—The packet UUCP under MUTOS 1800 for local and remote computer couplings via IFSS/V.24, inclusive of DNUe [data local transmission device] and modem.

5. Fields of Application

The main fields of application of the RVS K 1840 lie above all
—In the designing and simulation of very-large-scale integration circuits,
—in the automated designing of highly complex printed circuit boards,
—in intricate designing, drawing, and planning work with two-dimensional and three-dimensional objects,
—as central control computers in general CAD/CAM applications with automated assembly lines, ranging as far as the automated factory.

By using the RVS K 1840, effects on an order of magnitude that is economically significant can be achieved. These include, for example, the shortening of development times by up to 80 percent, increasing labor productivity to 500 percent or more of its former value, and a substantial savings in manpower, material, and energy.

6. Centralized Marketing

Because of the complexity of the hardware and software, a marketing of the RVS K 1840 that is efficient for all parties can be most appropriately achieved (in a manner similar to the marketing organization for ESER equipment) by a centralization of the marketing function. For this reason, Berlin Robotron Marketing VEB was assigned the role of system supplier.

The role of system supplier covers the providing of the RVS K 1840 as a unity of hardware components—chosen in accordance with the existing system—and of basic software, and includes in detail the following services:
—The specification of the object of delivery (the delivered system), to be done jointly with the user,
—the actual physical delivery,
—in the areas prepared by the customer, the startup and transferring of the delivered system to this customer,
—the training (hardware and software),
—the organizing and tasks-sharing implementation of the hardware and software customer service, inclusive of providing replacement parts and measuring and testing tools.

These services are to be stipulated on the basis of a corresponding balance-sheet proportioning in commercial contracts between the customer and Berlin Robotron Marketing VEB, or—if there is a tasks-sharing implementation within the Robotron Combine (see following comments)—with other enterprises of this combine. Within the Berlin Robotron Marketing VEB, project engineers are employed to assist each customer. They are responsible for the configuration of the delivered system, the planning of the computer system on the basis of the requirements of the user (which if necessary are to be defined more sharply in joint discussions on desired applications), and also a post-planning in the case of optional retrofittings. The configuration of the delivered system includes the software suppliable by Berlin Robotron Marketing VEB.

7. Software Customer Service

The software customer service offered for the supplied software components includes software implementation and maintenance. The maintenance includes all services that help to increase the software's utility value (usefulness) and to eliminate functional aberrations. It includes the determination of the causes of functional aberrations and their elimination as well as the conveying of program maintenance information to the customers and supporting the customers in the use of new output units or of modifications of software components. Within the guarantee period this maintenance is a part of the guaranteed services for the delivered software, but outside the guarantee period such maintenance is to be agreed on separately by contract, is the implementation.

The software customer service for the operating systems SVP 1800 and MUTOS 1800 as well as for the basic graphics software (GKS 1800, GEMO 1800) is executed by Berlin Robotron Marketing, whereas the Dresden Robotron Project VEB is responsible for customer service for the computer networking software, the data-base software, and the compilers FORTRAN 77, C, and MODULA-2.

8. Technical Customer Service

The technical customer service for the RVS K 1840 is organized on the basis of the time-tested territorial principle for the sake of ensuring short response times, and it is carried out by the appropriate Robotron servicing enterprise together with its customer-service centers. The main functions of the technical customer service include:
—technical assistance
—providing expendable working parts, replacement parts, and replacement subassemblies
—providing product-specific servicing accessories
—providing servicing documentation
—modification service for the hardware.

In addition to assembly and startup, the main content of technical assistance is upkeep. This upkeep is organized on a tasks-sharing basis between the user and the appropriate servicing enterprise. Within the framework of this division of labor the user's servicing personnel has the responsibility for maintaining the hardware system, trouble-shooting, and debugging. For trouble-shooting the servicing personnel has available a high-powered diagnostic system, which for both the computer system and the bulk of the peripheral devices permits the defective subassembly to be determined. The removal of errors is done by exchanging those subassemblies recognized as defective.

For technical problems that the user cannot solve himself, in the Robotron Combine there is a breakdown-servicing system that is directed by way of a constantly staffed dispatcher service. The nearest level of this breakdown-servicing system to the user is that of specialist teams from the Robotron servicing enterprises. A servicing center at Berlin Robotron Marketing VEB operates in support of these specialist teams. The main tasks of the servicing center include, among other things:
—Error diagnosis for selected systems
—Further development of the diagnostic system by way of establishing and managing error statistics
—Setting up of a consultation system for mechanical breakdowns (expert system).
—Modification service for the overall system.

9. Instruction

The instructing of the technicians of the Robotron Combine and of the users includes basic and advanced-training courses in theory and practice for maintenance, error determination (specifically, the use of the diagnostic software), and exchanging of subassemblies for all hardware components belonging to the existing system.

For the software groups provided by the Robotron Combine, namely
- operating systems,
- basic graphics software,
- compilers, and
- data-base systems
- an appropriately modularly organized training plan is offered for teaching the software specialists of the users to become qualified in handling these. The training of the hardware and software specialists is carried out by the instruction center of Berlin Robotron Marketing VEB.

Architecture/Hardware

23020022 East Berlin NEUE TECH. BUERO in German No 3, 1988 pp 67-72

[Article by Graduate Engineer G. Gieszinger, Graduate Engineer F. Kenner, and Graduate Engineer H. Rapp, Dresden Robotron Electronics VEB: "Architectural Features and Hardware Overview of the RVS robotron K 1840"]

[Text]

1. Introduction

In addition to a powerful processing capacity and a large and independent address space for each user, the RVS robotron K 1840 also offers the efficient implementation of multi-user capability, real-time capability, dialogue capability, multiprocessing, and data reliability.

2. Architectural Features

2.1. 32-bit Architecture

The registers and data paths are materialized using a width of 32 bits. There are likewise 32 bits available for the addressing.

2.2. Process Concept

One typical feature of multiuser systems is switching back and forth among tasks being handled at the same time. These tasks are called a process, and they consist of instructions and data that are characterized by a hardware context and a software context. The transition from one process to another takes place through a change of context, in which the context of the previous process is saved and that of the new process is loaded. This course of events is supported by special instructions within the computer. This process switching makes it possible to efficiently utilize the resources of the computer and to run the separate processes in accordance with the priority assigned to them.

2.3. Virtual Memory Concept

The RVS K 1840 makes available a virtual address space of 4 gigabytes. This virtual address space is subdivided into halves, one half being for the operating system, called the "system space," and one half for the user, called the "process space." Whereas the system space has only a single existence, each user regards the process space as his own address space. Thus the process space has a separate existence as often as there are processes.

Within the process space each user can formulate data structures up to 1 Gbyte in size. One task of the memory management is to translate the virtual addresses into physical addresses in the materially existing main memory. This procedure is called "mapping." The basic magnitude for this mapping is a data structure of 512 successive bytes, called a "page." The operating system manages the record of the pages that are currently located in the main memory and organizes the reading in of pages from the external store into the main memory when the data are needed. Pages with inactive or already-run portions of the virtual address area are stored away on the external store by the operating system. These operations are called "paging."

The protection of the individual user programs and of the operating system from mutual interference is ensured by the memory protection mechanisms. The basis for these are four hierarchic (privileged) modes that are designated according to decreasing priority as kernel, executive, supervisor, and user mode. Moreover for each page the protection level for each of the four access modes can be separately specified.

2.4. Instruction Set, Data Types, and Methods of Addressing

In the basic mode the RVS instruction set consists of 304 instructions, which can be combined in each case with a multitude of data types and methods of addressing. The instruction format contains the operation code consisting of one or two bytes, followed by zero to six operand specifiers, which for their part are one to 10 bytes long. Instructions can be at any given byte boundaries. This and the variable length of the instruction format lead to compact programs and ensure the easy expandability of the instruction set.

Depending on their function and their use, these instructions can be grouped into classes (Tables 1 and 2):

—Instructions for the manipulation of arithmetic and logical data. These are instructions for the handling of integral numbers, floating-point numbers, character strings, packed decimal numbers, and bit fields.

—Instructions for changing special types of data, such as queue entries, address manipulation, and loading and saving of the general registers. The operating systems make very extensive use of these instructions.

—Instructions for controlling the program sequence. These are BRANCH, JUMP, and CASE instructions and subroutine and procedure calls.

—Instructions for the rapid execution of special operating-system functions. These are process control instructions and the FIND FIRST instruction. These instructions are basically concerned with the rapid and efficient controlling of process sequences.

—Instructions for special structures in higher programming languages, such as the FORTRAN-GOTO statement and program loops. Such instructions lead to a reduction in the program size and an increase in running speed.

Table 1. Data Types

Data type	Length	Range (decimal) With sign	Without sign
Integer numbers			
Byte size	8 bits	-128 to +127	0 to 255
Word	16 bits	-32,768 to +32,767	0 to 65,535
Long word	32 bits	-2^{31} to $+2^{31}-1$	0 to $2^{32}-1$
Quad word	64 bits	-2^{63} to $+2^{63}-1$	0 to $2^{64}-1$
Octa word	128 bits	-2^{127} to $+2^{127}-1$	0 to $2^{128}-1$
Floating-point numbers		Value range without sign	
F-format	32 bits	$0.29*10^{-38}$ to $1.70*10^{38}$	
D-format	64 bits	$0.29*10^{-38}$ to $1.70*10^{38}$	
G-format	64 bits	$0.56*10^{-308}$ to $0.90*10^{308}$	
H-format	128 bits	$0.84*10^{-4932}$ to $0.59*10^{4932}$	
Character strings			
Alphanumeric character strings	0 to 65,535 bytes	one character per byte	
Numeric character strings (numbers)	0 to 31 bytes	$-10^{31}-1$ to $+10^{31}-1$	
Packed decimal character strings	0 to 16 bytes	Two digits in each byte, sign in lower half of the last bytes (31 digits)	
Bit fields of variable length	0 to 32 bits	Dependent on interpretation	
Queues	2 long words/queue entry point	0 to 2 billion entry points	

Table 2. Addressing Modes
(n = 0, . . ., 15; x = 0, . . ., 14)

Mode	Symbol	
Literal mode	S∧+literal	
Immediate mode	I∧+operand, corresponds to (PC)+	
Register mode	Rn	
Indirect-register mode	(Rn)	Subscripted [Rx]
Autodecrement mode	—(Rn)	
Autoincrement mode	(Rn)+	
Indirect autoincrement mode	§(Rn)+	
Absolute mode	§+address, corresponds to §(PC)+	
Displacement mode	D(Rn)	
Byte displacement mode	B∧D(Rn)	
Word displacement mode	W∧D(Rn)	
Long-word displacement mode	L∧D(Rn)	
Indirect displacement mode	§D(Rn)	
Indirect byte displacement mode	§B∧D(Rn)	
Indirect word displacement mode	§W∧D(Rn)	
Indirect long-word displacement mode	§L∧D(Rn)	

Table 2. Addressing Mode

2.5. Cache Principles

Designated as a cache are quick-access stores into which local copies of storage contents are loaded by a suitable mechanism, the aim being the capability of making these available as very probably the next needed information, and thus of drastically reducing the number of basically time-consuming accesses to the main memory. In the computer RVS K 1840, cache functions are implemented by the data cache, the address translation buffer, and the instruction buffer.

2.6. Data Reliability and Diagnostic Tools

Extensive hardware-based precautions are taken to ensure data reliability. Involved here are, in particular:

—Equipping the main memory with an error-detection and error-correction circuit (ECC). This corrects single-bit errors and detects two-bit errors as well as a number of multi-bit errors.

—Utilization of parity bits for microprogram control memories and in data transfer via internal BUS systems.

—Functional groups for recording changes in register contents that occur during the instruction processing. In case errors have arisen this information permits one to restore the state before the beginning of execution of the instruction and thus to ensure a restart capability for most instructions.

—Memory support (battery) for getting through line power outages.

—Monitoring of the fans and temperature monitoring of the power-supply subassemblies to avoid critical equipment conditions.

—Tools for memory management and memory protection.

A fully developed diagnostic system offers extensive tools for equipment testing and for trouble-shooting. This includes as important components:

—The diagnostic bus, through which the most important signals within the equipment can be sampled.

—Registers for supporting the diagnostic software.

—Diagnostic capability for the entire device through the console computer.

—Extensive diagnostic software for testing and for trouble-shooting at various levels, beginning with off-line operation under the control of the console computer and extending to on-line operation under the control of the operating system.

2.7. I/O Concept

The I/O system is designed as a structure that is modularly expandable. It provides BUS systems for connecting up large fast-access external stores and also for connecting an extensive range of standard and graphics peripheral equipment. The flexibility and capability of the I/O system is substantially supported by a fully developed interrupt system in the processor.

2.8. Compatibility Mode

The RVS robotron K 1840 ensures the upwards compatibility for the SKR computers K 1600, CM3, CM4, and so forth through the implementation of the compatibility mode. In this connection, the basic instruction set of these 16-bit computers is realized and a software environment is created by the operating system for running user programs of these computers.

Hardware Overview (Figure 1)

The RVS K 1840 contains a central processing unit, the CPU K 2810 with the floating-point accelerator FPA K 2812, and in addition the main memory MEM K 3581.10, the memory extension MEME K 3581.11, a console subsystem KSS K 2811, the I/O subsystems with the SKRBUS adapter SBA K 2815, and the MSBUS adapter MBA K 2816 as well as peripheral devices.

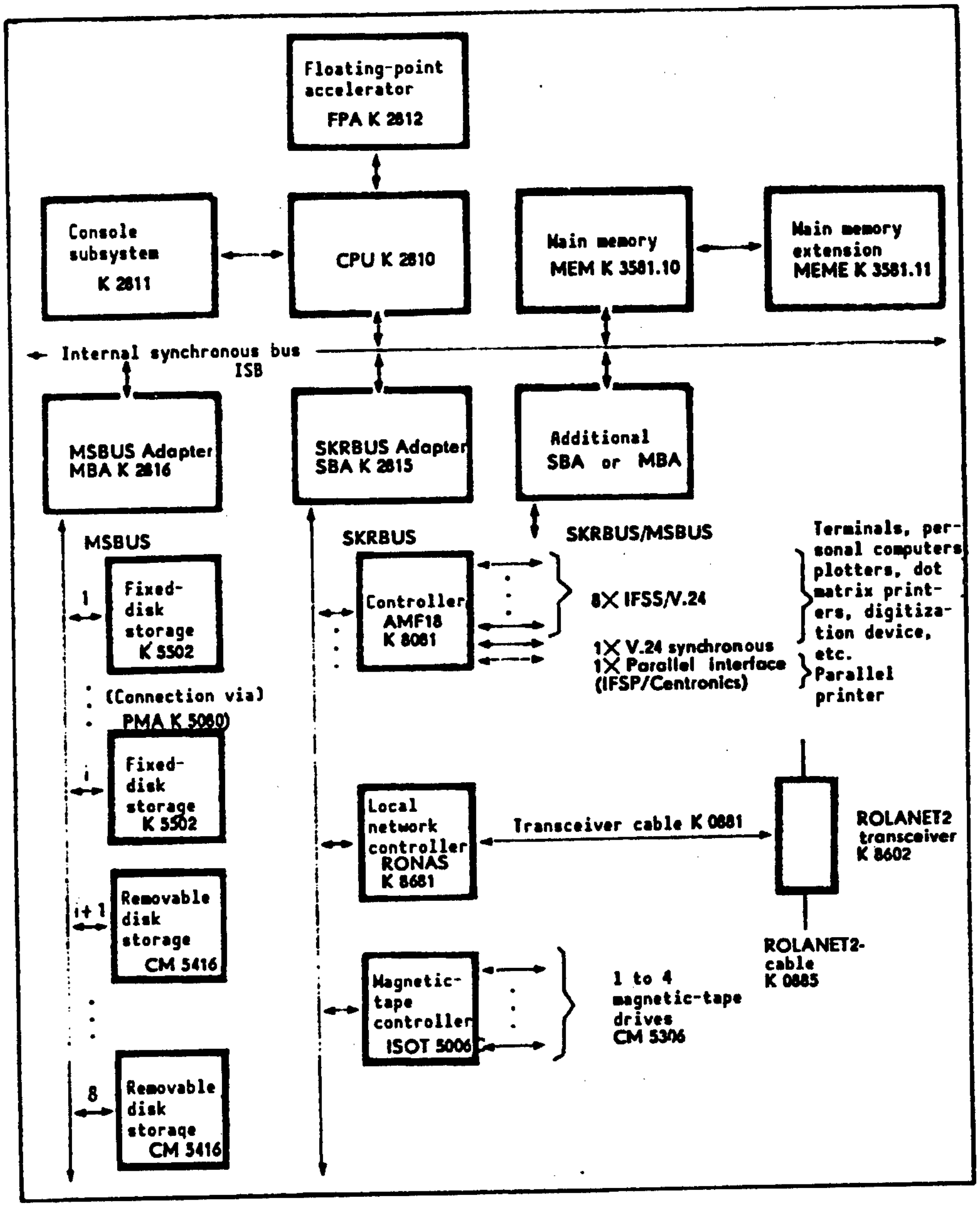

Figure 1. Block Structure of the RVS K 1840

Abbreviations Used in Figures 1-5:

ISB	Internal synchronous bus
VA	Virtual address lines
PABUS	Physical address bus
MDBUS	Memory data bus
IDBUS	Internal data bus
CSBUS	Microinstruction bus
VBUS	Diagnostic bus
UPC	Microinstruction counter
GRD	Data of general registers

3.1. Central Processing Unit CPU K 2810

The CPU K 2810 is a high-speed microprogrammed 32-bit processing unit that executes instructions in the RVS mode and non-privileged instructions of K 1600 computers in the compatibility mode. The instruction-sequence control and the operational sequences of the CPU are incorporated in the microprogram memory.

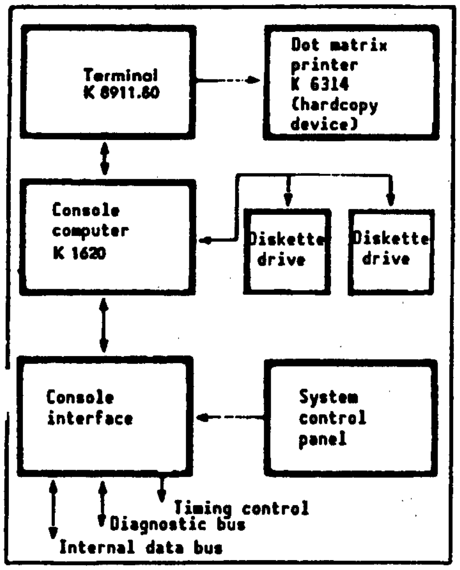

Figure 2. Block Diagram of the Console Subsystem

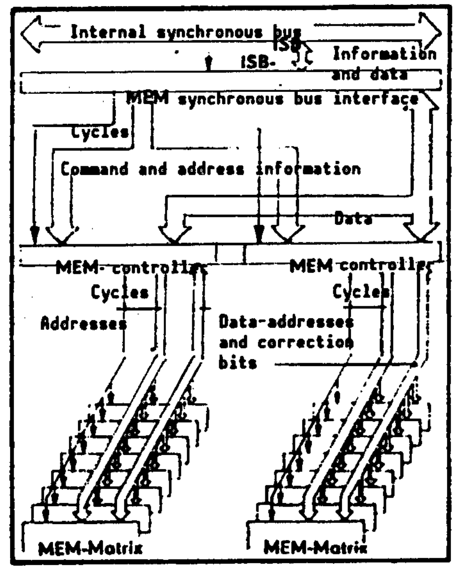

Figure 3. Block Diagram of the Main Memory

This is a ROM memory with 4K words and a RAM memory with 4K words. Each word of the microinstruction format consists of 96 bits and 3 parity bits. Moreover the microprogram memory also contains a 96-bit buffer, which permits the simultaneous calling of the next microinstruction even during the running of the current microinstruction.

The data paths within the CPU connect units that operate independently and in parallel for the purpose of processing addresses and data (Figure 4).

The physical address bus is a bidirectional internal bus with a width of 28 bits (PA 29:02). The PA bus transmits the translated physical address from the address translation buffer to the cache and to the ISB control, and also physical addresses from the ISB control to the cache for the purpose of reloading the cache.

The internal data bus (ID bus) is a bidirectional high-speed bus in the CPU that connects the units with one another and permits data transmission from and to the internal registers.

The memory data bus (MD bus) is a bidirectional information path for exchanging data in the long-word format (32 bits). It connects the arithmetic unit of the CPU and the instruction buffer with the cache and the ISB control.

The diagnostic bus (V-bus) is used for the diagnosis of CPU errors. It consists of eight serial data lines, a load signal line, a timing signal line, and a self-testing line. Each of the CPU modules contains at least one diagnostic-bus shift register.

The input lines of the shift registers monitor special test points of the CPU modules. The load signal brings about the parallel loading of the shift registers with the values of the test points when the CPU is in a stable state. The timing signal can then be used in order to transport the picked-up data serially from each shift register into a register, where the data can be read by the console computer under software control.

The timing control unit contains the subassemblies for the generation of the ISB clock signals, for the distribution to and decoding of ISB signals at the CPU modules, and for the voltage turn-on/turn-off sequences. The synchronous manner of operation of the RVS K 1840 is based on a timing cycle of 200 ns. There are four 50-ns time states per cycle (T0, T1, T2, and T3).

The CPU has a real-time clock that is used by the diagnostic software and the operating system for controlling time-dependent events and for management and maintenance of program data and times.

A calendar clock gives the correct time of day and the current date. This calendar clock is operated in buffered fashion via the clock feed module USM K 0285.

The internal synchronous bus (ISB) is a bidirectional information path with a communication protocol for data exchanges between the CPU, memories, and I/O adapters of the RVS K 1840. The ISB undertakes the parallel exchanging of tested information synchronously at the general timing-pulse rate. The communication protocol permits the time-divided operation of the information path, so that a number of exchanges of information can take place simultaneously in the processing

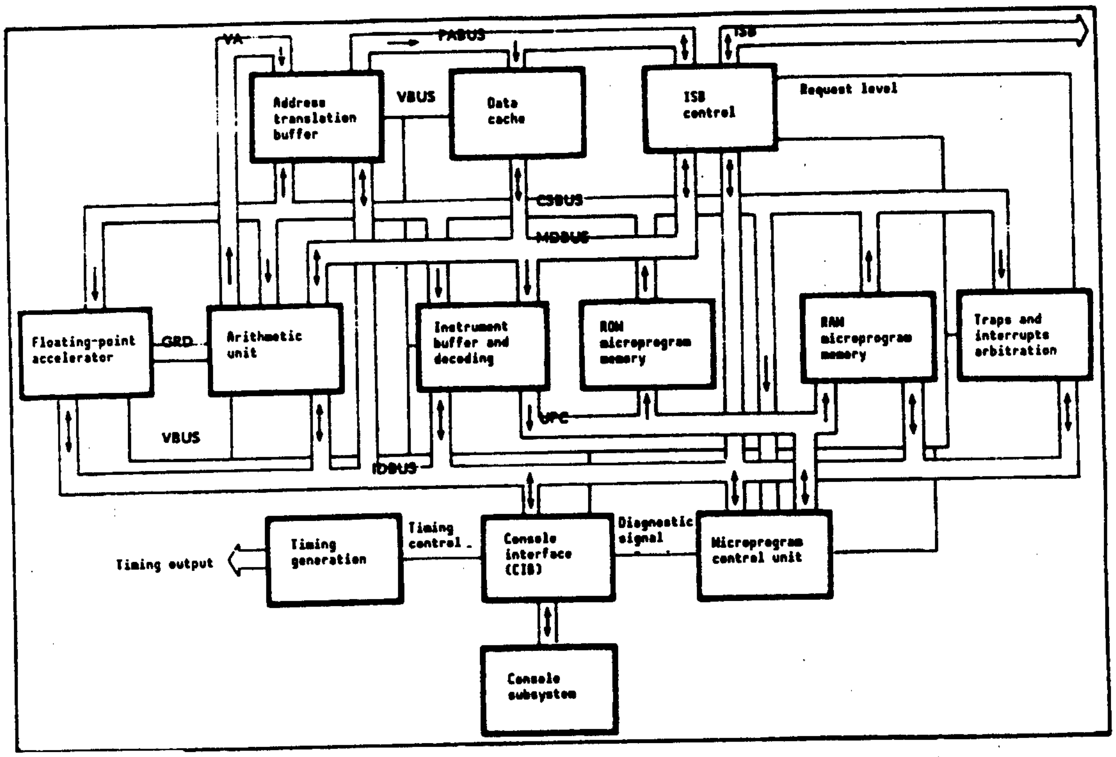

Figure 4. Block Diagram of the CPU K 2810

phase. During each timing period (cycle) the bus allocation, information exchange, and transmission confirmation can occur in parallel. The ISB signals are received in clock-timed fashion in receiving registers (latches). All tests and decisions derived from them are based on these collected signals. The error-testing logic recognizes single-bit errors in the information path.

The arithmetic unit consists of four functional parts:

the arithmetic section,

the address section,

the data section, and

the exponent section.

Each of these sections operates independently of the others, which permits a simultaneous processing of data and addresses. The instruction buffer is an 8-byte register. The operation code (Op code) of each instruction is stored in the first byte (byte 0) of the instruction buffer. The remainder of the instruction (operand specifier and extension) is stored in the following bytes of the instruction buffer. The structure of the buffer permits the look-ahead loading of new instruction data into the higher bytes while the current instruction is still being run. The capability for this anticipatory loading of instruction sequences considerably increases the performance of the processor.

The cache is a quick-access buffer store that serves the purpose of keeping as short as possible the total access time to the main memory needed by a program. This is achieved when the cache keeps on hand the data that have a high probability of being needed by the currently running program.

Thus for the sake of a high percentage of accesses to data ("hit rate") the stored data can be made available without it being necessary to execute a main-memory cycle via the ISB control unit.

The cache consists of 2 main parts, the cache data matrix and the cache address matrix. Each matrix is divided into two groups (group 0 and group 1). The address matrix stores the TAG field (identification field), which is identical to the higher bits of the physical address.

The data block belonging to a physical address, consisting of two long words (a quad word), is filed into the data matrix. The low-order bits of the physical address are used as an index for addressing the cache. Via this indexed address each entry in the address matrix corresponds to an entry in the data matrix consisting of two long words.

The address translation buffer of the RVS K 1840 reduces storage accesses during the address translation from the virtual into the physical address. It can store 128 address translations.

Interrupts and exceptions are the result of events within the system that require an interrupting of the current program. "Exception" is the term for events that occur during the current process execution, whereas "interrupts" represent events that in general are independent of the current process.

Interrupts and exceptions have a priority structure for stipulating the sequence in which they are run. The processor has 31 interrupt priority levels (IPL), which are subdivided into 15 software levels (01H to 0FH) and 16 hardware levels (10H to 1FH). User programs, system calls, and system utilities run on the level IPL = 0, which is called the process level. But exceptions that represent important system errors can set the IPL to the highest level (1FH). The interrupt levels (01H to 0FH) are reserved for utilization by the software. The interrupt levels (10H to 17H) are used by devices and controllers, including use by SKRBUS devices. In the K 1840 the SKRBUS levels BR 4 to BR 7 correspond to interrupt levels (14H to 17H). The interrupt levels (18H to 1FH) are used for top-priority conditions including those of interval clocking, errors, and power outages.

3.2. Floating-point Accelerator FPA K 2812

The floating-point accelerator K 2812 carries out addition, subtraction, multiplication, and division instructions for floating-point operands. The special instructions EMOD and POLY are also handled in formats with single and double precision. Moreover the FPA K 2812 increases the capability of the multiplication instruction for 32-bit integral numbers.

The FPA K 2812 can be used in the RVS K 1840 without changing existing software. It speeds up the execution of a floating-point addition in the register mode to less than 800 ns, and a multiplication instruction in the register mode requires less than a microsecond. The inner loop of the POLY instruction requires roughly only a microsecond for one interval of the polynomial.

For applications with increased decimal-place precision, the G floating-point format and the H floating-point format can be used. The precision increases to up to 33 decimal places.

3.3. Console Subsystem KSS K 2811

The KSS K 2811 provides the user with easy access to the system capabilities of the RVS K 1840. A simple console command language that can be entered as input via the console terminal controls bootstrapping, system initialization, self-testing, reading from and writing to the main memory, and so forth. Furthermore the KSS permits an effective diagnostics for the RVS K 1840. The integrated diskette drives allow the easy loading of diagnostic programs and software updates. Logically speaking the console terminal is the starting terminal of the system. The console subsystem consists of the following main components (Figure 2):

—Console computer KR K 1620, consisting of a special configuration of the microcomputer K 1620 and two diskette drives (5.25 inches),
—Alphanumeric terminal K 8911.80 as a console terminal or operator terminal including hardcopy printer K 6314,
—Console interface (CIB) with a ROM of 4K words,
—System control panel (SBF) on the CPU cabinet K 0681.

The console interface (CIB) connects the console computer (KR K 1620) with the central processing unit (CPU K 2810). The CIB contains interfaces to the KSS bus structures, access registers for each bus, and all the hardware needed for implementing the console functions. Moreover the CIB also contains a ROM of 4K words that holds the core of the K 1620 software, inclusive of the drivers for the terminal and diskette drives. The K 1620 starts up with the execution of instructions on the ROM immediately after the power switch-on sequence has been completed.

The system control panel (SBF) contains switching and display elements for the K 1840.

3.4. Main Memory MEM K 3581

The storage device MEM K 3581 is the main memory of the RVS K 1840. It is connected to the internal synchronous bus (ISB) of the computer (Figure 3).

The memory MEM K 3581 is characterized by the following primary features:
—Maximum storage capacity of 16 Mbytes
—Accesses to bytes, words, long-words, and quad-words
—Error correction
—Access to status and error information
—Bootstrap ROM

The memory has a read-only store of 1K x 32 bits for a bootstrap loader.

The memory consists of the following components:
—MEM synchronous bus interface
—MEM controller
—MEM matrix.

This memory uses 64-Kbit NMOS circuits. Its modular design includes a storage module MEM K 3581.10 with a minimum storage capacity amounting to 2 Mbytes. The control unit of this storage module permits memory upgrading in steps of 2 Mbytes by means of the memory extension units MEME K 3581.11, up to the total capacity of 16 Mbytes. The memory management system makes available a virtual address space of 4 Gbytes. This memory is capable of executing writing and reading operations with either 32-bit long-words or 64-bit quad-words. Addressing is done at the byte boundaries within a long-word or a quad-word. The memory operates in the internally overlaid mode—that is, the memory consists of two equal halves, which with increasing address sequence and quad-word processing are always addressed alternately, whereby shorter access and cycle times are achieved. The memory control unit has capabilities for error checking and error correction (ECC). Thus it finds all double-bit errors, most multibit errors, and corrects all single-bit errors. If there is a power outage, a memory support module SSM K 0286 ensures temporary data retention lasting about 10 min for 8 Mbytes.

3.5. SKRBUS Adapter SBA K 2815

In the SKRBUS subsystem, the SBA K 2815 connects the internal synchronous bus with the asynchronous SKRBUS.

The SKRBUS is an asynchronous bidirectional bus. It corresponds to the UNIT BUS in the System of Minicomputers (SKR unit bus). The form of information exchange on the SKRBUS is the same for all devices. Peripheral devices are coupled to the SKRBUS via controllers. The SBA has the task of controlling all transfer processes of this multiplex channel. The SBA allows the CPU to have access to the registers of the SKTBUS controllers—via which the peripheral devices are connected to the SKRBUS—by its transferring of addresses, data, and interrupt requests. For the full utilization of the available band-width of the ISB, an SBA makes available up to 15 buffered DMA [direct memory access] data channels and one direct data channel.

Each of these channels has a 64-bit buffer (plus a parity bit for each byte). Four 16-bit transmissions from/to a device require only one internal transmission of 64 bits. The maximum transmission rate for the 15 buffered data channels is 1.1 Mbytes/s. In connection with output, the SBA makes a look-ahead request for the next 64-bit quad-word from the main memory while the last 16-bit word is still being transferred from the SBA buffer via an interface. When the device requests the next interface transfer the SBA can begin this, because by then it has already read the data from the main memory. Unbuffered DMA transfers are possible through a direct data channel. Each 8-bit or 16-bit SKRBUS transmission requires an internal 32-bit transfer. The maximum transmission rate of this direct data path is 400 Kbytes/s. The SBA allows at the same time the acceptance of interrupts as well as unbuffered and buffered data transfers. The combined transmission rate of the unbuffered and the 15 buffered data paths is 1.5 Mbytes/s.

3.6. MSBUS Adapter MBA K 2816

Provisions have been made for wiring up either one or two MBA's with the computer; each MBA generates its own MSBUS for up to eight MSBUS controllers with connected storage drives in each case (Figure 6). The MSBUS adapter MBA K 2816 controls the transmission process, buffers data, and addresses on the one hand the selected device and on the other hand the needed storage location. The MBA is able to independently translate virtual addresses into physical addresses. In this way it can carry out either

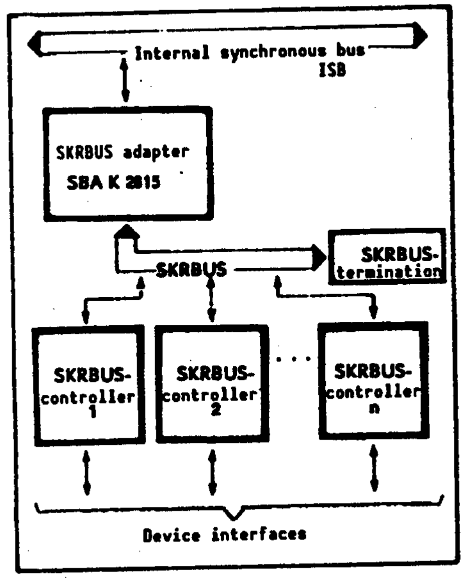

Figure 5. Block Diagram of the SKRBUS Subsystem

distributed or grouped data transmissions. In distributed transmission, physically associated blocks of the peripheral store are distributed into various areas of the main memory. In grouped transmission the MBA transports data from various areas of the main memory as associated blocks to the peripheral store. A translation table contains the page addresses with which the read or written blocks can be addressed within the total main-memory area. For input each MBA contains a 32-byte FIFO [first-in-first-out] buffer, in which the data are combined into 64-bit quad-words (plus parity bits) for the sake of efficiently utilizing the available width of the internal transmission path. In the case of transmissions from the main memory to the peripheral storage the MBS is already reading the next 64-bit quad-word from the main memory even during the transfer of the previous data from the buffer to the device. A maximum of eight MSBUS controllers can be connected to the MSBUS formed by an MBA. In turn, depending on the type each controller allows the hooking up of from one to a maximum of eight mass storage devices.

3.7. Structural Arrangement

The structural arrangement of the system is characterized by the use of three types of cabinets for built-in devices and two types of device supports for table-top devices.

There are one each of the cabinet types SCH1 K 0681 and SCH2.1 K 0682 in every configuration (Figure 7). They can be variously expanded. Both cabinets are designed as coherent units with shielding for the suppression of radio interference.

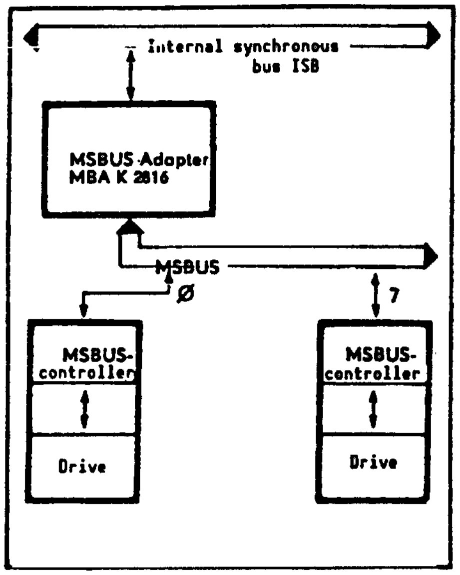

Figure 6. Block Diagram of the MSBUS Subsystem

The cabinet SCH1 houses the CPU, the main memory, the I/O adapters, the console subsystem, the power supply subassemblies, and the fans. The plug-in units of the logic subassemblies in the form of cartridges are arranged at right angles to the above; their back-wiring subassemblies (RV-BG) form a closed plane surface for the ISB cabling. The plug-in units are 4-tier multilayer printed circuit boards (MLL) whose dimensions are about 300 mm x 400 mm; they are connected to the RV-BG's via 6 x 36-pole direct connectors.

In the cabinet SCH2.1, up to two slide-in units SBE K 0685 for SKRBUS controllers (maximum of 44 plug-in locations) with their associated terminal boards can be installed. Provisions have been made on the back wall of the cabinet SCH2.1 for up to 40 terminal boards, which are occupied by distributor panels of the SKRBUS controllers. The interface lines of these controllers are brought out of the SBE to the appropriate distributer panel by means of ribbon cables and there they are converted to shielded round cables (in addition to undergoing functional and electric matchings).

The cabinet SCH2.2 is available as a device cabinet in three equipment versions. Depending on the specific configuration, the separate versions can be present more than once in the different setups.

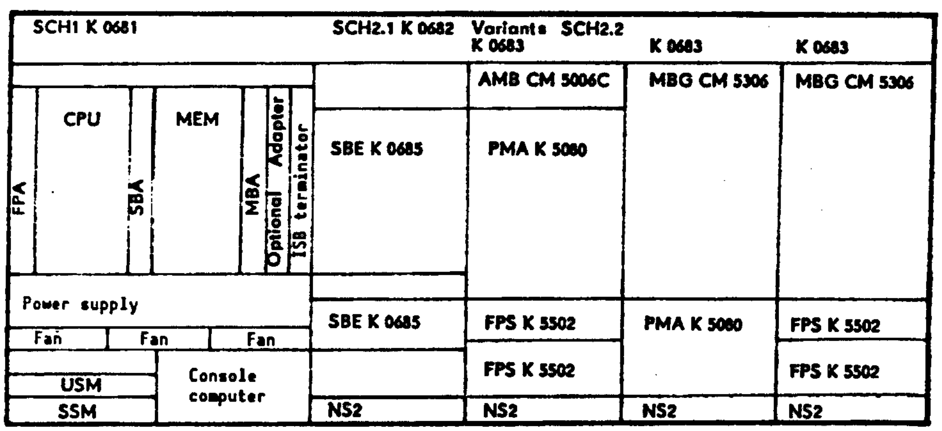

Figure 7. Cabinet Types and Their Internals

Table 3. Technical Data for the RVS K 1840

Processor	
Type	2/3 address machine
Circuit basis	Schottky TTL series
Microprogram	
- Word width	99 bits, 3 of which are parity bits
- Memory size	8K words (99 bits), of which 4K words are ROM and 4K words are RAM
Internal data width	32 bits
Cache store	
- Size	8 Kbytes
- Average access time	290 ns
- Typical hit rate	95%

Table 3. Technical Data for the RVS K 1840

Address translation buffer	128 address translations
Instruction buffer	8 bytes
Instruction list	304 basic operations
General 32-bit registers	16
Interrupt priority levels	32
Data types	Integer, floating point, alphanumeric character chains, packed decimal numbers and variable bit fields
Addressing modes	9
Internal synchronous bus	
- Transmission rate	13.3 Mbytes/s
- Cycle time	200 ns
Special attachments to the CPU	Floating-point accelerator FPA K 2812 with G- and H- floating-point add-ons
Other standard features	- Power outage monitoring - Automatic restart - Simple serial ASCII console interface - High-powered console commands - High reliability and freedom from upkeep - Interval timer, calendar clock
Main Memory	
Virtual address area	4 Gbytes
Physical address area	1 Gbyte
Physical memory extension	8 Mbytes, upgradable in steps of 2 Mbytes to a maximum of 16 Mbytes
Error recognition/correction	7-bit error correction code (ECC) for 32- bit long-word
Circuitry basis	64 Kbit NMOS circuits
Cycle time	4 ISB cycles for reading one quad-word
Data retention	Battery for backup power in brief outages, up to 10 min for 8 Mbytes
SKRBUS Adapter	1 standard; 1 additional, if no second MBA is required
Transmission rate	1.5 Mbytes/s total on an SBA, of which a max of 1.1 Mbytes/s via buffered data channels and up to 400 kbytes/s via unbuffered data channel
Buffered channels	15 channels; 8 bytes buffered in each channel
Unbuffered channel	1 channel
MSBUS Adapter	1 standard; 1 additional if no second SBA is needed
Transmission rate	2 Mbytes/s
Number of controllers	8
Buffer size	32 bytes
Dimensions and Weights	
Width	
- CPU cabinet	1,200 mm
- SKRBUS expansion cabinet	700 mm
- Device cabinet	700 mm
Height of all cabinet types	1,600 mm
Depth of all cabinet types	850 mm
Weights	
- CPU cabinet	ca 500 kg
- SKRBUS expansion cabinet	ca 250 kg
- Device cabinet	ca 250 kg
Conditions for Electrical Connections	3 x 380/220 V, 50 Hz, about 6kVA

Peripherals

23020022 East Berlin NEUE TECH. BUERO in German No 3, 1988

[Article by Graduate Engineer W. Branitz, Dresden Robotron Electronics VEB]

[Text]

1. Introduction

Together with the RVS K 1840 an extensive range of peripheral devices are being made available. In what follows the devices that can currently be connected are presented. The following hardware interfaces for the computer K 1840 are used:

—The SKRBUS, which corresponds to the EINHEITSBUS in the System of Minicomputers (SKR unit bus) and at which the magnetic-tape equipment is connected.

—The MSBUS, which corresponds to the Interface for Mass Storage Devices IMP in the System of Minicomputers. Disk storage hardware is connected to this.

—The interfaces IFSS and V.24 for hooking up local and remote terminals, serial printers, and graphics peripheral devices.

—The interface IFSP for connecting parallel printers.

The possibilities for establishing local networks are treated in another article of this issue number.

2. External Storage Device

2.1. Fixed Disk Storage Device Robotron K 5502

The fixed disk robotron K 5502 is a device with a non-removable storage medium and moving magnetic heads. It is used as the system memory for the operating systems SVP 1800 or MUTOS 1800 and as a data store.

The fixed disk K 5502 is a "Winchester" disk storage device. In its construction it is a slide-in unit. The disk module is a subassembly that is isolated from outside air. The magnetic heads are positioned by means of a rotary positioner with the aid of special servo-information. The average positioning time is about 40 ms. The fixed disk is connected via the SMD interface to a controller, called the PM adapter, and this in turn is connected via the MSBUS to the computer K 1840. For each PM adapter one fixed disk can be connected up. A maximum of eight PM adapters can be connected to an MSBUS. Moreover the PM-adapter slide-in unit K 5080 holds two PM adapters that are completely separate in their functioning.

The version K 5080.10 of this slide-in unit is provided with a single-computer junction and the version K 5080.20 is provided with a two-computer connection. In addition to the PM-adapter slid-in unit a maximum of 2 fixed-disk storage devices can be housed in the appropriate device cabinet.

Technical parameters:
Storage capacity:
- Gross: 160 Mbytes
- Net: 124 Mbytes
Data areas: 7
Bytes per sector: 512
Logical blocks per device: 242,606
Rotational speed: 2,400/min
Transmission speed: 806 kbytes/s
Average access time: 52.5 ms
—Fixed-disk storage:
Dimensions (width x depth x height):
482 mm x 770 mm x 265 mm
Weight: 60 kg
Power consumption: 550 VA
Interface: SMD
Length of the interface line: 15 m
Connection to: PM adapter K 5080
—PMD adapter:
Dimensions: (width x depth x height):
482 mm x 770 mm x 433 mm
Weight: 45 kg
Power consumption: 350 VA
Interface: MSBUS
Length of the interface line: 49 m (in all)
Connection to: MSBUS adapter K 2816.

2.2. Removable-disk Storage CM 5416/CM 5404

The removable disk store (WPS) CM 5416 is a single-spindle floor-standing device. It is used as a system store and data store. The manufacturer is the ISOT Combine, People's Republic of Bulgaria.

The connection of the WPS to the computer is made via the MSBUS. The corresponding adapter on the WPS side is an integral component of the CM 5416. The maximal configuration allows up to eight WPS's to be connected to one MSBUS, with these being designed to be stationed in a row. In the standard configuration each WPS is equipped with a two-computer interface. The removable-disk packs ISOT 0006C are used as storage media. The removable-disk storage device CM 5404 that can also be connected to the computer differs from the CM 5416 only in its storage capacity. Its disk pack has the type designation ISOT 0003C.

Technical parameters of the devices CM 5416/CM 5404:
Storage capacity:
- Gross: 200/100 Mbytes
- Net: 174/88 Mbytes
Data areas: 19
Bytes per sector: 512
Logical blocks per device: 340,670/171,798
Rotational speed: 3,600/min
Transmission speed: 806 kbytes/s
Average access time: 30 ms
Dimensions (width x depth x height):
990 mm x 820 mm x 1,150 mm
Weight: 351 kg
Line voltage: 380/220 V +10/-15 percent
Line frequency: 50 Hz plus/minus 1 Hz
Power consumption: 2 kVA
Interface: MSBUS Length of the interface line: 49 m (in all) Connection to: MSBUS adapter K 2816.

2.3. Magnetic Tape Device CM 5306

The magnetic tape device CM 5306 is a 0.5-inch storage device with NRZI or PE [NRZ = non-return-to-zero encoding, PE = phase encoding] as recording techniques and with a tape speed of 1.9 m/s. It is connected to the SKR bus of the computer K 1840 via the magnetic-tape controller ISOT 5006C. It serves as a fast-backup mass storage device. The manufacturer is the ISOT Combine, People's Republic of Bulgaria.

3. Alphanumeric Peripheral Devices

3.1. Terminal Robotron K 8911.80

The alphanumeric terminal robotron K 8911.80 is a video display terminal for communicating with the computer K 1840. Moreover it can be used either as a console terminal or as a user terminal.

The terminal K 8911.80 is a table-top input/output device. The operator communicates with the terminal via an alphanumeric functional keyboard. Through this keyboard the operator sets the operating states of test mode or job-running mode. In the SET-UP mode, internal operating states of the device can be set up and displayed. It is possible to connect up the dot-matrix printers K 6313/14 as hardcopy devices, using an ISO instruction set. The modified version designated as K 8911.81 has V.24 as the interface and can be connected up to the computer K 1840 only via the DNUe [data local transmission device] K 8171.

Technical parameters:
Dimensions of monitor (width x depth x height):
530 mm x 410 mm x 337 mm
Dimensions of keyboard:
520 mm x 250 mm x 65 mm
Weight: 30 kg
Power consumption: 120 VA
Interface: IFSS
Length of the interface line: 500 m
Connection to: AMF18/AIS of the console computer K 1620.

3.2. Parallel Printers VT 27000

The parallel printers of the family VT 27000 are drum printers with a printing speed of 600 to 900 lines/min. The types VT 27060, VT 27065, or VT 27090 can be hooked up to the computer K 1840. They are manufactured by the firm Videoton in the Hungarian People's Republic. The parallel printers VT 27000 are floor-standing devices. The printing principle is drum printing with 132 printing positions per line. Perforated fanfold paper with a width of 100 to 430 mm and a fold spacing of 304.8 or 279.4 mm are used as the printing paper. A print back cloth serves as an inking medium; it has a width of 369 mm and a maximum length of 27.5 m. The number of copies per sheet is one original and a maximum of five extra copies. The connection to the computer K 1840 is made via the IFSP.

3.3. Parallel Printers VT 23000

The parallel printers of the family VT 23000 are steel-band printers of intermediate printing output. The types VT 23300 and VT 23600 are designed for connection to the computer K 1840. The manufacturer is the firm of Videoton in the Hungarian People's Republic.

The printers VT 23000 are floor-standing devices. The printing principle is steel-band printing with 132 printing positions per line. The character set consists of 64 Latin uppercase characters or 96 Latin uppercase and lowercase characters. Fanfold paper with a width of 76.2 to 406.4 mm and a fold spacing of 304.8 or 279.4 mm is used as the printing paper. An endless ribbon in a special cartridge serves as the inking medium. The number of copies per sheet is one original and a maximum of five extra copies. It is connected to the computer K 1840 via the IFSP on the AMF18.

3.4. Dot-matrix Printers Robotron K 6313/6314

The printers robotron 6313/6314[1] are designed for outputs of alphanumeric and graphic information. They can be connected up both directly to the computer K 1840 as output printers and also to the terminals as hardcopy printers.

3.5. Serial Printer Robotron 1152/257

The serial printer robotron 1152/257[2] is a daisywheel printer. As an output device it is used wherever high printing quality is needed.

4. Graphics Peripheral Devices

4.1. Interactive Graphics Terminal Robotron K 8918

The interactive graphics terminal (IGT) robotron K 8918 is a table-top terminal designed for color graphics. In the graphics mode it functions as a GKS work station and has a scope of functions corresponding to GKS, Version 7.4. The images are pictured in accordance with the framing technique on the monitor K 7229.25 or on a color monitor.

For the representation of alphanumeric data an image store is used, with 32 lines for each 80 characters. The graphic image store has four image planes of 640 x 640 bits each. On the monitor, 640 x 480 pixels are displayed. It is possible to display alphanumeric and graphic data either in combination or alternately. Each picture element can be represented in any one of 16 shades of gray or 16 colors. The represented image objects can be defined, manipulated, and selected in the interactive mode. The keyboard and/or the graphics palette K 6405 are used for this purpose. The contents of the video screen can be printed out by means of the attachable graphics-capable dot-matrix printer K 6314. The connection to the AMF18 of computer K 1840 is via the interface IFSS or V.24, using a modem or DNUe K 8172.

Table 1. Technical Parameters of the Parallel Printers VT 27000

PRINTER VERSION	PRINTER SPEED	CHARACTER SETS
VT 27060	600 lines/min	64 Latin uppercase characters
VT 27065	650 lines/min	96 Latin/Cyrillic uppercase characters
VT 27090	900 lines/min	64 Latin upercase characters

Printing width: 132 characters/line
Line height: 6 or 8 lines/inch
Dimensions (width x depth x height in mm): 940 x 650 x 1,050
Weight: 200 kg
Power consumption: 1 kVA
Interface: IFSP
Length of the interface line: 15 m
Connection to: AMF18

Table 2. Technical Parameters of the Parallel Printers VT 23000

Printing speed:	300 lines/min (VT 23300); 600 lines/min (VT 23600)
Printing width:	132 characters/line
Line height:	6 or 8 lines/inch
Dimensions (width x depth x height in mm):	770 x 853 x 111
Weight:	82 kg
Power consumption:	400 VA
Interface:	IFSP
Length of the interface line:	15 m
Connection to:	AMF18

Table 3. Technical Parameters of the Interactive Graphics Terminal robotron K 8918

	Dimensions (mm)			Weight
	Width	Depth	Height	(kg)
Logic unit	486	451	170	20
Monitor K 7229	338	364	323	15
Keyboard K 7637.9x	455	240	56	4.3
Graphics palette K 6405	498	364	47	3.5

Power consumption of terminal: 250 VA
Graphics Palette: 15 VA
Interfaces: IFSS, V.24
Length of the interface line: 500 m (IFSS); 15 m (V.24)
Connection to: AMF18

4.2. Plotter Robotron K 6411

The plotter robotron K 6411[3] is an A2 flat-bet plotter and is used for the outputting of graphic information.

This plotter is a table-top device. The information can be printed out on standard paper, foil, or transparent paper. Up to eight styluses can be placed in a magazine. In addition to plotting a digitization of individual points is also possible.

4.3. Digitization Device Robotron K 6404.20

The digitization device robotron K 6404.20 is a floor-standing device with a measuring plate in the format A0. It us used for logging, pre-processing, and packing graphic information. This digitization device consists of a measuring plate mounted on a double-sided drawing table with a variable menu field and scale magnifier and pin as the data sensors. The measuring plate can be rotated up to 90 degrees. The working surface is 841 mm (x axis) x 1,189 mm (y axis), which corresponds to the format A0. An inductive measuring principle is used. Via a 16-digit display the user is given error signals, function settings, and the current operating state.

Before using the digitization device it must be loaded with an appropriate program for the operating mode WORKSTATION.

Precision of pin: plus/minus 0.5 mm in an orientation at right angles to the measuring plate
Precision of the magnifier: plus/minus 0.1 mm
Measured-value deviation of pin: Maximum of 1 mm (temperature-dependent)
Measured-value deviation of magnifier: Maximum of 0.5 mm (temperature-dependent)
Weight: 113 kg
Power consumption: 190 VA
Interface: IFSS
Length of the interface line: 500 m
Connection to AMF18.

5. Data Transmission Equipment

5.1. Modem TAM 1200

The modem TAM 1200 is used for connecting remote terminals to the computer K 1840 or for the coupling of computers via two-wire or four-wire lines. It is produced by the Hungarian firm of Telefongyar Budapest.

The modem TAM 1200 provides for the conversion of the serial binary data signals coming from the data terminal device into a frequency-modulated line signal, and for the reception and conversion of the frequency-modulated signals coming from the telephone line into serial binary signals. This transmission can be done over public-telephone or data networks, dedicated circuits, or functional networks.

Technical Parameters:
Mode of operation: Synchronous, asynchronous, half-duplex, duplex (only on four-wire lines)
Speed: 600 or 1,200 bits/s
Modulation method: Frequency modulation
Dimensions (width x depth x height):
310 mm x 245 mm x 118 mm
Weight: 4 kg
Power consumption: 35 VA
Interface V.24 synchronous, asynchronous
Length of the interface line: 15 m
Connection to: AMF18.

5.2. Device for Local Transmission of Data, Robotron K 8172

The device for local transmission of data (DNUe) robotron K 8172 is a table-top device and is used for the transmission of data in the local range up to a maximum of 30 km.

The DNUe converts the data coming from the computer by means of a bipolar direct-current sampling having a low transmission voltage. Thereby such data can be transmitted to the other station at a maximum transmission speed of 19,200 bits/s over directly connected two-wire or four-wire lines. This transmission can be done in half-duplex and duplex modes and in point-to-point or multipoint communication.

Technical parameters;
Mode of operation: Asynchronous, synchronous (with or without scrambler/descrambler), Half-duplex, duplex
Speed:
Asynchronous: Up to 19,200 bits/s
Synchronous: 600, 1,200, 2,400, 4,800, 9,600, and 19,200 bits/s
Modulation method:
Bipolar direct-current sampling
Transmission distance:

Speed (bits/s)	Two-wire line (km)	Four-wire line (km)
1,200	20	30
2,400	15	25
4,800	10	15
9,600	5	10
19,200	2	5

Dimensions (width x depth x height):
230 mm x 275 mm x 90 mm
Weight: 4.5 kg
Power consumption: 30 VA
Interface: V.24 synchronous, asynchronous
Length of the interface line: 15 m
Connection to: AMF18.

5.3. Modem VM 2400

The modem VM 2400 is used for the transmission of data between two computers K 1840 in the voice-frequency range. It is produced by the Leipzig Telecommunications Electronics VEB.

The modem operates in the synchronous mode and at speeds of 1,200 or 2,400 bits/s, duplex on four-wire lines or half-duplex on two-wire lines. Transmissions can be made over public-telephone or data networks, dedicated circuits, or functional networks. It is connected to the computer K 1840 via the V.24 of the AMF18.

Technical Parameters:
Mode of operation: Synchronous (with or without scrambler/descrambler), half-duplex, duplex
Modulation method: Quadrivalent differential phase modulation
Dimensions (width x depth x height):
230 mm x 275 mm x 90 mm
Weight: 3 kg
Power consumption: 10 VA
Length of the interface line: 15 m

Footnotes

1. Carius, M.: "The Printer Program of the Robotron Combine VEB," NEUE TECH. BUERO (German edition), Berlin 30 (1986) 2, pp 38-40.

2. Fischer, W., and Mueller, W.: "Daisywheel Printers for Word Processing," NEUE TECH. BUERO (German edition), Berlin 31 (1987) 3, pp 68-70.

3. d'Avignon, H. N., Richter, A., and Steinicke, K.: "Plotter robotron K 6411—a Color-capable Line Plotter in the Flat-bed Design," NEUE TECH. BUERO (German edition), Berlin 31 (1987) 2, pp 40-42.

Network Software

23020022 East Berlin NEUE TECH. BUERO in German No 3, 1988 pp 95-97

[Dr of Engineering K. Hamann, Graduate Engineer U. Inhoff, and Graduate Engineer K. H. Schultz, Robotron Dresden Project VEB: "Network Software for the RVS robotron K 1840"]

[Text]

1. Introduction

In modern computer engineering the coupling of computers is gaining increasingly in importance. In the joining up of computers into a computer network in which at all times an exchange of information between any of the partners can take place, the capabilities of the individual computer are considerably increased if it can always avail itself of the resources of the entire network. For the RVS K 1840, network software for the operating systems SVP 1800 and MUTOS 1800 is available.

2. Network Software for SVP 1800—SKRNET

2.1. Network Architecture

Hardware and software allow the establishment of both spatially restricted (local) and extended computer networks; local networks can be subsystems of extended networks. The participating computers are generally designated as nodes of the network. Figure 1 gives an overview of possible structures. In the local network ROLANET2 all subscribers communicate on an equal basis directly with one another in accordance with the CSMA/CD procedure.

In the extended network the transmission procedure DDCMP is uniformly applied. The network can be subdivided into sectors. Generally this is done on the basis of territorial considerations. The network can consist of a maximum of 63 sectors, and each sector can contain up to 1,023 nodes. Each node of a sector is unequivocally characterized by a number (its "address"). If the network consists of several sectors a specific sector-identifying number is put in front of the address (separated by a period). Moreover, in the network software each network node is unequivocally characterized by its name one to six alphabetic characters). A node that is capable of forwarding to the correct addressee any messages that are not meant for it itself is called a routing node (directing node, router), while a node that does not have this ability is called a terminal node. This article describes the first expansion stage—the coupling of RVS K 1840 computers with one another. Work is currently being done on incorporating other equipment into the network.

2.2. Hardware

Figure 1 shows the hardware required for the establishment of a network. In the local network the nodes are connected by a coaxial cable that permits transmission speeds of up to 10 Mbits/s. The node is joined to the network via the local network controller RONAS K 8681. This allows the addressing of a maximum of 1,023 nodes in the local network.

For transmission in the extended network, the device interface control unit AMF18 effects the electrical interface in accordance with CCITT recommendation V.24. This control unit has one channel for synchronous operation and eight channels for asynchronous operation, which are equipped either with the interface V.24 or IFSS. Two of the V.24 connections are provided with a modem/GDN control. The interfacing with the transmission lines is made via modem or GDN, and for short-distance connections (V.24 up to 15 m and IFSS up to 500 m) a direct hook-up is also possible.

The transmission speed can lie between 1,200 bits/s and 19,200 bits/s, depending on the selected transmission method, the configuration, and the distance. With the use of modems any given distances can be spanned, and transmission speeds of, for example, up to 2,400 bits/s are possible with the use of the VM 2400 (synchronous mode only).

2.3. Software

For the computer system RVS K 1840 software is made available that permits the establishment of local, extended, or mixed SKR networks. The program packet described below is designed for use under the operating system SVP 1800 and has the following general properties:
—Simple operator interface to the SVP 1800
—No restrictions with respect to the data to be transmitted (reliable, transparent transmission)
—Implementation of a multilevel protection of access to the computers and files
—Easy modification of the network configuration
—Equal standing of all computers in the network
—High throughput rates within the local network.

The capabilities of the provided software permit:
—General communication among subscribers to the network (operating personnel, programs),
—common utilization of individual resources (computing capacity, special peripheral devices),
—access to files on other computers of the network,
—effecting of virtual terminals.

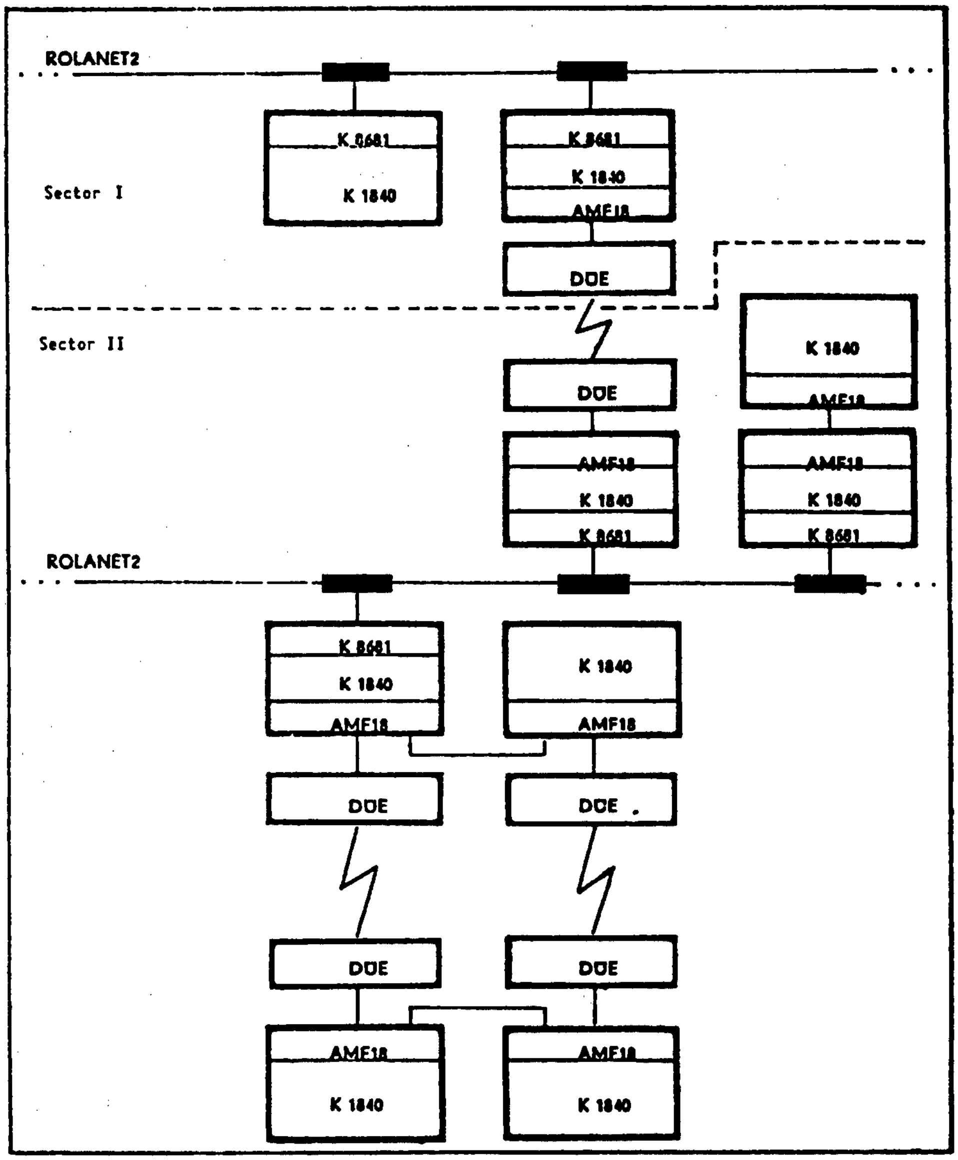

Figure 1. Example of the Structure and Hardware of an SKRNET Network: K 8681—Local network controller; AMF18—Device interface control unit; DUeE—Data transmission device (modem, GDN)

2.4. User Interfaces

For this purpose the user can use existing utility programs, but he can also develop his own programs adapted to his special requirements. In this way diverse complex problems can be solved within computer networks.

Utility programs

The utility programs of the SVP 1800 are used by way of the command language of the operating system or by means of command files. The following utilities are provided:

—Access to files at any given node of the network (FAL) The program FAL permits the execution of the commands for file handling at the remote node (for example DELETE, PRINT, EDI, DIR, command-file running) or for transmission between the local and the remote node (for example, COPY, TYPE, DIFFERENCE).

—Sending messages to subscribers within the computer network (MAIL).

—Conducting a conversation with any desired subscriber in the computer network (PHONE).

User programs:

The user can develop his own programs for working within the computer network. These programs can be written in a higher programming language (FORTRAN77, C) or in assembly language. Here there are two different access levels.

The easiest way of working in such a network is for the user to employ the standard utilities such as those offered, for example, by the file access system (RMS). In such a case he can use standard calls to establish connections, transmit data, and complete the transmission in an orderly fashion; in short, he works in the same as with any sequential, record-oriented device. Network-specific knowledge is not necessary for this, and for the user the network is transparent.

If in special cases the transparent mode of working is not adequate, non-transparent work can be done by using system calls (for example, QIO requests).

2.5. Startup and Maintenance of the Network

Database

The SKRNET software is supplied on an appropriate storage medium, together with the operating system SVP 1800.

The information that a node needs for working with the network is kept in the database. This includes, among other things:
—Name and address of the node
—Access rights for external users
—Number and size of buffers
—Number and kind of connections
—Time intervals needed for special monitoring functions
—Information on the other network nodes.

Such a database must be generated when a node is hooked up to the network; it is made into a disk file as a permanent database and is then available for further work.

Upon starting the system a copy of the permanent database is loaded into the main memory; it remains there as a "volatile" database so long as the programs of the network software are active. During this time it is constantly updated on the basis of the work done in the network. This end is served above all by the special network communications that are exchanged among the routing nodes of the network on the basis of interrupts or other events. In a local network the nodes send identification messages at regular intervals (customarily every 10 min) that update the volatile database.

Utility program NCP

The utility program NCP is used by those in charge of the system or by the operating personnel to establish and modify the database, to install, manage, and control the network, and to test network components.

Tasks:
—Generating and modifying the database of the local node
—Generating and modifying the databases of remote nodes
—Monitoring and displaying the status and activities of the network
—Controlling activities of the network, such as starting and stopping network components, modifying the status of the line
—Directing the recording of significant events in the network
—Preparing network components for tests
—Execution of loop tests
—HELP service to the operator.

Maintenance of the network

In addition to the NCP other programs are also available that provide information to the operating personnel or permit other tests to be done:

1. Program for the recording of significant events in the network (EVL)

Significant events occurring within the network can be continuously recorded with the aid of the program EVL.

These events include:
—Circuit and node activities
—Changes in the condition of circuits, lines, and nodes
—Servicing requests
—Passive loopback
—Routing services with a counting of malfunctions in circuits, lines, and nodes
—Data transmission services with a counting of malfunctions

2. Program system for testing process/process communication over the network by means of the utility program DTS/DTR

The utility program DTS/DTR serves the purpose of checking out the software for process/process communication over the network. With the transmission program DTS and the reception program DTR four basic tests can be carried out:

Test for proper connections Data test Test for breaking a connection Interrupt test.

Each basic test can be defined more sharply by means of subtests.

3. Network Software for MUTOS 1800

As powerful 32-bit computers became available the need arose not only to couple these computers with one another but also to hook up other computing equipment and intelligent terminals to these computers. The operating system MUTOS forms a good starting point for carrying out this task on the basis of its uniform user interface for different computer classes. The designing of network software for MUTOS 1800 is being done in two development stages. The first already concluded stage consists of the development of the program packet UUCP, which on the user program level supports a coupling of devices via serial interfaces. In the second stage a comprehensive network solution integrated within the operating system is being developed, which is to bring about a rapid exchange of data via the local network ROLANET2.

In what follows the result of the first development stage—the program packet UUCP—is described.

3.1. General Properties of the Program Packet UUCP

UUCP supports reliable transparent data transmission among computers that have operating systems compatible with MUTOS. It also supports the remote execution of any desired commands and computer work via virtual terminal connections.

There are no limitations with respect to the topology of the network or the number of subscribers. All computers are enabled to establish a connection at any point in time with one or several partners in the network. There can be communication among those computers directly connected via long-distance lines, but also communication across network nodes. The operator interface to UUCP conforms to the general rules of the operating system MUTOS. To use UUCP no knowledge about the field of remote data processing is needed.

UUCP makes use of a spooling system of its own for the management of the data to be transmitted. After entering his transmission instructions into this spooling system the user is immediately given back control and can then deal with other tasks while the execution of the requested transmission takes place in the background. The program packet UUCP has at its disposal comprehensive means for controlling the access enablement of any computer in the network. The UUCP components operate on the application-program level and use the standard I/O interface of the operating system (transmission security is achieved by means of a packet transmission protocol completely within UUCP). For this reason no modifications in the operating system or to the existing hardware need to be made upon the installation of UUCP.

3.2. User Functions

File transmission

The syntax of the transmission command uucp is congruent with the syntax of the copy command cp of the operating system MUTOS, with the added feature that the name of the corresponding computer is to be put at the beginning of files stored in remote computers.

For files that are to be transmitted there are no restrictions with respect to their size and structure or their content.

Remote command execution

The program packet UUCP supports the execution of any desired MUTOS command on remote computers and the local execution of MUTOS commands with the involvement of remotely stored files. This function also permits the utilization of remote devices, such as printers.

Virtual terminal connection

With the aid of this function the operator whose terminal is also logically connected with the remote computer can put in a call to this computer and do work just as with his local computer.

Servicing functions

Various utility programs effect the outputting of information on the status of the local UUCP system as well as give user support for the maintenance of the directories used by UUCP.

3.3. Structure of the DFV system

Figure 2 shows an example of a UUCP network. This structure can be expanded by other computers and connections among the computers. The connecting lines can be established as an IFSS line, as a V.24 direct connection line, or as a remote-transmission line (four-wire line with GDN or duplex-capable asynchronous modems) (transmission speeds of 1,200 to 9,600 bits/s).

The RVS K 1840 is connected to the network via the controller AMF18, which also operates the local terminals.

In Figure 2 it is assumed that all the computers included there are working under the control of an operating system compatible with MUTOS. Computers using other operating systems can be connected up by way of an emulation of the UUCP protocols by these operating systems. For the computers robotron 1715 (SCP) and A 5120 (SCP) appropriate emulation programs are available. The internal design and the functional principles of the UUCP components for MUTOS 1630 have been described in[1].

These basic principles also apply to UUCP for MUTOS 1800, with allowance being made for the expanded scope of functions.

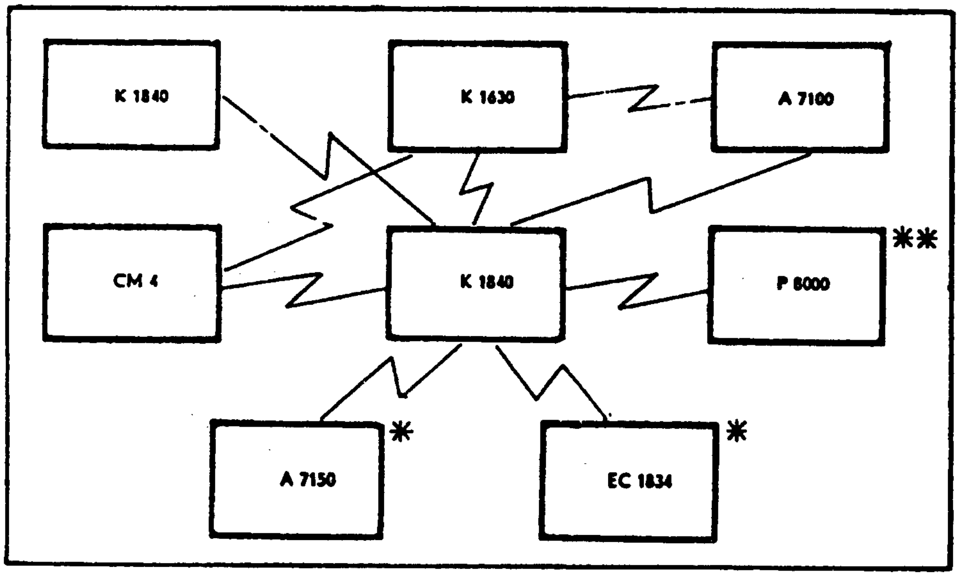

Figure 2. Example of the Structure of a UUCP Network:
*These devices are to be connected up in the second development stage; **The UUCP components for the P 8000 were developed at the KEAW VEB

Footnotes

1. Damme, L.; Inhoff, U.: "Supporting Remote Data Processing Within the Operating System MUTOS 1630 by Using the Software Packet UUCP," NEUE TECH. BUERO (German edition), Berlin 31 (1987) 1, pp 20-23.

GDR: New Approaches to Process Control System Configuration

23020023 East Berlin MESSEN STEUERN REGELN in German No 6, 1988 pp 247-251

[Article by J. Sawatzky: "New Aspects in the Design of Process Control Systems on the Data-Oriented System Level"]

[Text]

Introduction

The analysis of the international developments of process control systems shows that in addition to complex process control systems, other system concepts are emerging in particular for small and medium-size automation projects.

All these system concepts have one thing in common: as the transition is made from 8-bit to 16-bit and 32-bit technology, new application functions are being implemented primarily on the data-oriented system level which can be combined into a so-called data-oriented functional complex.

These functions have been partially implemented by adding the data-oriented system computer K1520 to the audatec system.[1] This paper will briefly analyze the developments and discuss the prerequisites for implementing this functional complex.

1. Analysis of Current Trends in Process Automation

During the past few years, the international development in the field of process automation has been characterized by two separate trends.

One trend is the development of small systems and automation componentsat a reasonable cost, the other trend covers developments to create increasingly complex and more powerful decentralized process control systems (PLS) (Figure 1[2]).

The development of small systems at a reasonable cost uses the enormous price degression of microelectronic components and modules, so that the method which has been used for the development and application of automation solutions for instruments and technological systems can be utilized for plant automation up to a project value of 50 to 500 thousand marks.

This methods uses primarily the advantages of universal PC technology in the form of PC systems with subordinated microelectronic closed- or open-loop control systems connected via PC-typical interfaces or in the form of industrial PC and small control systems.

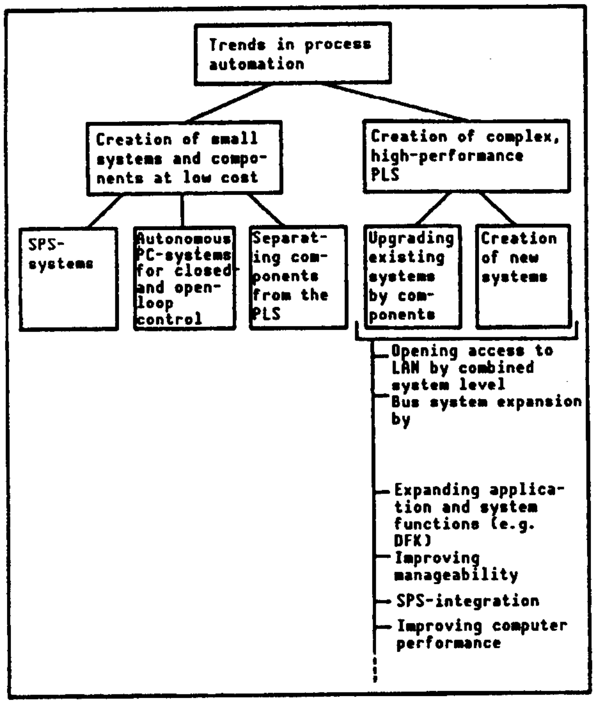

Figure 1. Trends in Process Automation

This automation strategy opens up completely new possibilities for providing access to commercial PC technology. It allows for a high flexibility and universality beyond company-specific solutions. Therefore, we can talk about open automation solutions using commercial system technology.

This is contrasted by the second trend which is directed towards a global improvement of the established decentralized process control system concepts. This trend comprises two directions:

One, the integration of stored-program controls and control systems makes it possible to develop new system concepts, secondly, existing concepts are considerably upgraded through the use of new technology and new software.

This upgrading is made possible, for instance, by expanding the system bus structure in up-front process control with field bus systems and on the factory control and dispatch level by opening access to the local area networks (LAN) of commercial data processing.

The trends described above result in five columns shown in Figure 2 which cover the configuration of the system structures and capability.

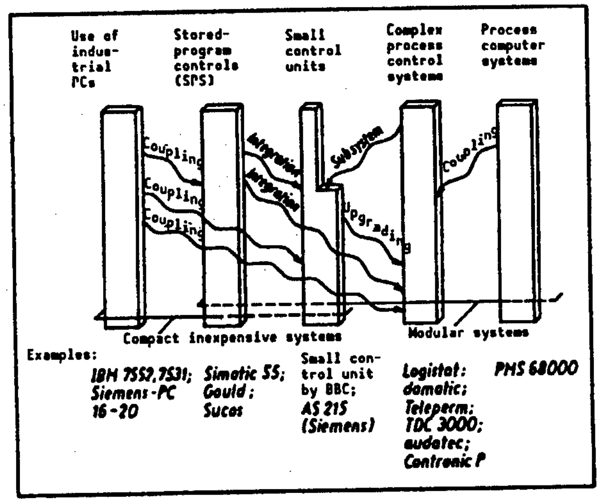

Figure 2. Structural Priorities in Designing Process Control Systems

There are numerous transitions between these structural concepts which illustrate the interrelationship and interdependence of the concepts.

As can be seen, in addition to the complex decentralized process control systems, industrial PC systems and stored-program controls represent independent structural concepts while the small control systems emerged from the more complex PLS also in the form of autonomous subsystem concepts.

The new hardware developments of the 16-bit and 32-bit computer systems, in particular on the data-oriented system level and/or on the operational level make possible new configurations of the functional software for all structural concepts described which impact almost all international new developments and which will be discussed in more detail in this article.

2. Focus of Functional Expansion on Data-Oriented System Level

On the data-oriented system level, functional expansions focus primarily on:

—historical data storage and filing
—output of historical process sequences in the form of protocols and curves
—creation of integration possibilities for application-specific functions in addition to the standard functions of the automation systems
—data compaction and parameter determination for supporting operator tasks
—process operation within the framework of a graphic-oriented visualization and interactive operator guidance

—integration of feedback documentation possibilities of the internal processing structures
—text-oriented specification of measuring points and data
—situation recognition.

The literature discusses increasingly the use of knowledge-based systems (expert systems).[13] These systems which will be used in the future to support, among other things, operative process control, operative guidance and complex process reliability will probably not be installed on system-integrated units, but rather on coupled units because of real-time and memory space considerations. In[13] situation recognition is suggested as an interface for the PLS whose complexity allows installation on system-integrated units. Therefore, only this function will be included in the range of functional possibilities described above.

All functions mentioned are based on process data. They manage and manipulate data based on certain characteristics. They do not provide direct, automatically acting process control data. Therefore, these functions will be combined into a so-called data-oriented functional complex (DFK). This complex is characterized by functional- and data-oriented processing of the process data as compared to previous processing and managing in PLS which was basically measuring point oriented.

Implementation of this functional complex in installations on the data-oriented system level or on the operational level requires use of the new system hardware options, such as

—16-bit and 32-bit process technology
—large addressable internal memory (greater than 0.5Mbyte)
—use of external storage media such as floppy disk and hard disk storage
—hardware-assisted memory management
—use of function-oriented special processors such as arithmetic and graphics processors
—reduced number of modules in the computer core and transition to more universal modules

However, new system software options such as

—real-time multi-task operating systems
—file systems
—high-level languages for system development
—graphic software systems

create critical prerequisites for implementation. The data-oriented functional complex has indeed parallels with commercial office data processing with personal computers, workstation computers and workstations. However, despite formal similarities basic differences remain which result from

—the considerably higher reliability requirements for PLS

—special requirements of real-time operation to which these functions are subordinated

—requirements regarding system integration of these functions (monitoring, diagnostics, system communication, managability, uniform operation, etc.)

The expansion of functions will result in the original process computer functions being integrated into the PLS units themselves, without requiring coupling of non-system hardware and software. Thus, these functions are directly accessible for the plant operator. This requires, of course, new concepts of process operation (visualization and operator guidance) which differ considerably from the previous ones. Due to the large number of manipulation possibilities in the operation of DFK operation, a function-oriented keyboard alone cannot handle these requirements. Operation is possible only with preset menus which have a hierarchical structure and can be called up on the screen.

Thus, the importance of process computers in process automation continues to decrease.

3. Structural Organization of Functional Integration

DFK installation can be based on different concepts. They range from a loose PC integration on the one end to its installation into the system-integrated units on the other end.

However, this depends on the origin of system development. Modern PLS are characterized by two different organizational strategies: additions to the system and/or system expansion, and the development of a completely new system (Figure 3).

The most modern PC technology at the time can be connected to the DFK via standard interfaces. However, because of the low data transmission rates of slow serial interfaces there are limits to the capture of data.

The integration of new installations in existing PLS allows full use of DFK under PLS conditions. This requires primarily direct bus connection between these units and thus high data transmission rates when accessing the process data already present in the system.

Expanding exisiting PLS by a superimposed structural level allows, on the one hand, great freedom when configuring the functional distribution and the functions in this level, and on the other hand use of a proven system as a data basis and subsystem for process control.

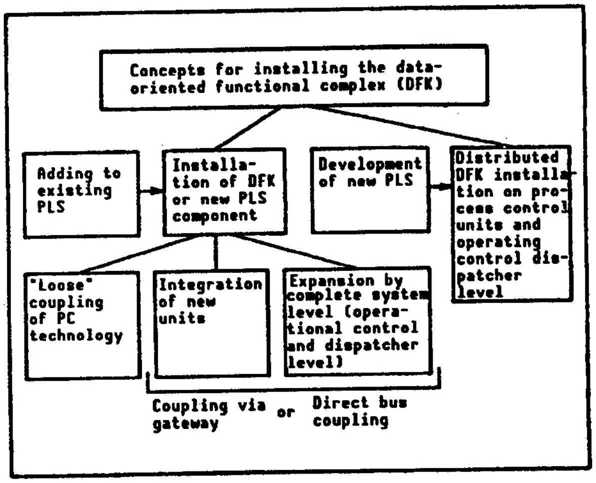

Figure 3. Concepts for Installing Data-Oriented Functional Complex

This is an effective method for system renewal while at the same time meeting the compatibility requirements, for instance, for reconstruction projects.

4. Implementing Data-Oriented Functional Complex

4.1. Operating System

Once 16-bit microcomputer units are being used, the management of large internal storage areas, the management of external storage devices with data systems and, among others, also increased efficiency of software development require the use of call-directed real-time, multi-task operating system, at least for the data-oriented system level of PLS.

Among the units on the data-oriented system level, real-time requirements result primarily from the

—requirements for periodic updates of the temporary data basis, which is the basis for historical data storage and filing and also for all other application functions
—sporadic, non-cyclical operator actions, for instance, to call up new system functions (screen change with new data capture, change of cycle time for data capture)
—data transmission requirements

This real-time operation is affected by external memory operation. The time-sensitive effect of data transmission and external memory handling can be mitigated by use of controllers on the respective connection controls. During data transmission in particular, event-oriented loads on the host computer cannot be excluded.

In the units used in up-front process control, real-time requirements result primarily from the

—equidistant data capture and output and process control algorithms

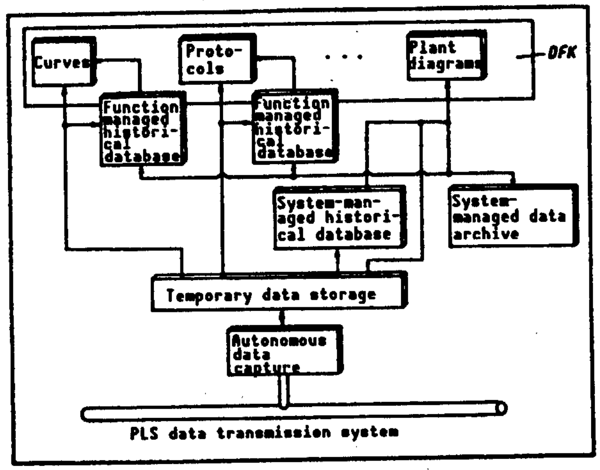

Figure 4. Simplified Data Structure for Implementing the Data-Oriented Functional Complex

—event-oriented process requirements
—data transmission requirements

These requirements are one order of magnitude higher than those for the data-oriented system level (time between events greater than 10ms for processing, greater than 100 ms for data-oriented system level). This means that the units of up-front process control require a considerably higher real-time reliability for the operating system used than those of the data-oriented system level. This is reflected in the selection of the operating system or the configuration size in case of configurable operating systems.

Real-time, multi-task operating systems which have been prepared for use in OEM module systems are, for instance, iRMX 86[3], iRMX 286 (both Intel), RMOS 2[4] (Siemens), Concurrent CP/M-86[5], and BOS 1810 (robotron).[6]

A characteristic feature, in particular of 16-bit and 32-bit operating systems, is their ability to make software development more managable by providing extensive libraries, subsystems for device connection and file management, language compiling and testing tools. However, troubleshooting in the system becomes considerably more costly due to their complexity and reduced transparency (dynamic memory management).

4.2 Data Storage

Data storage, an essential part in DFK implementation, has three different levels (Figure 4):

—temporary data storage which comprises the complete process data basis of the subsystem with a storage depth of 1 and which is provided by data transmission

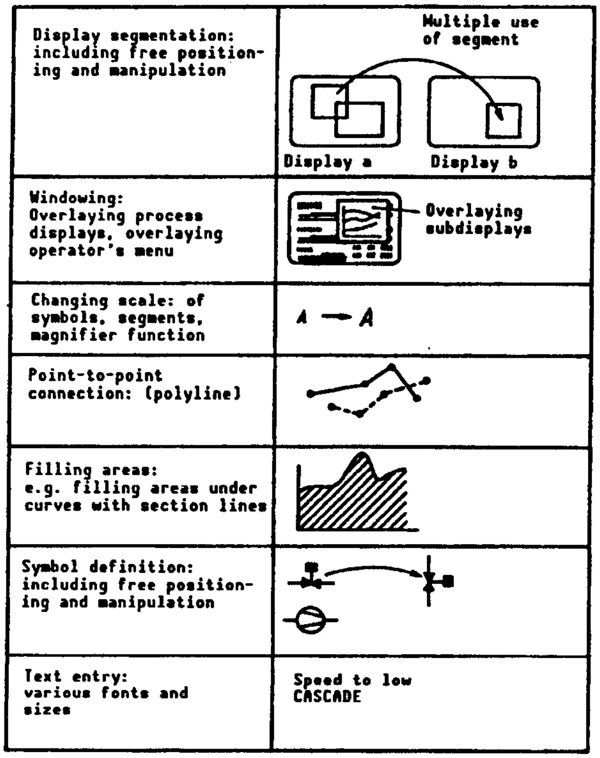

Figure 5. Application-Oriented Graphics Functions for Visualization in PLS (Examples)

—historical data basis which is divided into a system-managing part and a part privately managed by the respective functions (freely definable storage depth)

—data archive which represents the data basis residing in the storage medium.[12]

While temporary data storage takes place in the host computer, the data of the historic data basis can be stored on a hard disk or a floppy disk from a certain historical depth on which can be freely specified.

The data archive is always stored on a floppy disk.

These systems require a minimum of 500 Kbyte main memory.

4.3. Graphics

To output diagrams, primarily quasi-graphic systems, some of them with added plotter units, were used for PLS where the data-oriented operational level is based on 8-bit processors. Their available number of characters is very low and the degree of freedom for visualization is limited. On the other hand, quasi-graphic output requires relatively little hardware and software. Output with full graphics are supported by special controllers (e.g. graphics controller IU 82720) which convert graphics primitives.

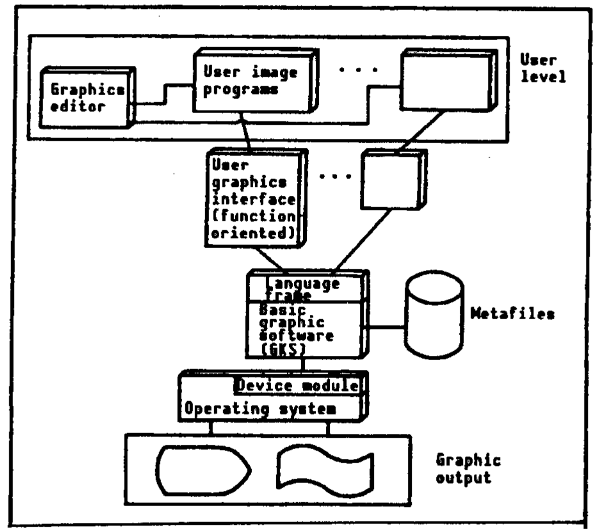

Figure 6. Structure of Graphic Systems in PLS Using Graphics Standards

Extensive graphics software packages were developed on the basis of standards, in particular for CAD systems. These standards are, for instance, CGI, a suggested standard for a graphic interface, or GKS, the graphic core system. Graphic expansions for specific operating systems must also be included (SCP-GX).

These standards allow easy expansion as well as programming independently of the computer system (Figure 5).

These features are particularly important for PLS. Therefore, these standards must be used when designing graphic system in PLS.[7]

The functions made available by these systems (Figure 6) provide a new visualization quality.

The option of displaying sub-screens (windowing) in particular ensures a more concentrated display of information while retaining the same number of monitors. Being able to freely arrange information results in better process control.

Windowing is also suitable for overlaying the pre-set operator menu.

4.4. Data Logging

Because of their limited ability for historical data capture, 8-bit processor based PLS have relatively low-level logging capabilities because external, directly connected mass storage media have not been available previously

(TDC 2000, audatec). In this context, the users of control systems emphasize the necessity of a historical data basis supported by mass storage media to which the plant operators have direct access.[8,9]

The protocols which can be used for audatec with the newly developed data-oriented system processor K 1520 as a directly system-integrated unit such as

—fast trendlog (cyclical, resolution 5s for 24 measuring points)
—slow trendlog (cyclical, resolution from 60 s for a total of 120 measuring points)
—Havarielog (event-oriented, resolution from 60 s for 100 measuring points)

will be expanded by day, shift, month and balance sheet protocols which are supposed to be freely configurable by the user and by event-oriented protocols. The types of events for event-oriented protocols include malfunctions (exceeding limit values, changes in the measuring point status, etc.) as well as switching conditions, operator actions, system erorrs, etc. A protocol generating option must allow inclusion of new types of protocols by the user himself.

4.5. Curves

As typical for DFK, this section will discuss the representation of process data in the form of curves. The freely selectable multiple curve display for process data of the historical data base with a freely settable time period has become a critical requirement for making process control effective.

In addition, compared to international DFK solutions, curve implemention requires in addition selectable storage of the precise curve values and curve output in various coordinate field sizes (for output as sub-pictures in other representation, e.g. in the plant layout). Basic manipulation options when using the graphics software include changing the time scale and the display area of the curves displayed per display,free movement of the curves across the time range of the historic data base, filling the integration area below the curve as well as masking and overlaying of curves.

Prognosis for System Development Audatec on Data-Oriented System Level

In line with international trends, the continued development of the PLS audatec will include advanced DFK integration using 16-bit technology and will thus directly implement both function-oriented and measuring point processing of process data. This development will be based on the extensive experience gained in the development of adatec units coupling-unit/data oriented system level computer and data-oriented system level computer K1520.[10] An audatec system upgrade by an additional system component which will be integrated into the complete system the same way as those already present has proven to be the most advantageous version.

In the GDR, the device systems AC 7150[11], PC EC 1834 by VEP combine Robotron and the modular basic module system S 700 by VEB Numerik "Karl Marx" are available for 16-bit adaption in PLS. They provide most of the assemblies for the modular system components and have capabilities comparable to international standards.

Footnotes

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Experts Discuss Situation of Computerization in Hungary

25020054g Budapest COMPUTERWORLD/ SZAMITASTECHNIKA in Hungarian No 8, 20 Apr 88 pp 10-11

[Roundtable discussion. The participants were Tamas Boromissza, a department chief in the National Technical Development Committee; Janos Gantner, director of the Videoton Computer Technology Factory; Miklos Havass, first secretary of the Janos Neumann Computer Science Society; Gyorgy Jani, deputy director general of Elektromodul; Gabor Szeles, chief of the Percomp Association; Tamas Kolossa, editor of COMPUTERWORLD/SZAMITASTECHNIKA; and Elek Nagy, editor-in-chief of COMPUTERWORLD/ SZAMITASTECHNIKA: "Supply, Lobby, Market"]

[Text] "Please change the world!" wrote Gyorgy Balint in 1931. "In general one of the greatest faults of the world today," he continued, "is that people do not want to change. Rather they carefully desert, some in exercise out in the mountains, others in theory in comfortable and air tight little manias and neuroses. Please come back from the mountains to the cities, and please, urgently, change the world!"

Who can deny it—computer technology often happily simpers in the role of world changer, warmly promising us all a better future. And now, at least domestic computer technology, as if to be more modest. As if it had not already promised so much. The events of recent months have shown that there is no agreement within the profession in the matter of world changing—so the outside judgment of the profession cannot be uniform either. As if it were Hungarian computer technology which required changing.

We invited several prominent representatives of the profession to a roundtable discussion. It was not because of their activity but rather because of the state of the profession that the table which was supposed to be round turned out to be a bit angular. The angles we examined were: domestic manufacture or assembly of personal computers, the efforts made for internal supply, the relationship of computer technology to the background industry and the national economy, new possibilities connected with individual foreign trade rights, and the status of professional interest protection.

Elek Nagy: A love of and fear for our profession has prompted us to organize this roundtable discussion. It is our conviction that even in difficult times we should not slow the rate of development of computer technology. It is already recognized that proper efficiency can be attained only with modern tools. We have often given room in our journal for the diagnosis. But we would like to devote more room to the therapy as well. So now we should not criticize individual decrees but rather seek answers to questions which may be determining ones in regard to the future. We have long debated, for example, domestic manufacture of personal computers. But without coming to a united position. One unwillingly recalls the status of domestic auto manufacture, which is characterized by a similar duality. The debate flares up from time to time: Should we or shouldn't we make them. Raba has gotten out of it, but the talks continue. At the same time we have before us the example of South Korea—within a few years they achieved spectacular results in the area of electronics. Why is it that we have no powerful, economical manufacture? Is this really in everyone's interest?

Gabor Szeles: Today primarily, perhaps, Instrument Technology and the Percomp Association are interested in manufacture. We think that it is thanks to manufacture that a staff of experts with very serious hardware and software knowledge has grown up in both the enterprise and cooperative sphere. We have reached a level where this group of experts would be capable of starting a new electronics and computer technology program. But it is a condition for this that Hungary develop the technological background on which the knowledge could rest. Today we see the essence of the argument not in whether or not we should manufacture but rather in how to produce an economical manufacturing technology. Unlike the Far East we have no American know-how, no Western capital. So we see no other path than following the Western European model, developing the institutional and enterprise structure for development and manufacture of the background technology, which would slowly help the country to bring technology into balance with the computer technology expertise of our engineers. I know that I am talking about a very difficult thing, all the more so since here shining results can be achieved with short-term commercial operations and not with long-range thinking.

Elek Nagy: The manufacturing know-how for an IBM PC/XT can be achieved already. The question is, "Is it worth struggling for?"

Gabor Szeles: That is not what I was talking about, but rather about the manufacturing culture of the near future. About taking apart a PS/2, and seeing the results of entirely new manufacturing technologies which we do not have. Such things as multilayer printed circuit cards, surface mounting, the automatic testers needed for this, and so forth. They are now leading four lines between two pins of an IC, so the fine resolution printed circuit technology known here is already quite obsolete. This is a new line of thought because either we catch up with what is or we go further and adopt an entirely new manufacturing culture, or develop one, which, however, would require very much money and serious research effort.

Tamas Kolossa: Which costs more, importing finished products in large batches or manufacture and development here at home?

Gabor Szeles: That depends on where the country or East Europe is in use. As long as manufacture here was a thousand units a year it was cheaper to hire four or five engineers for oscilloscope testing. If manufacture reaches 5,000 it is worth buying automatic testing equipment and automating the manufacture of mechanical parts. Above 10,000 there are new calculations. I think that there is already a need for 15,000 PC's per year in Hungary. And demand in neighboring countries will probably strengthen too. It is already worth it to invest in this.

Elek Nagy: These are very small numbers compared to Western series....

Tamas Kolossa: And we are easily passed on the socialist market; Robotron has begun large series manufacture of XT's.

Gabor Szeles: We began this a good bit earlier. What is alarming is that Robotron is probably already beyond those investments and manufacturing development decisions for which the situation is not yet ripe here. This should be coordinated and accelerated in the OMFB [National Technical Development Committee].

Boromissza: I am convinced that domestic manufacturing capacity is equal to the solvent demand. But having a more developed manufacturing culture is not just a question of PC's, it is a comprehensive electronic technology problem. The OMFB is trying to solve this by supporting the development of surface mounting and automatic testing equipment.

Janos Gantner: This has been a fluid theme for years, in connection with it we easily fall into the trap of sentimentalism. I would like to put the discussion on a strictly business basis. Starting from the law of supply and demand we know that if a computer is very cheap then a lot of them are needed, if it is expensive then few are needed. So there is a rational way to bring supply and demand into balance—we have to raise the prices. Obviously many are not pleased by this, they would rather increase the supply. But to do this we would have to import more or make more. I believe that prices are not established in accordance with the economic environment, and this increases the shortage. Let us not forget that this product has a very high import component. If we want to raise the import quota we can do so only with a good bit more capitalist export, the relative import component of which is higher still. So the problem can be solved only with more foreign exchange. Yes, but there are at least two rates of exchange. According to our calculations we would have to make 50,000 to 100,000 PC's per year to reach suitable efficiency. This involves an awful lot of import, not necessarily at the lowest rate of exchange. With lots of this size we could not neglect the question of clear title, which involves more foreign exchange expenditures. In full awareness of my responsibility I say that all this cannot be solved in this volume with the present import game rules, with costs calculated at the official rate of exchange. So really the question is not whether domestic manufacture can be realized but rather whether it can be done with the present regulations.

Elek Nagy: Probably not everyone considers computer prices low....

Janos Gantner: Housing and telephones are cheaper than their real value too, but what is that worth if I cannot get one? Last year Videoton had a contract for 1,200 cheap computers, we delivered 2,000 domestically, this year the contract is for 1,100, and we again may reach 2,000. We cannot undertake more under present conditions. With about a one week switchover we might reach 10,000 per year, with a one month switchover we could reach a series of 20,000 per year, but only if there were additional import possibilities suiting the solvent demand. Then we could approach market balance from the supply side, if the market balance were not maintained by increasing prices from an acceptable demand side.

In the case of the school computer program the enterprise bears the burdens of applications support—for educational and business policy reasons—but this would be impossible with a PC program of such a volume.

Gyorgy Jani: I do not believe that economical computer manufacture can be realized in Hungary. Yet I think that we must urge manufacture, only we must examine how deep it should be. From this viewpoint I consider the PC competition to be a modest but forward looking step. In my opinion assembly is worth doing because in this way we can learn the technology needed for good operation, and we can select the homogeneous machine park needed for commerce. As a vendor I start from the idea that the key question is not so much manufacture as it is applications and the background development serving it. The practical successes prove this too, for example in the case of Instrument Technology....

Gabor Szeles: I do not agree. It will always be the interest of a commercial firm to get more and more import quotas. But the interest of a manufacturer is deeper and deeper manufacturing. We must find a rational compromise between the two, but not at the price of forgetting the results achieved. In any case in my eyes the word "assembly" is only good to smooth over the problems. If a semiskilled worker plugs cards into a box this is not assembly. But if we build an IC level line this is no longer assembly but manufacture. If we want a long-range technological development strategy in Hungary then we should not trifle with it at this level.

Gyorgy Jani: Getting a good motherboard designed here at home is senseless....

Gabor Szeles: We not only design them we make them.

Tamas Kolossa: So there is no agreement, no decision....

Gabor Szeles: That is not true, because Instrument Technology decided and it goes its own path. Only we would not like the background industry to go bankrupt.

Tamas Kolossa: Would a balanced rate of exchange help?

Janos Gantner: Yes, but we would still not know how much. The several manufacturers get foreign exchange from various sources, at various rates of exchange, so there is a spread in prices even in the case of the same products. Of course this does not interest the user. So then the debates turn toward changing the world. But as long as we cannot make an infallible judgment in these questions we will not see clearly in the whole economy. So one of the articles in COMPUTERWORLD/SZAMITASTECHNIKA offended me a bit—perhaps because it was true—when it said that the large enterprises were lazy. But, if you please, we have been making computers for 12 years, and we are not making more because we don't want to. A different sort of market decides in Taiwan, because their money is exchangeable, and performance is measured adjusted to the world market.

Gyorgy Jani: So acquisition might be concentrated on sensibly. This might be accompanied not only by foreign exchange savings but also by more uniform supply.

Janos Gantner: This "supply" is a bad word today. [Translator's note: The word used here is "ellatas" meaning "to supply" and carrying an obligatory, planned economy connotation. The Hungarian word "kinalat" meaning "to offer" is used when "supply and demand" are discussed in a market context.] In a performance oriented economy he manufactures who finds it worth while. A dynamic must be created not on the basis of a supplying responsibilty or a professional, emotional basis, but rather on an economic policy, financial and market basis. If the resources can be obtained and if there are market prices then everybody, big and little, will get in who has an economic interest in doing so.

Gyorgy Jani: I cannot agree that prices should go up. Very many would like to rationally exploit the possibilities given by a computer, and this will happen only with a bearable price level.

Elek Nagy: And with a concentrated industrial policy. From this viewpoint the effectiveness of the competitions is dubious, for if we give a little everywhere our forces will be scattered. Why isn't a large, serious capitalist manufacturer coming in, why couldn't we establish a mixed enterprise?

Boromissza: Twenty years ago there was an effort to establish a large Hungarian system to manufacture printed circuits. It did not succeed. The competition was not a scattering but rather a relatively good distribution. We extended the competition to this year too and we have signed contracts for the manufacture of more than 3,000 units in the first half of the year.

Miklos Havass: For me the basic question is not whether to manufacture or not. We should examine whether the hypothesis according to which a demand for applications should be aroused and then a demand for manufacture would follow from it was correct. I am not convinced it was. So today the question arises: For whom do we manufacture? For the Hungarian, socialist or capitalist market? I am afraid that we should not aim at large investments, because of the swift technological changes. If our management system should make it possible I consider it imaginable that some multinational firm would get into some shared undertaking and aid in exploiting the market gaps or, better yet, get into delivering turnkey systems. But we would have to create management security and interest for him. For example with a stable regulator system.

Janos Gantner: It is an error to believe that wages are still low here and this will entice Western capital. And we gladly nourish the illusion that our intellectual capital is good. In a short time we could fall behind in this area too; the Far Eastern experts study at American universities while we may get stuck at one level in this situation.

Elek Nagy: How much might the problems be eased by the so-called individual foreign trade rights which went into effect in January?

Miklos Havass: If we want to be out there on the world market then it is impossible not to have our own direct market contacts. The bargaining positions of Hungarian vendors today are at just the same level as those of the producers. It is fundamentally important that the enterprises got into more favorble bargaining positions. There is no doubt that the new opportunity might produce awkward situations, Hungarian experts may bump into one another on external markets, but we must accept this together with a clarification of positions. Of course this must be coupled with a new quality attitude. We cannot manufacture several qualities within one firm. It is very difficult to harmonize different strategies and qualities within one enterprise as a result of the three markets—domestic, socialist, and capitalist.

Gyorgy Jani: The individual foreign trade right is today still a formal institution actually, because the system of authorization has not changed and the foreign exchange quotas are limited. Despite this I agree with the new possibility, because, on the one hand, the enterprise experts can propagandize their products substantially better and, on the other hand, the foreign trade people in a given case will be forced to get to know the goods.

Elek Nagy: One question more, professional interest representation. One hears more and more about such efforts by other professions. What sort of groupings represent the interests of manufacture, of software, of the experts for us, do these appear in the Neumann Society for example, or is there a need for parallel channels?

Miklos Havass: It is the intention of the Society to try to embody certain interests, for example the grading of software. And a forum of software exporters is being formed now in the Economic Chamber. I believe that this is good, we should let a number of interest groups form—for small entrepreneurs, for researchers and manufacturers and so forth.

Gyorgy Jani: In my opinion computer technology is not so uniform that interest representation should be uniform. The interests differ at this table too....

Janos Gantner: We can agree that we might lobby, for example, for an understandable, stable regulator system. But this is not computer technology. Not to speak of the fact that lobbying is useful only up to a certain limit beyond which it is definitely harmful. We all know examples of this. But today this demand is not too realistic, because it is unimagineable for example that—let us say—we could lobby another one million dollars for the PC competition.

Miklos Havass: We were able to "lobby" an MEV [Microelectronics Enterprise].

Tamas Kolossa: Apparently it is hopeless to get even one million dollars. But this computer technology, one of the most dynamically developing branches of the economy in which it would be good to invest in the interest of structural change, did it get anything from the one billion marks FRG loan? So far no one from the profession has questioned this. This is what we find missing when we talk about professional interest representation....

Gabor Szeles: That is true, representation at such a level is missing.

Miklos Havass: Let us not pass the responsibility too "high", we all know about the one billion, and we must prove the usefulness of the investment. At the same time the situation is not so simple. With the aid of the OMFB the SZAMALK [Computer Technology Applications Enterprise] is trying to get World Bank credit. And two basic things changed on 1 January—the investment is costing 20 percent more and the dollar costs 10 percent more. So it is difficult to plan for the long term....

Janos Gantner: So this is where we always come out—we need a realistic market with performance and price relationships in harmony. And still we live from daily tactics. But no doubt about it, it would be worth going after a billion.

Computer Assisted Machine Tool Design, Production in Hungary

25020053b Budapest MAGYAR ELEKTRONIKA in Hungarian No 3, 1988 pp 19-28

[Article by Peter Kerekes and Peter Raboczki, of the FLEXYS Joint Stock Company: "Computer Assisted Machine Tool Design and Production, the FFS CAD/CAM System"]

[Excerpts] The FFS (Free-Form Shapes) system was developed for machine industry CAD/CAM purposes. The system makes possible the design and machining of bodies defined by free form surfaces. This article describes the method of surface description, the geometric designing and the machining procedure.

Introduction

The development of machine industry CAD/CAM systems today has accelerated to such an extent that without its results it has become virtually impossible to have economically competitive production and thus market success. Consequently, there is ever greater need for such R&D work and for rapid industrial introduction of the results also in our country.

The basic tools—NC machines and computers—are already available in Hungary, but the number of computerized systems developed for industrial purposes is very small. Domestic development is also highly significant, because it has become impossible to buy such systems from developed capitalist countries as a result of the strict embargo policy. The drastic reduction in the price of hardware today supports or makes possible the development and industrial introduction of such systems. IBM PCs provide acceptable computing capacity and graphics—although generally not with suitable resolution.

The development of such computerized systems has been going on for years at the MTA SZTAKI [Computer Technology and Automation Research Institute of the Hungarian Academy of Sciences] and they solve various problems of machine industry design and manufacture. The newest of these is the FFS CAD/CAM system. The system is sold by the FLEXYS Manufacturing Automation Joint Stock Company. The product has already proven its viability in many actual industrial applications here and abroad (the Csepel Works Machine Tool Factory, Ikarus, TST VUNAR, the Dacia Auto Factory and Aerofina).

The FFS system provides for designing and machining of bodies defined by free form surfaces. Designing takes place in an interactive graphic way. The system is suitable for reproduction on the basis of technical drawings and models and for computer assisted form design. After putting in the technological parameters on the basis of the designed surface geometry it automatically produces the NC control tapes needed for machining, both roughing and smoothing.

Mathematical Methods for Describing Sculptured Surfaces

General Approach

Since we want to use surface description methods to describe the surfaces appearing in engineering practice we must describe quite varied geometric surfaces easily and naturally, surfaces which in many cases occupy singular positions from the mathematical viewpoint. Thus there may be sections of infinite steepness, edges, derivative jumps of various orders, closed spaces and recurrent surface sections. It is very difficult or simply impossible to use the z=f(x,y) explicit functions to describe all these because the set of such functions is quite limited. We have much greater freedom in regard to the form of manageable surfaces and the above singularities if we describe the surface with a two-parameter vector-scalar function, where even a three coordinate change is described by three two-variable functions which can be given independently of one another, thus x=x(u,v), y=y(u,v) and z=z(u,v), or, in vectoral form, F=F(u,v).

Thus this function has a vector for every point of a domain of the [u,v] parameter plane, and the endpoints of the vectors set the surface.

In practice our surfaces are generally so complex that they cannot be described with a single vector-scalar function. So according to some systems an interdependent surface must be broken down into parts and a descriptive function must be defined separately for each elemental surface. And for esthetic but most often for fundamental physical reasons one must also ensure the smoothness of the surface, thus the continuity between these surface elements in various orders. So one must select two-parameter functions which have the simplest possible form, having at the same time suitable free parameters to create the above connections. A special requirement for surface description methods is that they can be handled well on a computer, since we want to do all the geometric operations with a computer.

The method must make possible a computer computation of the various surface characteristics (tangents, normals, sections, projections) with an acceptable expenditure of time. It must also make possible a graphic display of the surfaces and surface elements.

Surface Description in the FFS

The FFS System is a surface modeling system. Basically it can handle surfaces which arise by the smoothing of a point network with a matrix structure. We call the three-dimensional square shaped surface parts defined by point lines and columns elemental surfaces or surface elements (in English, patches). The surface elements also have a matrix arrangement, that is can be identified as elements of a matrix. The system permits only continuous surfaces, there can be no breaks in the surfaces. In the case of simple continuity there can be break lines (edges) where surface elements join. Continuous tangential matching ensures the unbroken connection of surface elements. In other cases we may want curved continuity in the connections. The mathematical methods used automatically ensure curved continuity inside the surface elements. The surface created can be changed both globally (extending to every surface element) and locally (having an effect only on neighboring elements).

Sixteen factors define every surface element: four corner points, eight tangent vectors in the corner points and four twist vectors in the corner points.

The system determines the internal points of the surface element on the basis of these data by means of interpolation. When using two-parameter vector-scalar functions the UV parameter plane maps unambiguously onto the surface element a unit square where U is equal to or greater than zero and less than or equal to one and V is equal to or greater than zero and less than or equal to one. Thus every point of it is characterized by two parameters. If we select the value of some parameter as a constant then we get a surface curve. We call this curve the parameter line. The system uses a dense net of these parameter lines to display the surfaces.

The schematic structure of the system can be seen in Figure 1.

The FFS is a collection of programs which can call one another directly or which communicate via data files. This articulation is justified by two circumstances. On the one hand we would like to sell the system on smaller (cheaper) computers and on the other hand this articulation makes it possible for a user to freely put together a software environment best suiting his task (that is, he does not have to buy program components which do not fit into the planned product profile).

Geometric Designing in the FFS System

Before one can have computerized designing one must have:

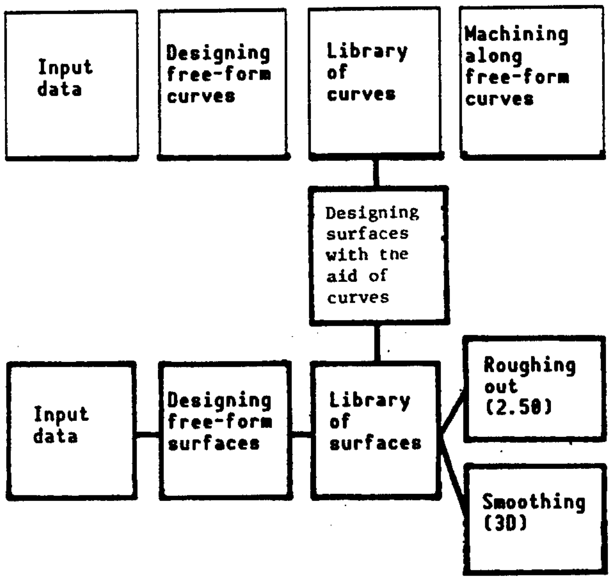

Figure 1.

—technical drawings precisely defining the geometry of the part, or
—a full scale or reduced model, or
—a design idea faithfully describing the essence of the geometry of the part.

The data characterizing the curves and surfaces can be given with a simple input language, this constitutes the input of FFS. In the case of a simpler surface geometry all the data can be put in in the interactive mode. There are two large groups of free form surfaces. In the first are those surfaces which can be simply described with the aid of their individual characteristic curves. These include rotation, translation and control curve plus section curve type surfaces. In the second group are all other surfaces. These can be defined with the aid of a point set.

The FFS system offers a broad variety for designing curves, designing both free form curves and curves made up of the traditional elements of machinery. When designing free form curves it is enough to give data on a few characteristic points; the system interpolates mathematically and esthetically smooth curves between the points. Various applications can pose different requirements in regard to the form of the curve, so four interpolation algorithms are built in.

One can also interpolate arcs corresponding to traditional geometry or straight segments into the free form curves. The interpolated form can be changed locally and globally. Local modification means transforming the environment of some characteristic point, in the course of which we can change the coordinates of the network points and the size and direction of the tangent vectors interpreted in the network points. In the case of a tangent with a larger absolute value the curve is "smoothed better" to the tangent, thus the so-called "saturation" of the affected part will be greater. By rewriting the direction of the tangent vectors it is also possible to create breaks (Figure 2). Global modifications change the entire form of the curve. These include, for example, simple linear transformations, rotation, extension, shifting and reflection.

Only a restricted group of parts can be described using exclusively free form curves. To make it easy to manufacture and check the parts the traditional elements of machinery dominate in the drawings (this will presumably be so in the future also). Computerized reproduction of tasks of this type is significantly simplified by a module of the FFS system which interprets mechanical drawings—the GEM. In essence the functioning of the GEM copies the activity of a design engineer. When using it we can define basic design elements (arcs and straight lines) and can reproduce the desired contour by cutting and attaching these in pairs.

The designed curves can be archived at any phase of designing. This internal computerized display is the basis for later processing. With their aid we can generate simple NC tracks. Even then the most important technological parameters can be give interactively and the final result can be checked graphically (Figure 3).

Simple surfaces can be easily defined with the aid of the curves. We have already described the surface generation possibilities offered by the FFS system. As an illustration we now describe only a rotation surface generated on the basis of a derivative curve (Figure 4). The program producing the surface from the curve creates a data file just like the surface designing program, thus we can use all the services of the surface designing program to create the final form of the surface.

In the unfortunate event that not one of the above methods leads to a result we can define the supporting points of the surface with the aid of a point network. Then we must smooth the initial form with some surface interpolating algorithm. The surfaces generated by the global interpolation procedures go through the given points but it is frequently necessary to execute modifications in the interest of getting the final form; that is, we must overrule the geometric parameters (determining the form of the surface) set by FFS. As in the curve designing programs here also we can execute local and global modifications on any of the curves defining the surface. Another method for modifying surfaces or preparing variants is joining previously designed surfaces (Figure 5). In any phase of the designing we can execute various transformations (shifting, rotation, reflection, extension) on the surfaces.

Displaying the free form surfaces is a key point in geometric designing. The system offers a broad assortment for displaying the surfaces. The program fits a so-called dense net onto the surfaces, from which we can

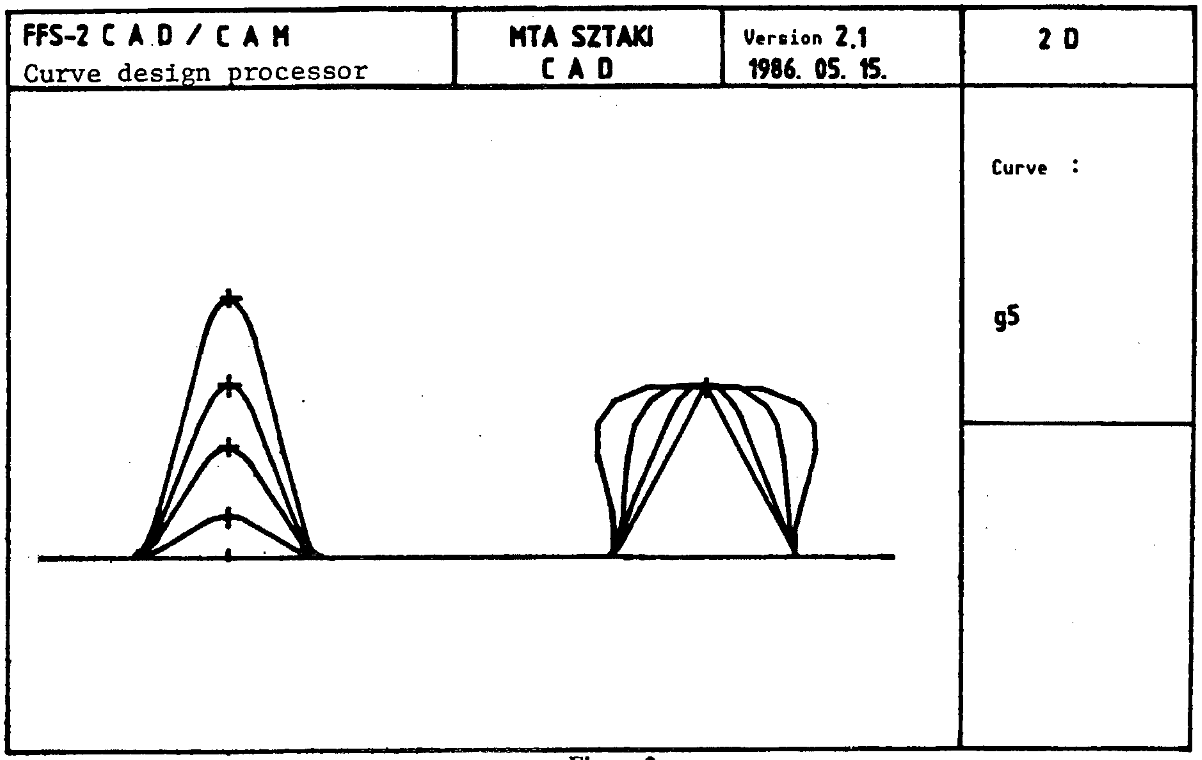

Figure 2.

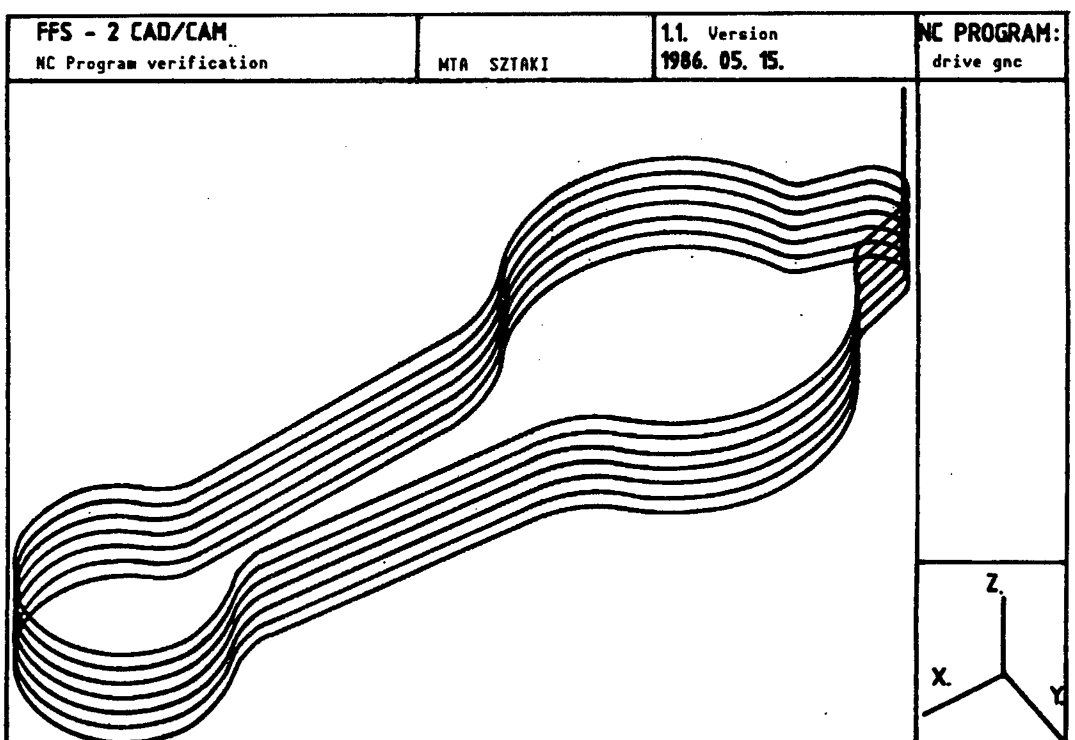

Figure 3.

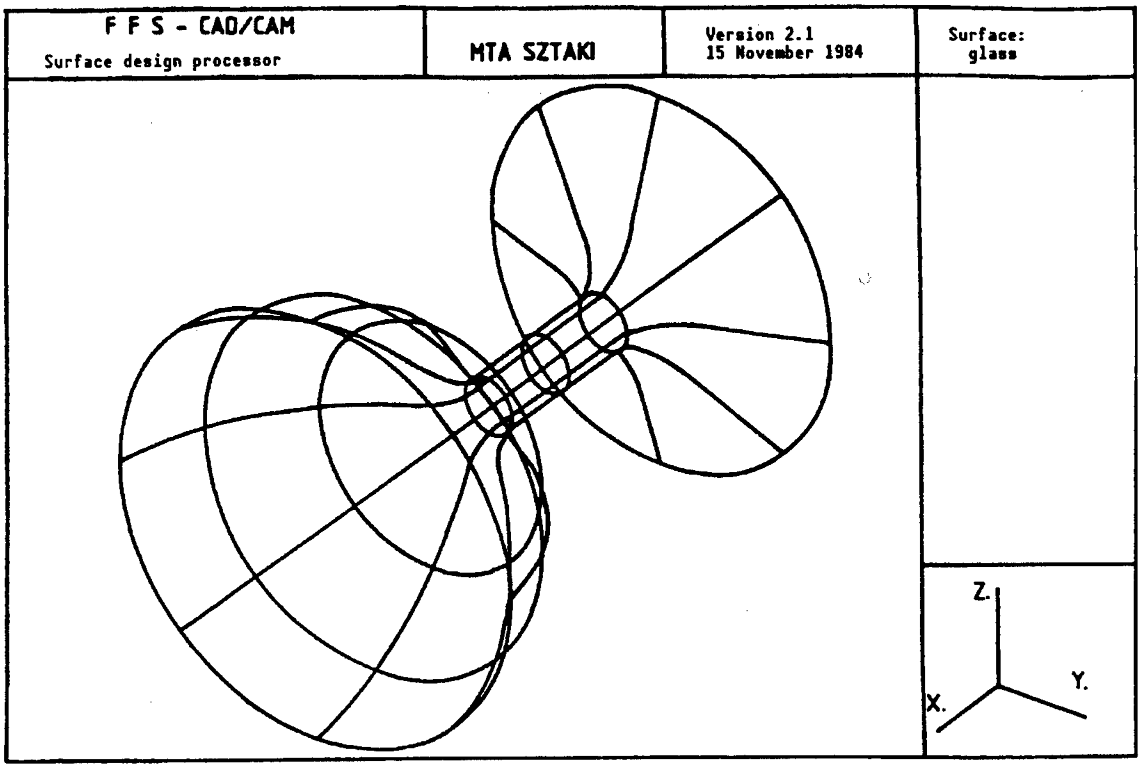

Figure 4.

request orthogonal projection images or perspective figures prepared from a point in space which can be selected optionally. Changing the density of the lines, magnification and reduction are effective tools for illustrating three-dimensional surfaces. The figures appear on the graphic display or on the connected plotter (if desired) almost instantly (Figure 6).

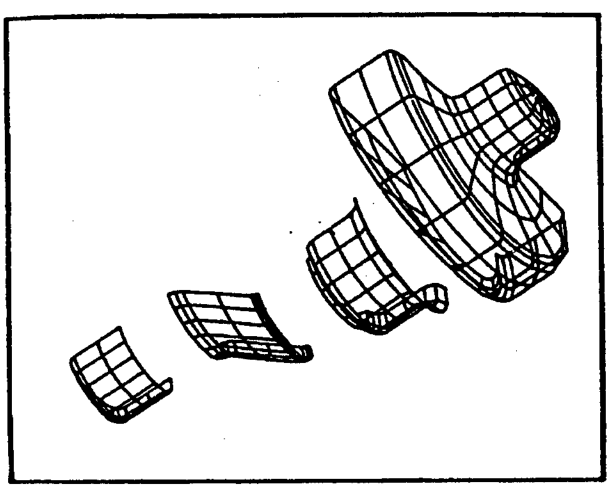

Figure 5.

Machining in the FFS System

On the basis of the internal computer depiction of the curves and surfaces created in the designing phase the technological processors of the FFS are capable of automatically producing NC machining programs. We can find several NC processors in FFS, which make maximal form faithfulness possible. The most important of these are:

—tool path generation along curves,

—2.5-D roughing of surfaces,

—3-D smooth machining of surfaces, and

—5-D machining.

Like the geometric designing programs the technological processors are also interactive graphic programs. In the course of rough machining the material surrounding the surface can be removed quickly and efficiently by a cylindrical milling machine. The roughing processor guides the tool along a 2.5-D terracing path. Preparation of each terrace can be broken down into three phases: plane cutting, offsetting and tool path generation.

We have shown the phases of roughing in Figure 6 on a crank axle.

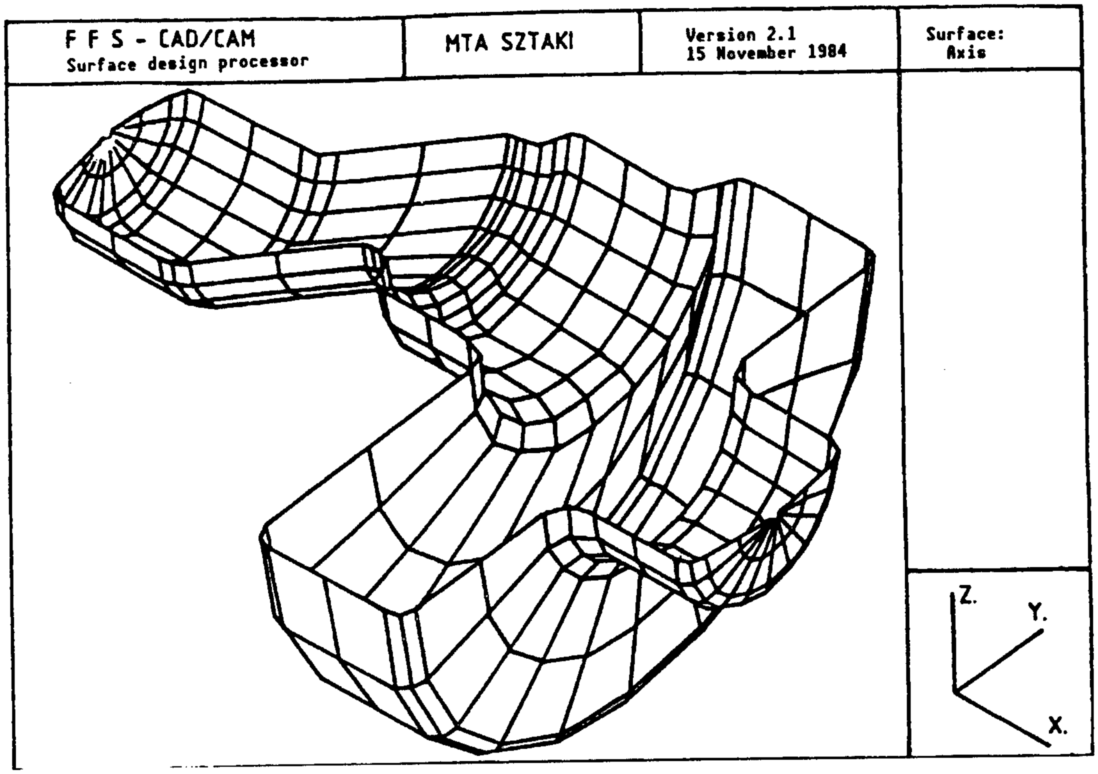

Figure 6.

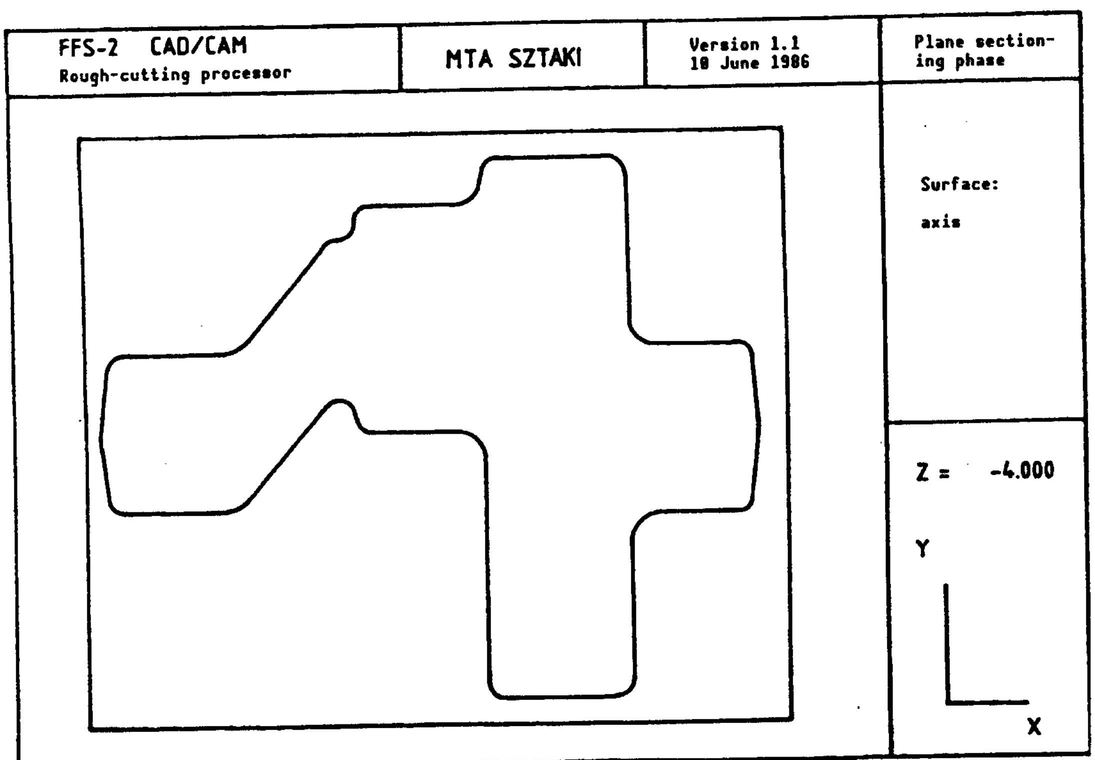

Figure 7.

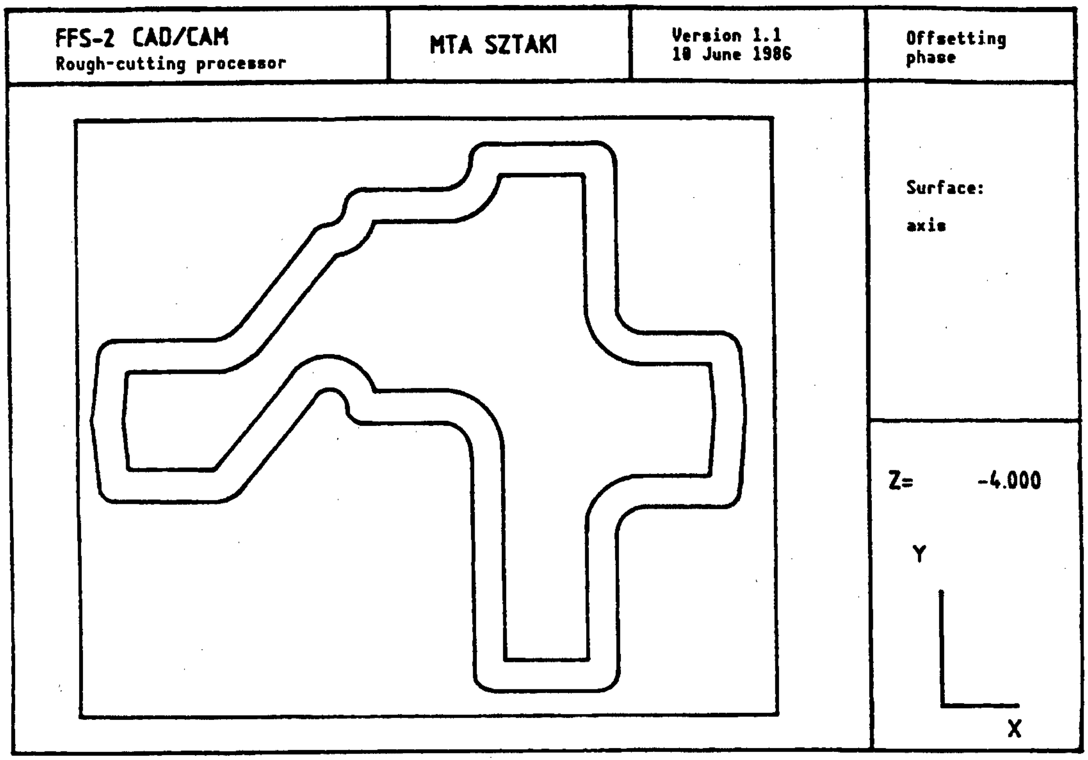

Figure 8.

The first phase of preparing a terrace is plane cutting, in the course of which the program cuts the surface with a Z=constant plane. The number of planes will mean the number of machining catches; their distance determines the depth of the catch. The first plane section of the axle an be seen in Figure 7.

In the second phase (during offsetting) the program fattens, in accordance with the tool radius, the contour produced as a result of plane cutting. The fattening can be outward or inward depending on whether one is designing a die or a stamp. The offset contour also determines the nearest path to the surface of the point (reference point) being controlled by the machining tool (Figure 8).

In the last phase of preparing a terrace we must remove the material indicated in the course of offsetting. In accordance with the form of the part (more precisely the given plane section) one can select several material removal strategies (Figure 9). A very efficient way to machine a terrace is to use a "large" tool as the first step to remove most of the material which can be found on the terrace (area milling), then we generate a new offset contour for a "smaller" tool and simply follow the curve with a small diameter tool (countour milling). In this case the small tool must remove material only where the large tool did not fit in.

Another useful service of the roughing processor is that in the course of offsetting this program filters out self-cutting tracks. Tools or machining strategies can be defined separately for terraces or terrace groups coming one after another. The roughing program automatically builds in the appropriate tool change and machine start functions.

The 2.5-D NC program comes from tying together the terraces formed, and the roughing processor takes care of this automatically. The tied together NC tracks can be checked graphically too (Figure 10).

The purpose of the smoothing program is to smooth the terraced structure developed by the roughing program, using a rounded cylindrical or spherical head cutter. The designer can prescribe different technologies for different parts of the surface so that only a minimum of hand working will be needed later. The smoothing program automatically generates the geometry of the tool tracks, but it offers a number of intervention possibilities to the designer. For example, the direction of machining, the approach strategy, the type of tool, etc. can be defined freely. Figure 11 shows smoothing machining of a surface piece according to a helix strategy. The NC tapes

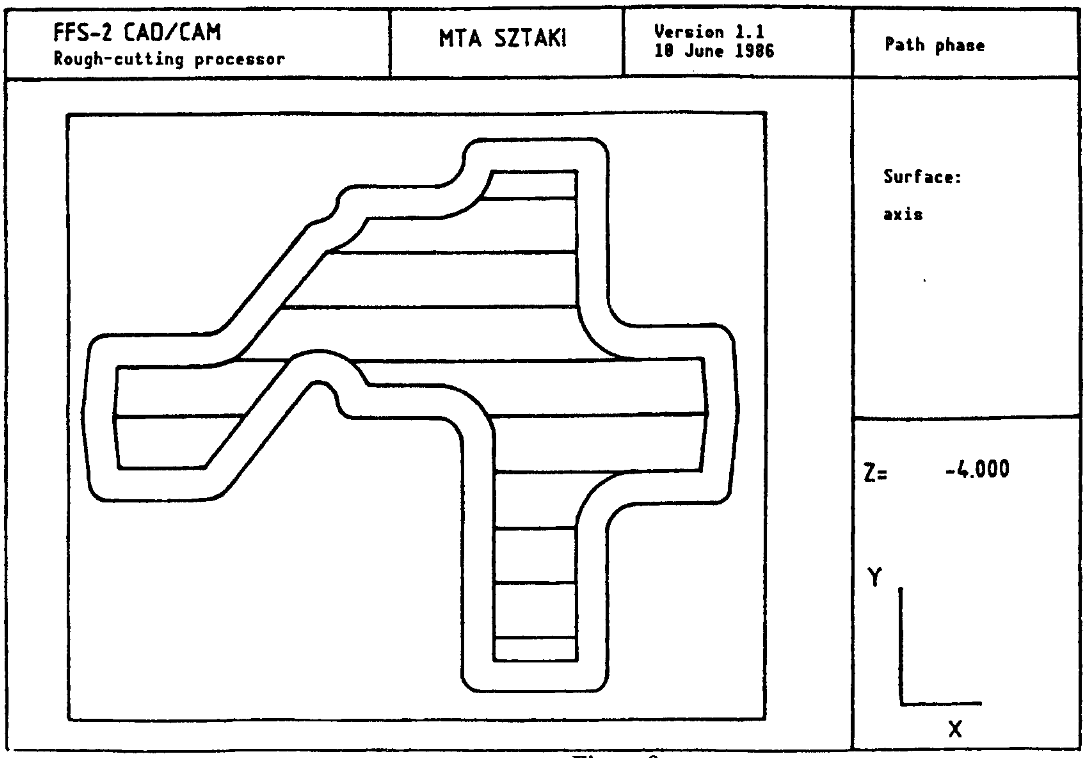

Figure 9.

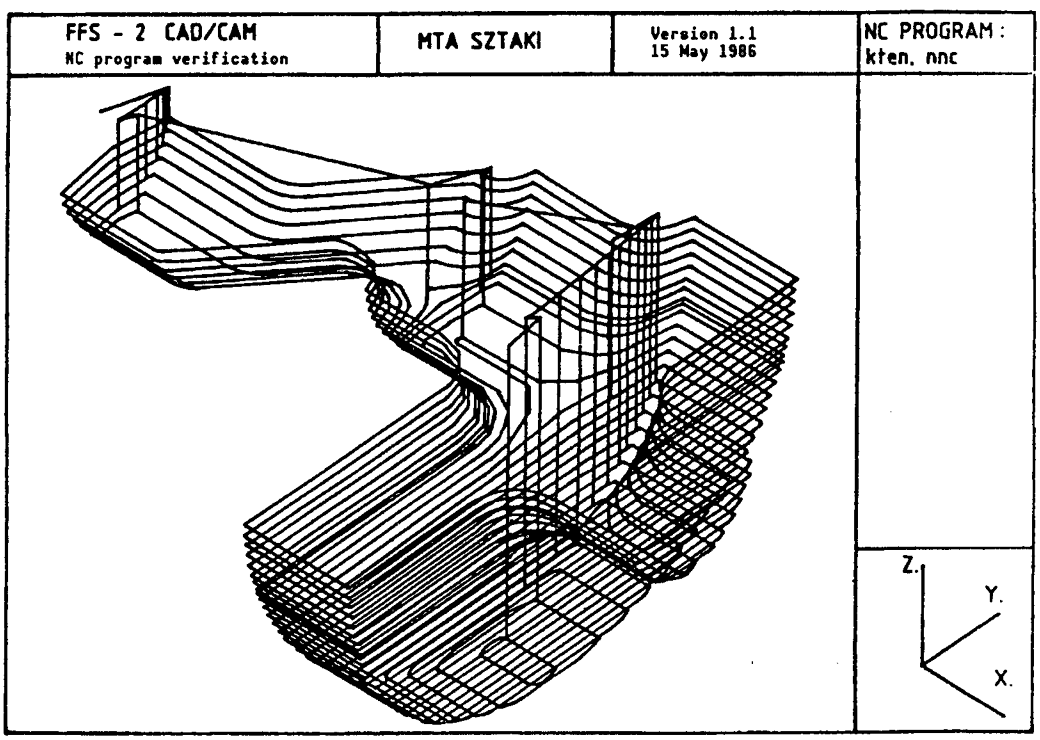

Figure 10.

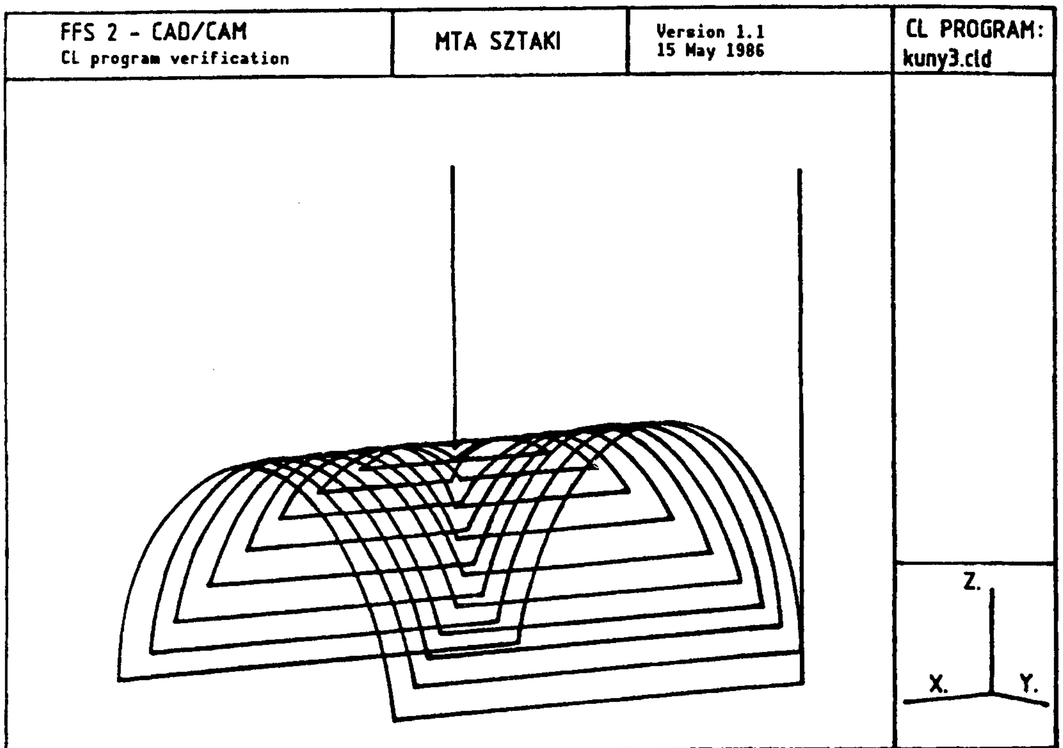

Figure 11.

can be checked graphically both without postprocessing and in their condition following postprocessing, so by using the FFS the possibility of possible waste can be reduced to a minimum.

Autobiographic Notes

Peter Raboczki: I graduated as a mathematical engineer from the Mechanical Engineering School of the Budapest Technical University in 1982. I got a position in MTA SZTAKI and dealt with computer graphics and programming problems of CAD systems. In connection with this I learned the Graphical Kernel System and I implemented the so-called Dialog system aiding CAD programming. In November 1987 I transferred to the FLEXYS Manufacturing Automation Joint Stock Company where I became leader of a group dealing with marketing of the FFS system.

Peter Kerekes: I completed my studies in 1982 as a mathematical engineer in the Mechanical Engineering School of the Budapest Technical University. Since then I have worked at MTA SZTAKI. Since 1979 I have been dealing with computerized geometric modeling and related NC machining themes. I participated from the beginning in development of the FFS CAD/CAM system and at present lead this research group.

Hungarian MRP-II, IBM PC Package for Manufacturing Resource Planning

25020053d Budapest MAGYAR ELEKTRONIKA in Hungarian No 3, 1988 pp 39-42

[Article by Maria Skonda (Mrs Volgyi): "The MRP-II 'Manufacturing Resource' Planning Program Package for IBM PC Compatible Computers"]

[Excerpts] The FLEXYS MRP-II program package was prepared on the theoretical basis set down in the MRP (manufacturing resource planning) methodology well known in the professional literature. It is an easily managed, effective tool for planning the resources needed for efficient operation of manufacturing systems. The system includes the data necessary for comprehensive planning and organization and guidance of manufacturing and it provides for swift communication between the organizational units participating in the manufacturing process and the units supporting it. In this article we provide a review of the functions of the system, the conditions and possibilities for its use and its computer technology characteristics.

Functions of the MRP-II

Figure 1 shows the chief functional groups provided by the program package; on this basis the system is suitable for solving the following tasks:

—manufacturing resource planning (MRP);

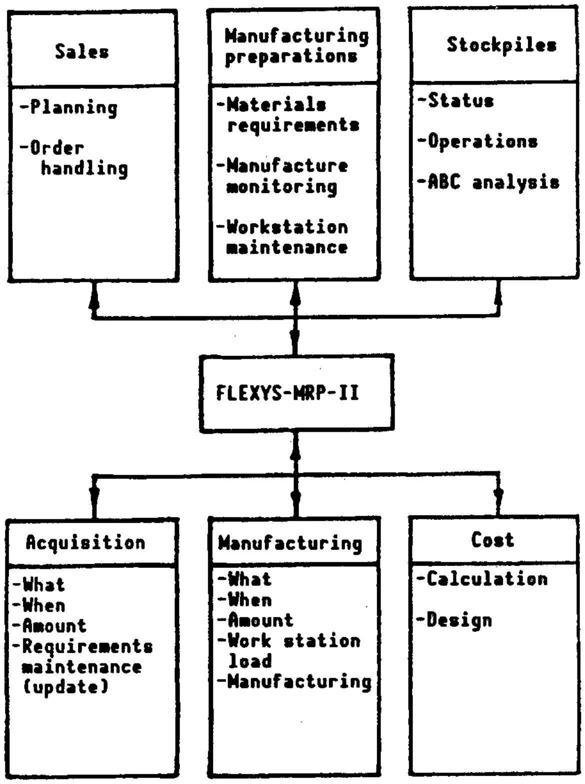

Figure 1. Functional Groups of FLEXYS MRP-II

—(stockpile, acquisition, manufacturing and capacity planning);
—stockpile status monitoring;
—total and final cost calculations;
—issuing and monitoring acquisition orders;
—planning and monitoring manufacturing schedules;
—handling data on products and the manufacturing process.

System Data Files

The system covers the data needed for manufacturing resource planning and organization of the production process.

The chief data files are: stockpile file, parts file for products, jobs file, manufacturing schedule file, marketing data (materials, customers), production instructions file, acquisition data (materials, orders, shipments) and a file containing costs data.

Some of the data files must be loaded when starting up the system; updating is automatic. Others are created in the course of operating the system, as a result of various computational procedures.

System Outputs

The results and information created by the programs of the MRP-II appearing on the screen or in the form of printed lists are the following:

—stockpile list,
—stockpile status report,
—stockpile forecast,
—ABC analysis,
—material needs list by product,
—list of material use,
—marketing plan,
—acquisition plan,
—acquisitions in process,
—production plan,
—loading of job sites,
—manufacturing in process,
—budgeting, and
—inventory.

System Operation

The MRP-II works in a conversational mode easily handled by the user.

After calling up the system the integrated menu shown in Figure 2 appears on the screen. From it one can select the desired menu element by giving three letters. The individual menu elements contain additional activities which can be selected. Screen messages aid operation of the system. Protection is built in at the most important places to prevent erroneous data entry.

Passwords can be attached to the menu elements; the several functions of the system can be assigned exclusively to certain people, job areas or organizational units.

Computer Technology Characteristics

The MRP-II program package was prepared in the Quickbasic program language.

The link for loading the individual data files or for querying from them can be established with other systems working with the dBASE III database manager.

The minimal hardware requirement is an IBM PC XT compatible with 256 K bytes central memory, printer, one 5 ¼ inch floppy disk unit and one hard disk unit. The capacity of the hard disk unit depends on the amount of data to be stored.

The MRP-II is also suitable for operation in a network; in this way we can distribute its functions and provide communication between the several organizational units.

	[A]Files	[E]Procedures	[J]Reports
[A]Materials	[S] Organization	[M] Operations	[L]Listing [H]Conditions [P]Prognosis [A]ABC
[G] Manufacturing preparation	[B]Incorporation [A]Materials [M]Work-station [S]Order	[S]Syntax	[A]Materials needs [F]Use
[E] Marketing	[A]Materials [V]Customers		[T]Design
[T] Planning	[U] Scheduling	[E]Accounting resources (MRP)	[U]Scheduling
[B] Acquisition	[A]Materials [I]Claims [S]Shipping agents	[I]Claims processing	[T]Design [F]Flow
[G] Manufacturing	[M]Materials [U]Orders	[U]Orders processing [I]Claims processing	[T]Design [M]Work-station [S]Organization [F]Flow
[K] Costs	[A]Materials	[A]Execution [A]BC-analysis	[K]Expenses [L]Inventory

Configuration: Choice...[ ] Exit

Figure 2. Integrated Menu of FLEXYS MRP-II

Applications

The MRP-II program package provides for operation of an information system for organizational units directly guiding or serving production.

With its aid one can review at any time: the status of manufacturing, the resources available, the status of acquisition and marketing, and the development of costs. Thc development of these components can be forecast. When any factor is modified the system automatically updates those connected with it, thus the effect of certain measures and events can be projected onto the manufacturing system and analyzed.

Introduction of the MRP-II requires significant, well thought-out preparatory and organizational work.

The MRP-II was developed by the COMPUMAX (USA) firm. It is used in the most varied areas of the economy in the United States and in South America. On the basis of favorable applications experience the FLEXYS Joint Stock Company took over the system for sale in Hungary and other European countries. It is doing the adaptation work necessary for domestic use and has planned certain further developments.

Since professional preparation for its use is a precondition for effective operation of the MRP-II the FLEXYS company is organizing study courses for customers in addition to the usual installation and on-the-job training; at these courses one can learn the methodology for manufacturing resource planning and get a guide for organizing acceptance of the system. The FLEXYS company will also undertake to fit the MRP-II into enterprise information systems and existing computer systems.

Autobiographic Note

Maria Skonda (Mrs Volgyi): I graduated from the Transportation Engineering School of the Budapest Technical University in 1973, in the materials movement mechanical engineering branch. Following this I worked at the university for two years on a scientific scholarship. Between 1975 and 1987 I worked at the Machine Industry Technology Institute. In 1984 I earned an economic engineer's degree. My chief specialities are computerized design and control of material movement and warehouse systems and computer organizational problems of manufacturing systems.

Hungarian SZAMALK Offers Computer Aided Technical Design Services

25020053f Budapest MAGYAR ELEKTRONIKA in Hungarian No 3, 1988 pp 50-55

[Article by Peter Gombkoto, Gabor Horniak, Jozsef Szecsi and Tamas Toth: "Computerized Technical Design Services at the SZAMALK"]

[Excerpts] In March 1987 they finished putting into operation the ASKA finite element program system purchased by the SZAMALK [Computer Technology Applications Enterprise]. In the time since the SZAMALK has continually built up its network of finite element services. In the interest of this, parallel with the testing of applications, it has developed both the hardware and the software environment. It is also dealing with the development of a link between CAD systems and finite element systems.

As the result of several years of preparatory work and in the interest of developing a domestic tool base for automated technical design the SZAMALK acquired the ASKA [Automatic System for Kinematic Analysis] system, based on the finite element technique, and the associated interactive graphic net generating system, ASKAMESH (under the earlier name FEMGEN), and FEMVIEW, an interactive system for the graphic display of the results. The ASKA—with its associated systems—is a modern system widely used throughout the world, recognized even technically among the systems obtainable on the software market.

The system was put into operation at the end of March last year and beginning in April we began finite element services. We run the system on the IBM 4341 computer of the enterprise on Vahot Street. We created a department consisting of engineers and mathematicians to exploit it and we got into the complex solution of designing tasks. It is also possible for prepared users to solve their tasks themselves by leasing machine time, but so far this possibility is of only theoretical significance given the original system arrangement.

CAD and Finite Element Method (VEM)

In the course of the computerization of technical designing we must distinguish a number of phases which can be separated from one another and handled independently. Recognizing the importance of the other phases of designing work we will stress here two phases essential from our viewpoint. These two phases are the planning of the design (drafting) and the functional check of the design. They fall between task specification and physical realization and are closely linked to one another—with feedback through the designer (Figure 1).

Planning the design means drafting (giving it form), for the computerization of which an increasing number of interactive graphic and geometric modeling systems are available. The great majority of the so-called CAD [Computer Aided Design] and CADD [Computer Aided Drafting and Design] systems fall in this category; they make possible the development of drafting workstations realized with computer technology tools. This process accelerated especially since the appearance of high performance personal computers (and more recently workstations) with good graphic abilities. Although the first succesful CAD applications go back to the era of large computers the systems which can actually be reproduced and installed and used conveniently have appeared only in recent years. The use of such microcomputer systems as AUTOCAD, CADdy, PC-DRAFT and recently the promising CADSTAR is spreading even here.

Even in the early phase of design planning it is necessary for the engineer to perform extensive calculations to determine the life span and safety of the structure designed by him. Various procedures are available for this purpose. In the case of relatively simple supporting structures (beams, cantilevers, supports) one can use the analytic solution procedures of classical strength studies with good results. But if the structure and environmental connections of the structure studied are complicated these methods will fail.

A solution method which can be executed economically was given with the appearance of electronic computers and the high level matrix operations which can be performed on them. The method of finite elements soon stood out from among the possible solutions, and its development has been practically unbroken since the 1960's.

ASKA Applications

Since ASKA was put into operation in March 1987, the SZAMALK has been asked to solve a number of tasks in architectural and civil engineering and machine manufacture. In addition we did a few comparative computations where we compared the results and times obtained with other finite element systems, on the same structure.

In what follows we will describe a few of these tasks, stressing the services offered by ASKA in the area of graphic net generation and the display of results.

Static Study of a Dam

The dam for a reservoir is made by filling on the original soil, so it can be modeled with two types of material. The hydrostatic pressure of the water gives the load. For the model we selected membrane elements with three or four nodes suitable for a study of the plane stress.

As results of the analysis we determined the nodal movements, the nodal and element tensions and the reaction (support) forces.

The graphic presentation of the results makes a swift evaluation possible. Of the figures thus obtained we show four, which depict the form change—in two ways—and the perpendicular stresses, or the equivalent stresses which can be calculated from the three stress components on the basis of the HMH theory (figures 5-8).

Static Study of a Dome

The dome studied is formed by two spherical sections connected by an overhead lighting arc; the sections are supported by rigid steel columns. The dome is made of wooden structural elements. We modeled the structure with rigid beam elements for bending, twisting and shearing; loading is given by its own weight and partial snow burden, wind pressure and a linear combination of the two. Because of the structural and load symmetries it was enough to study a half model. Within the framework of the static study we determined the nodal movements, the drawing (pressing) forces on the individual elements, the shear forces and the bending and twisting pressures.

We should note that the 8.5 version installed in the fall of 1987 is also capable of calculating the stresses deriving from the requirements listed in the designated points of the beam cross sections.

We performed the flexible stability studies in the case of self-weight plus snow burden. Since in this case the load also had two symmetrical axes it was enough to study a quarter model of the dome.

Because of the dimensions of the model and the structural symmetries it was useful to use the subnet (part structure) technique.

Figures 9-11 show the finite element model of the dome and the form changes developing as a result of the self-weight plus snow burden.

Static Study of a Portal Crane

We modeled the crane structure studied with the same beam elements as the dome. Four different positions of the crane bridge represented the four loading cases. Here also we got as a result the same quantities as in the dome study. Figure 12 shows the deformed shape for one of the loading cases.

Autobiographic Notes

Gabor Horniak: I graduated from the Automation and Computer Technology School of the Moscow Energetics University (MEI) in 1965. I began to deal with system identification during my university years and continued this with furnace chamber modeling and power plant process identification at the VEIKI [Electric Power Industry Research Institute]. I earned a candidate's degree in technical science in 1974 with a thesis on identification of dynamic processes (VIVO). Between 1968 and 1983 I dealt with operating systems, teledata transmission, terminal and computer net development and development of information systems as chief of the software department of the VEIKI. I am married and have two small daughters. I do photography in my free time.

Tamas Toth: I graduated as a mathematical engineer from the Mechanical Engineering School of the BME [Budapest Technical University] in 1986. At present I work at SZAMALK where I deal with finite element modeling. I spend part of my free time programming. I am most interested in computer graphics and graphics algorithms.

Jozsef Szecsi: I graduated from the Electrical Engineering School of the BME in 1981. Because of my diploma work I got involved in computer graphics, which became my hobby. I joined SZAMALK at the end of 1986, where I deal with solving graphics tasks for ASKA.

Peter Gombkoto: I got my mechanical engineering degree at the BME in 1967. I worked as a mechanical designer at the EMG and as a tool drafter at RADELKIS. After 1972 I taught in the machine elements faculty of the BME, where I also became acquainted with computer technology. Since 1986 I have worked at SZAMALK where I deal with finite element applications and development of engineering programs. I like to ski and surf and for more than 25 years I have entered cross-country events. I now pursue my hobbies with my oldest son and my younger children are already beyond their first computer programs.

Development of Winchester Drives in Hungary

25020053g Budapest MAGYAR ELEKTRONIKA in Hungarian No 3, 1988 pp 56-59

[Article by Bela Egri: "Winchester Drives in the World and Here at Home"]

[Excerpts] Because of the disturbing deficiencies in the supply of computer peripherals in Hungary and the socialist countries, the OMFB [National Technical Development Committee] supported a development at the KFKI [Central Physics Research Institute] which had as its goal the creation of a large capacity Winchester disk (a minimum of 120 Mbytes, see MAGYAR ELEKTRONIKA, Vol III, No 4).

At the beginning of the development, the Western market already offered a quite varied assortment; larger capacity examples existed in the country as well, but acquisition of even the smaller ones ran into embargo problems. (Later they raised the embargo limit; today such limitations hinder only the import of devices over 100 Mbytes.)

The development started virtually without domestic antecedents; the most important exception was the manufacturing and developmental activity of the MOM [Hungarian Optical Works] done on the basis of a SAGEM license. In the course of the preliminary studies we discovered which elements we should not try to develop ourselves, and what the technological and infrastructural deficiencies were, without which the work could not be continued—or could not even begin.

On the basis of extraordinarily profound research work and economic analysis, it was decided that we must import the magnetic sheet, and even the ferrite heads for the time being. Instead of developing a new type of ferrite head, we should create a thin film head, which was promising for the future.

Creation of the first experimental examples was accompanied by a number of measurement technique and technological developments. (Special equipment to test the disks could have been obtained from a number of sources, but in part the equipment was matched to some product, and in part it would not have made possible the checking of the part solutions which were indispensable in the course of development.)

The chief problems in the development were caused by the fact that we had set ourselves a goal which might appear contradictory in itself. Namely, we had to create a device which counted as peak technology but in a form where series manufacture could be realized with existing domestic technological possibilities or with a minor further development of them. (Naturally, concessions could not be made in a few questions, for example in the parameters of the clean air rooms necessary for assembly.)

What finally brought success was that with consistent use of the "mechatronic" system technique mentioned earlier the electronic control system eliminated the precision deficiencies due to the relatively lenient mechanical tolerances while simple mechatronic structures carry out the tasks which could be solved electronically only in an extraordinarily circuitous way.

The space of this article does not make possible a detailed account, so I will only list the special areas cultivated in the course of the Winchester development: precision engineering, in vivo vibration diagnostics to measure the mechanical and electrical characteristics, closed and open loop control, organization of digital data traffic, a technique for read-write circuits, design and realization of custom design circuits (CMOS-ULA), etc.

The successful model testing of the 160 M byte capacity disk born as a result of the developmental work was recently completed; after testing according to the MSZR [the CEMA small computer standard] prescriptions, the Hungarian Optical Works began to prepare for series manufacture.

A few specifications of the device are:

—capacity, 160 M bytes (unformatted)
—average positioning time (random seeking average), 27 ms
—band stepping time, 6 ms
—number of cylinders, 823 (of these 15 are reserve)
—recording density, 6,580 bpi
—band density, 680 tpi
—number of disks, 3
—recording mode, MFM (Modified Frequency Modulation)
—interface surface, standard SMD (Storage Module Drive).

The first examples will reach users in 1988.

Table of Contents of Hungarian Electronics Journal

25020059a Budapest MAGYAR ELEKTRONIKA in Hungarian No 5, 1988 p 2

[Text]

Table of Contents

On Our Cover

The graphic on our cover attempts to illustrate the software development activity taking place at the Szamszov Computer Technology Small Cooperative. The article by Balint Lukacs and Karoly Petroczki describes the REXLIB program development environment created for preparers of user systems. Its development is part of the effort aimed at integrating into one common enterprise system the (micro) computers used for management computerization at enterprises and institutes—as the floppy disks seen in the picture become elements to build an imaginary house....

Communications Engineering

The author of the article in this section, Jozsef Zigo, describes a cable television headend station developed at the Communications Engineering Cooperative. In the early 1980's, with the beginning of artificial satellite broadcasting, the development of cable television systems began first in Western Europe and then a few years later in our country. Building on the experience gained in development and manufacture of professional transmission technology instruments and manufacturing technology equipment, the HTSZ [Communications Engineering Cooperative] began developing the constituent

elements of cable television systems in 1984. The figure here shows a cable television headend station of moderate size. Microelectronics

The possibilities for the extraordinarily rapid development of the present silicon based semiconductor industry will probably be exhausted by the early 1990's because the size reduction of parts is approaching the physical limits. How to proceed? Even if the switching speed characterizing the technology cannot be increased very much, the complexity may be increased significantly with a simultaneous reduction in production costs. The parallel VLSI structures analyzed in detail by Tibor Tuzson may have a role in this connection. They offer an opportunity for parallel, i.e., concurrent processing.

CSSR Said To Have 250,000 Private Computers

AU2410155888 Prague RUDE PRAVO in Czech 21 Oct 88 p 4

[Editorial report]

[Text] Prague RUDE PRAVO in Czech on 21 October on page 4 carries a 450-word article by doctor Bohumir Stedron, candidate of sciences, and engineer Vladimir Smejkal, candidate of sciences, entitled "The Entrepreneurial Spirit of the 'Program' Cooperative." The authors report the founding and describe the activities of "Program, a small production cooperative" that intends to develop and distribute software for personal computers, take care of repairs to these computers, organize programming classes, and, in general, provide consulting services for owners of personal computers. The article mentions that, according to unidentified sources, "there are now around 250,000 home and personal computers owned by individuals in the CSSR alone."

FACTORY AUTOMATION, ROBOTICS

Hungary: FLEXCELL, Prefabricated Manufacturing Cell Control

25020053c Budapest MAGYAR ELEKTRONIKA in Hungarian No 3, 1988 pp 29-38

[Article by Janos Horanyi, Peter Bertok and Gabor Csurgai: "FLEXCELL: A Prefabricated Cell Control for Control of Industrial Manufacturing Cells"]

[Excerpts] The FLEXCELL industrial manufacturing cell control of the FLEXYS Joint Stock Company realizes flexible automation of manufacturing with acceptable expenditure which pays for itself. The article starts with a description of cell manufacture and then describes in detail the machinery and informatic environment of the FLEXCELL industrial manufacturing cell control, its hardware and software structure, its functions, services and use. Finally it gives a brief review of the development of FLEXCELL, its sales and its upcoming applications.

Basic Principles for Development of a General Cell Control

A manufacturing cell developed according to the FLEXCELL conception is built up of units with local intelligence. Although the manufacturing cells can operate independently if they are connected into an appropriate network they are capable of exchanging information and materials. Thus a larger automated system (a manufacturing system) can be created by connecting cells together.

We determined the tasks of the computer which provides local intelligence for the manufacturing cell (hereinafter, the cell control) by taking into consideration the needs and present technical possibilities, and those expected in the near future. We broke down the cell elements into functional groups. In addition to the functions realized by the several element groups (e.g., machining, transportation, storage, etc.) we defined those parameters of the elements which are of determining significance for development of cell control software interfaces in the event of concrete cell implementations.

When creating the functional groups we took as a basis not the physical form or type of the element but rather we abstracted from the physical appearance and placed the functions realized by the physical units in the center of our studies. Thus instead of the unique characteristics of the individual elements we concentrated only on the functions realized—striving for a more general formulation.

The result of our surveys is a generalized functional system which makes it possible for a cell satisfying this system to satisfy a large part of the needs arising, to support multiple use and reproduction (for generally only a part of a complete functional system must be realized for individual applications).

The software controlling an industrial manufacturing cell is connected to elements providing the following chief functions:

—Equipment carrying out technological tasks, together with the control unit (in this group one can put machine tools and other manufacturing equipment with their own controls);

—Elements storing the workpieces, together with the control unit (e.g., buffer stores which serve to store materials, tools and auxiliary materials within the cell);

—Elements providing cleaning and washing functions, together with the control unit (we took various types of washing and cleaning machines into consideration for these functions);

—Elements carrying out auxiliary functions (elements performing operations during or at the end of an operation; e.g., lining things up, finishing, supplementary equipment);

—Elements performing transport within the cell (this includes workpiece transport between elements carrying out technological tasks and auxiliary functions and the transport of other materials to be moved within the cell);

—Transportation outside the cell (those elements which move material between the cell and its external environment); and

—Elements performing quality control within the cell (measuring machines which may figure in the cell as an option).

FLEXCELL Industrial Manufacturing Cell Control

Building on the cell concept—and following the basic principles outlined—we designed and realized the generally useable FLEXCELL industrial manufacturing cell control. This is a complex product containing systems technology, hardware and software components. It does not belong among the "cash and carry" type generally used systems. This means that FLEXCELL becomes useful only in the hands of a devoted system developer.

In this section—describing the FLEXCELL cell control—we will describe the mechanical and informatic environment of the cell, the hardware and software architecture of the cell control, its functions and the interfaces providing for integration into a system.

Mechanical, Data Processing Environment

The cell control is capable of controlling 2-3 CNC manufacturing devices and the 6-8 mechanical elements connected to them, depending on the control possibilities of the connected machines and the complexity and time requirements of control of the machining processes.

Mechanical equipment with various functions can be included in a manufacturing cell:

—metal cutting and cold forming machines, assembly and welding equipment;
—robots, other transportation devices;
—washing and cleaning equipment, etc.

The functional mechanical structure of an average manufacturing cell can be seen in Figure 2. The topology of the structure shown, the number and type of devices, may vary from cell to cell, primarily depending on the mechanical needs and possibilities. The cell control makes practically no demands on the form of the cell.

The fact that various types of mechanical equipment can be used is thanks to the fact that the cell control does not control the equipment directly but rather is in an information link with their controls. So the mechanical equipment must consist of "intelligent" devices.

Figure 3 illustrates the computer technology structure of the cell control equipment.

In both function and computer technology implementation the cell control is connected to various parts of its enviornment in different ways:

—it maintains interactive contact with the operator through the operator's console:
—it exchanges information with the central computer of the manufacturing system and with other cell control devices through a local communications network (LAN);
—it communicates with the controls of the mechanical equipment (CNC's, PLC's, robot controls) via standard serial lines—usually in a star arrangement.

Hardware Structure of FLEXCELL

The FLEXCELL cell control equipment is based on an IBM-AT (or equivalent) professional personal computer of the usual structure:

—320 x 200 (640 x 400) resolution (color) graphics,
—20 M byte hard disk,
—1.2 M byte floppy disk,
—512-1024 K byte RAM memory,
—(IBM asynchronous communications adapter).

In order for the cell control to operate in the structure shown the basic configuration is supplemented by a local network control and a special "intelligent" hardware module—with one or more IBM-MPX cards as star point for standard serial communication lines. Keeping in mind an ability for general industrial and measurement technology use we developed the IBM-MPX expansion card within the framework of the FLEXCELL project and we already manufacture them in small series.

Eight-Channel Intelligent Multiplexer (IBM MPX) for the IBM PC

The IBM-MPX card is an intelligent I/O manager (slave) module which fits eight independent RS232C serial asynchronous lines to the system bus of an IBM PC (XT,AT) computer. It operates at a maximum data transmission speed of 19,200 baud; if needed it operates with different data transmission speeds and protocols on different lines. (The hardware also makes possible a synchronous, HDLC/SDLC, data transmission mode.)

The card fits into the structure defined in the ISO/OSI reference model, and it realizes the lower three levels directly.

The circuits of the IBM-MPX are on a modern, four layer printed circuit card the dimensions and connections of which make it possible for it to be plugged into any IBM PC (XT, AT) or hardware compatible equipment as an I/O expansion (Figure 4).

The advantage of the card is that in applications for which the computer must handle more than two fast, simultaneously operating serial lines only one expansion card is needed. And it relieves the PC of the burden accompanying the handling of the serial lines. This advantage is realized truly when the IBM PC is used in a more extensive system because in this case the computing capacity of the PC is rather fully exploited and the I/O card expansion possibilities are limited. In addition, a significant price saving can be realized if even four channels are needed.

The "central" computer (IBM PC) can forward high level commands or functions directly to the slave peripheral control. It is the task of the protocol programs to ensure the formal requirements of information arriving from or sent to the serial channels and data transmission as error free as possible. These protocols are built into the electronics of the card. Data can be transmitted in two forms:

—transparent transmission, and

—protocol transmission.

At present one can choose between three different protocols in addition to transparent transmission. These are LSV2, BSC and LAOCON, of which the LSV2 is the standard protocol in the area of industrial electronics—even in Western Europe. The IBM-MPX module logically filters the input data according to the above, collects the information in its own buffer areas and then transmits it to the IBM PC with fast data transmission. The opposite of this takes place for output.

The software system of the multiplex card fits into the software structure of the central computer. Accordingly at this level also there is need for the possibility of user level management.

A "C" language interface is available to access the channels of the MPX card. Thus an optional character block can be sent to the RS232C lines directly from the user program running on the IBM PC, by calling the appropriate "C" function. It is enough to send the clear message from the user program, the MPX card takes care of the administration connected with data transmission—according to the valid protocol on the current channel—without using CPU time of the central computer. To send a message line or optional data set it is enough to give the size of the character block containing the data set, the pointer for its first element and the channel number to which the data must be sent. Thereafter it is sufficient just to "look" at the appropriate channel from time to time from the user program to see if a message has come or if a return message must be processed with the upper level break handling routine of the card.

A routine which can also be called from the "C" program performs initialization of the channels, or initialization of any channel at any time according to user need.

CNC Controls Used in the Cell

The needs of domestic industry, of the CEMA market and of convertible export place new demands on the services of modern control equipment. The developers and manufacturers involved have developed a two step strategy to develop machine tool controls which can be connected into the system.

The first step is aimed at supplementary development of existing domestic controls according to the needs of cell operation and manufacturing system operation. This can extend to development of the following HW and SW modules:

—a system communications interface;
—supervisory, diagnostic functions;
—expansion of the control of machine functions;
—expansion of operator functions; and
—development of a programming input language.

The second step would be development of a concept for an entirely new control family on the basis of manufacturing experiences with present controls, international trends and the need for developed services. A uniform, modular control family which can be integrated into a manufacturing system and which is open in the direction of further development must satisfy the needs of machine tool customers, machine tool manufacturers, control manufacturers and system developers.

After defining the theoretical and methodological foundations for system development and the requirements necessary for practical realization let us briefly review the results of domestic development of the most important system elements.

Machine tool controls have significant traditions in two Hungarian factories. In the future also VILATI and the EMG [Electronic Measuring Instruments Factory] want to satisfy the planned market needs, and both are capable of this too. The present product division will probably remain the same:

—the EMG, cheaper category CNC controls (e.g. lathe controls),
—VILATI, complex CNC controls, capable of more.

Both control manufacturers have begun development of an expanded DNC option—necessary for connection of their CNC controls into a manufacturing system. Cooperating with the developers of the FLEXCELL cell control they have developed uniform system communication interfaces for CNC control types, and integration of supervisory and diagnostic functions into control

Progress has been made in preparation of a so-called second, long-term step in the developmental concept. Developing a long-term, common strategy is the first step in the development of a uniform, modular, open control family which can be integrated into a manufacturing system.

Structure, Functions of FLEXCELL Software

We can list the functional modules of the cell control software in two large groups.

—Basic programs and program packages which provide the background for operation from the purely computer technology viewpoint. These include:

- PC-DOS 3.0 operating system and associated auxiliary programs;
- Program system providing "multitask" management (the priority and start order of tasks can be changed dynamically, the tasks can transfer information to each other directly);
- Database management, library management;
- Program packages providing for communication across various interfaces;
- Screen management and graphics programs, etc.

—Programs which take care of the actual control tasks of cell operation, relying on elements of the preceding group.

For the user the functions of the second group are the interesting thing and we will describe them in detail. Their common property is that the chief functional blocks operate within the system as separate tasks. From the viewpoint of cell operation certain essential, previously determined events activate the tasks, taking into consideration the links between these events and the internal state of cell functioning.

The functions of the cell control are:

A. Production scheduling,
B. Operation according to a task list,
C. Diagnostics,
D. Localizing danger situations,
E. Logging, and
F. Cell configuration (set-up).

A. Production Scheduling

By cell level production scheduling we mean only those activities which are connected to the distribution among cell units of tasks prescribed by the external world. (The distribution criteria might be maximum load of the machines, minimal idle time, minimal cost, etc.) If some unit within the cell becomes incapable of operation—a unit assigned a task by production scheduling—then a new distribution can be initiated without the aid of the external world. This makes possible (from a certain viewpoint) operation of the cell with little supervision, for in certain cases the cell control can take changed resources into consideration without human intervention. (In a number of cases variations in the structure and elements of the cell can make use of the reconfiguration service of the cell control. The cell control software offers a possibility for efficient and swift performance of such tasks.)

B. Operation According to Task List

While solving this control task the operation of the units belonging in the cell must be coordinated (in the error-free case). Tools and devices must be managed during operation and the several units must be supplied with information.

—*Workpiece Management:* The cell control keeps a record of the workpieces arriving in the cell and of their processing, in an order which can change; it shows the processing capacity and takes care of the prior reporting of the transportation needs for finished, semi-finished and other products, etc.

—*Tool Management:* The cell control can handle tools and tool data uniformly, filtering out errors. By constantly tracking the information it can realize, for example, automatic lifespan monitoring, automatic tool exchange and indication of tool needs.

—*Processing, Technological Information Management:* A series of processing instructions for a given workpiece (e.g. an NC program) is part of the performance of the technological tasks of the cell. The cell control automatically discovers the existence or lack of such information, thus a list of missing data is prepared before actually beginning production.

On the basis of the task list (which is actually nothing more than a listing of the tasks to be performed broken down for the several units) the cell control "guides" the workpieces (within the cell) through the several processing phases. The task of the cell control in the case of transport within the cell is prior scheduling of transport needs and implementing them or, in case this is obstructed, rescheduling the transport needs. On the basis of the technological sequence the cell control organizes material movement within the cell, thus it transfers workpieces, tools and other devices between processing machines (e.g. via robots). If the transport needs between processing machines are not synchronized the movement system takes care of the continuous loading of the processing machines with the automatic intervention of buffer positions.

It forwards the technological information needed for the several processing phases to the appropriate units, with sufficient lead time. It tracks the path of the workpieces and tries to relieve overburdened points with appropriate measures. It records tasks completed in the cell and can request new tasks from the environment to ensure continual loading of the machines. The information stored in the cell control—as data files—can be easily accessed and modified by the operator or technician and by the higher level information system. Thus there can be secure archiving of many variations of the parts program. Operating personnel are informed through an appropriate man-machine interface about events during operation, so they get a surveyable picture of the operational conditions of the entire cell.

Through this interface the operator is informed about possible failures taking place within the cell, about irregular operation, and through it he can forward data and decisions to the cell control.

Production and other data on elements within the cell provide essential information for higher level control and inform the information processing modules about momentary and statistical data on production. The measurement, collection and pre-processing of these data can be done automatically according to user needs. On the basis of higher evaluation of the data thus obtained the enterprise leadership can accept extra orders, fulfilling them at the appropriate level.

C. Diagnostics

The diagnostic tasks of the cell control come to the fore when events deviating from normal operation occur. We must add that the diagnostics can have a developed strategy only for predicted events (those "expected to occur"). An intervention sequence by the control begins after certain information comes from the cell units (telltale signals or sensing and recognition of irregular operation already under way). With diagnostic information of sufficient depth it can eliminate a function set of the faulty element in the operational model of the cell. Thus, by closing off the error spreading chain, it ensures that other cell elements will not go down, or that the task can be solved as well as possible by a reconfiguration of the cell. By circumscribing the cause of the failure it can automatically compile a list of intervention measures the implementation of which is started by service personnel having the proper technical tools and methods. The sphere of events which can be diagnosed is defined individually for each cell by the current cell configuration, the machines used, the type of controls and the linkage system. This is done in a way to be defined by the user—e.g., he establishes the sphere of failure phenomena to be expected and handled and the activities involved.

The diagnostic part of the system software is isolated to the greatest extent possible from the other modules, because the strategies to be used by diagnostics and the implementing algorithms greatly depend in every case on the structure and configuration of the individual cells, and on the needs specified by the user.

This program section is in touch with the other parts of the system software via a previously established interface. This interface "hides" various versions of the diagnostic module from the other parts of the system. It is thus possible to derive a special diagnostic module from the general diagnostic module, on the basis of the concrete needs, fitting it to the other modules of the system software.

D. Localizing Danger Situations

In what follows we use "danger situations" to refer to those conditions where the further operation of the individual elements of the cell could cause damage within the cell (e.g. cutting with a broken tool, the robot does not sense the grasping of a workpiece, etc.). In these cases the cell control very quickly executes a sequence of measures with the cell elements which excludes the possibility of damage. In most cases this means immediately shutting down ("freezing") the element involved. This part depends strongly on the cell, and in every case it is loaded on the basis of user needs. To provide generality a framework system handles the danger situations. By using the framework system the various danger situations and associated sequence of measures can be fitted easily into the system on the basis of the current individual needs.

E. Logging

By logging we mean the recording of events which have taken place within the cell together with accompanying information (time, unit identifier, etc.). Two-level logging figures in the general conception for an industrial cell. The first is the so-called user level logging and the second is internal logging of the cell control software which the cell control uses to carry out its monitoring function. The user cannot access the internal logging, cannot get information from it directly. Various diagnostic observations can be used as input data. The user level logging makes it possible for the user to have the system record events he is to monitor and perform prescribed manipulations on it.

F. Cell Configuration (Set-up)

We can break cell configuration down into two parts—basic configuration and reconfiguration.

In basic configuration the appropriate parts of the status tables must be filled with data regarding the cell structure and certain operational characteristics of it. To complement this after switching on the operator also can load certain table parts in regard to cell elements he judges to be operational at the moment or in regard to cell states considered correct at the moment. (During operation the diagnostics can overrule the human decision.)

Reconfiguration arises primarily when some element fails during cell operation, when the "diagnostics" and the "avoidance of danger situations" functions indicate a failure in the operation of certain elements or shut them down.

Link Between Manufacturing Cell, Environment

An industrial manufacturing cell poses new requirements vis-a-vis the operating enviornment. When it is put into production the traditional manufacturing preparation based on a foreman goes through great changes.

Technological preparation is a good bit more complicated task than in traditional manufacturing where the knowledge of the foreman and workers is generally used to simplify the preparatory work. In the case of a manufacturing cell we cannot talk about information already acquired, about learned situations, about data already available. To operate a manufacturing cell all the information must be made available to the cell control in every case, broken down into the smallest details (Figure 5). [This figure and the next two are photographs of computer screens. The program supplied prompts are in English; the operator input is in Hungarian.]

To carry out the technological task we must provide every unit with a task list which describes the tasks to be performed and we must provide all the ancillary information needed to carry out this task. All this must be prepared in a form accessible by computer technology tools (floppy disk, magnetic tape, hard disk, etc.). A certificate system cannot be used in a cell. Information must be supplied in several ways. There must be a possibility for transmission via a network (a manufacturing system or ad hoc network) and for reception of information on some portable data carrier (e.g., bubble memory or the widely used floppy disks) or direct human information (Figure 6).

To fill information gaps occurring during operation the cell control transmits information requests to the environment. Depending on the given application these are addressed to the controlling computer technology devices or directly to the personnel monitoring the operation of the cell. The environment is similarly informed about matters within the cell. For tasks requiring intervention (the existence of a situation which the cell control cannot solve on its own authority) the cell control uses these same information paths. When using a cell control the related activities can generally take place without human intervention (the information and material flow network operate within the cell).

Data traffic between the cell and its environment take place through three communication interfaces. The character and structure of the data flowing through the three different communication interfaces differ. The three interfaces (Figure 3) work as follows:

a. Messages for the cell arrive primarily through the network interface. These include:

—the task list for the cell, the technological sequence order;
—the NC programs (for machine tools and robots);
—the PLC programs (for other mechanical controls);
—external requests, querying cell status.

The cell sends to its environment primarily:

—status information,
—answers to external requests, and
—deficiency lists and failure signals.

b. Using information exchange taking place on serial lines between the cell control and the controls of the mechanical equipment of the cell the cell control sends:

—NC parts programs and robot control programs;
—PLC programs and corrections; and
—instructions starting, authorizing or forbidding operations.

It receives from the machine controls:

—status information and failure signals;
—possible measurement data;
—parts and operating programs stored in the machine controls, etc.

The basic structure of the messages and data is in accordance with the LSV2 protocol (this corresponds to the SIEMENS controls among others) but message exchange according to other protocols is possible also. The formal tasks connected with the protocol are handled on the basis of information sent or received in the intermediate format in the memory area of the IBM-MPX card.

c. The operator interface has an important role in communication between the cell control and its environment. The technical tool for this link is the color, graphic monitor of an IBM AT.

When first starting up the cell, reconfiguring it or turning it on the tables of data needed for operation are filled on the screen. This is system generation, which takes place in the form of a dialog with the operator (Figure 7).

During cell operation the screen is divided into four parts: Part 1 is reserved for general information; part 2 provides an outline of the cell; part 3 is the communication area between the operator and the cell control; part 4 is available to the operator for auxiliary information, reminders and response possibilities.

So a is the network interface (the link between the cell control and the superior control); b is the serial lines handled by the IBM-MPX card (the link between the cell control and the subordinate CNC and PLC controls); and c is the operator interface (the man-machine link at the cell control level).

The basic outline is edited on the basis of the base tables of the cell taking the following data into consideration:

—how many machines the cell has;
—does the machine have a separate buffer, how many pallets can it accept;
—how much transportation equipment does the cell have;
—how many pallets can each device transport;
—does the cell have a buffer area and how many pallets can it store.

The operator can participate in forming the basic outline of the cell by moving elements within the outline. An arrangement can be formed which follows the spatial location of the cell elements.

In the basic outline of the cell one can see pictograms of the machines, transportation devices and buffers. Their identifiers and associated buffer areas are shown beside the machines.

Different colors indicate the different states of the machines:

—whether they are turned on or not,
—awaiting receipt or removal of a workpiece,
—awaiting tool exchange,
—processing under way,
—failure, etc.

There is a symbol in the figure for every single pallet which has entered the cell. Its location shows the location of the pallet in the cell. It can be in the cell buffer, on some transportation device, in the buffer of the machines, or being processed. The symbol indicates if there are several workpieces on one pallet, if the workpiece is scrap and to which series the workpiece on the pallet belongs.

Its possible path and the number of pallet positions which can be transported by it represent the transportation device in the figure.

During the operation of the cell the operator can request more detailed information about an element in the figure, and this appears in parts 3 or 4 of the screen.

The processes taking place in the cell can be followed on the basis of the outline:

—movement of workpieces within the cell, and
—the momentary state or status changes of the cell elements.

The different colors of the current transport route indicate the movement or transportation of the workpieces and a change in the color of the depicting element indicates status changes.

Development, Sales, Applications

The research leading to and the development of the FLEXCELL general industrial cell control were done in the machine industry automation main department of MTA SZTAKI [Computer Technology and Automation Research Institute of the Hungarian Academy of Sciences]. The hardware and system software and the software modules of the cell control making possible industrial use of PC's were developed here on the basis of the conception and the system plan.

The FLEXYS Manufacturing Automation Joint Stock Company joined in the developmental work in 1987. It took over the product which had been developed in the meantime, with all trading, applications and further development rights. The developmental and applications work of FLEXYS connected with manufacturing systems and manufacturing cells is based on the FLEXCELL.

We have implemented the first application of FLEXCELL in a demanding environment; the FLEXCELL cell control will control the five manufacturing and serving cells of the CIM model system being developed at the BME [Budapest Technical University].

We also installed here—and connected to the CIM system of the BME—the metal cutting manufacturing cell of the FLEXYS company. In addition to its experimental laboratory role this latter will produce industrially in two shifts, manufacturing complex parts on a jobwork basis. We thus want to make it possible for future customers of FLEXYS to get practical experience operating a similar system for the cell manufacture of their parts before or during installation of their own manufacturing cells. It will certainly increase the attractiveness of this opportunity that users of the FLEXYS manufacturing cell can access the services of the CIM model system of the BME connected with it, primarily modern, large capacity designing and technological planning systems.

We plan additional applications of FLEXCELL in projects being realized within the framework of the G/6 program of the OKKFT [National Medium-Range Research and Development Plan], in the vehicle industry, in equipment manufacture and in custom machine manufacture.

We also see broad possibilities for use in the electric and electronics industry and we hope that this article will contribute to this by awakening ideas.

Autobiographic Notes

Peter Bertok: I earned my diploma in 1975 at the Electrical Engineering School of the BME. Since then I have worked at MTA SZTAKI, presently as a chief scientific worker. Beginning in the fall of 1980 I spent two and a half years as a scholarship student at the Tokyo University in Japan. On completion of my work there I was given a doctoral degree at Tokyo University. Since 1975 I have been dealing with control problems for manufacturing systems. I participated in the designing or creation of several manufacturing systems, in the development of CNC control equipment among others. I have dealt with the problems of operating manufacturing systems with little supervision and I developed a failure recognition unit for machine tools. I prepared a metal cutting torque calculating system based on a computerized designing system. At present I deal with problems of manufacturing cell controls. I have written a number of articles for Hungarian and International journals and have given lectures at Hungarian and foreign conferences. I am a member of the Machine Industry Scientific Association and of the Measurement Technology and Automation Scientific Association.

Janos Horanyi: I earned my mechanical engineering degree at the Dresden Technical University in 1971 and a degree in computerized system organization at SZAMOK in 1976. At VILATI and INFELOR or their legal successors (SZAMKI and SZAMALK) I dealt with computerized control of machine manufacturing processes and with design and development of enterprise information systems. From 1979 to 1985 I developed data processing, information and manufacturing control systems at a small enterprise dealing with computer applications tasks for the wood industry and forestry, and then directed program development work as department chief. Since 1985 I have dealt with machine industry automation and CAD/CAM applications tasks at MTA SZTAKI and at the COSY subsidiary of MTA SZTAKI, and with activity connected with the founding of the FLEXYS Manufacturing Automation Joint Stock Company. Since its founding I have led the systems technology office of FLEXYS as office director. The office deals with systems analysis, systems development and systems design tasks embracing the entire activity sphere of FLEXYS.

Gabor Csurgai: I pursued my university studies between 1974 and 1979 at the Electrical Engineering School of the BME. After obtaining my degree I was placed in the machine industry automation main department of SZTAKI on a scholarship from the Hungarian Academy of Sciences and I have worked there since as a scientific colleague. The chief area of my work is industrial automation and within that control problems for flexible manufacturing systems. I participated in hardware development for CNC and PLC control equipment, in design and preparation of supplementary hardware units for the IBM PC/XT, and in preparation of the IGYR-630 integrated manufacturing system installed at the Machine Tool Factory of the Csepel Works. I have dealt with design and implementation of a distributed industrial control system (CONESYS) based on intelligent PLC's. I participated in development of system plans and control technology ideas for a number of industrial manufacturing systems (Videoton, Ikarus, DIGEP Machine Tool Factory) and in preparation of the FLEXCELL industrial manufacturing cell control software. I have written a number of articles for various Hungarian technical journals and have given lectures at foreign conferences.

Hungary: SATT Method for Complex Systems Design

25020053e Budapest MAGYAR ELEKTRONIKA in Hungarian No 3, 1988 pp 43-49

[Article by Gyorgy Asboth and Vilmos Kovacs: "SATT—A Tool for Designing Complex Systems"]

[Excerpts] If an expert is not capable of surveying the design of complex systems consisting of very many elements, the Structured Analysis and Design Technique [Strukturalt Analizis es Tervezesi Technika], or SATT, offers a usable method for solving complex problems.

Computer Aided System Design With SATT-DOC Program System

The SATT method can be used in two ways.

In the simple case it can be followed as a paper and pencil method, the course of which is as follows:

The designers outline the breakdown, this is copied out and divided up according to the personnel in the designing group, then, getting back the critiqued versions, the original plans are corrected and modified. Following the SATT principles they prepare a project library where diagrams, versions of models and critiques of diagrams are stored. At the end of the design-critique process they select the plan version best suitable for further processing and propose it as the accepted version.

When there are larger tasks to be solved there must be a team member to serve as project librarian; his tasks include storage and retrieval of diagrams and models from the project library, checking the connections of the prepared diagrams and informing the project leaders about the moment-by-moment status of design and analysis. A uniform graphic representation and taking care of the project librarian tasks for large tasks can make using SATT as a paper and pencil method rather clumsy. This can be aided by inserting a computerized program system.

SATT-DOC, Program System Aiding SATT Method

SATT-DOC, an interactive graphic program system introduced at SOFTWARE 88 by the FLEXYS Joint Stock Company, serves to overcome the bulk of the difficulties mentioned above. It aids in taking care of project leader tasks and in drawing out the diagrams. The MAT SZTAKI [Computer Technology and Automation Research Institute of the Hungarian Academy of Sciences] is the developer of the SATT-DOC program system. Figure 5 illustrates the drafting capabilities of the program system.

The chief characteristics of SATT-DOC are:

- With its aid one can prepare, check, store, retrieve and correct a complete SATT system plan. It is simply and quickly handled. By using color, fast, interactive graphics it is more convenient than the paper and pencil method and one can prepare figure and text documents in a uniform format without error.
- The critiques prescribed by SATT can be made in the form of notes attached to the diagram.
- It stores plan variants and keeps a record of changes. The entire designing group can use the project database.
- The system plan database consisting of A4 format drawings and text can be checked continuously, so one can monitor the progress of design and analysis.
- SATT-DOC checks the rules of the graphic language for SATT and aids in uncovering contradictions and deficiencies in the system. With its use the designing group can gradually refine the design database.
- It makes it possible to prepare ad hoc plans suiting momentary concrete needs using general system plans prepared in advance without a complete redesign of the system.
- It stores the other information connected to the models (e.g., indications of acceptance, the circulation list).
- Since SATT also prescribes storage of diagrams on paper it also contains a standard GKS metafile printing possibility.
- It prepares the content records, the so-called block list, connected to the models.
- It offers an opportunity for links to other designing procedures, with storage of the information content of the diagrams in a relational database.

Implementation Data for SATT-DOC Program

Two versions exist at present, an IBM PC/AT/EGA version and a VAX/VMS/PHAROS version.

The operating systems are MS-DOS 3.1 and VMS 4.1.

The program language used was PASCAL (MS-PASCAL or VAX-11 PASCAL).

The graphics base packages were DSS/CGI or GKS (CORE).

The necessary central unit memory is 640 K bytes.

Autobiographic Notes

Gyorgy Asboth: I graduated from the Electrical Engineering School of the Budapest Technical University in 1976. From graduation until 1987, I worked as developmental engineer at the Developmental Institute of the Machine Tool Industry Works. My work area was development of manufacturing systems and manufacturing cells. I participated in the development of the DIAGON-500 integrated manufacturing system built here and was project secretary for the first industrial application of the SATT methodology. In 1987 I worked for a few months in the PRO-KONTRA Small Cooperative as an electronics developmental engineer. Since December 1987 I have been a system designer for the FLEXYS Manufacturing Automation Joint Stock Company, where I deal with computerized automation and applications of SATT-DOC.

Vilmos Kovacs: I graduated from the Electrical Engineering School of the Budapest Technical University in 1979. Since then I have been working at MTA SZTAKI as a scientific colleague. In the meantime I studied for about a year and half at the Polytechnic of the South Bank in London. I participated in development of the SATT methodology and in several industrial applications (IGYR 630 and the SZIMFI manufacturing cell). I undertook a leading role in realization of the SATT-DOC program. In addition to the above my areas of interest are computer graphics, artificial intelligence, etc.

MICROELECTRONICS

Premise of Hungarian Microelectronics Program Challenged

25020055 Budapest FIGYELO in Hungarian No 20, 19 May 88 p 5

[Text] As reported in FIGYELO a few weeks ago—following a press interview with the Ministry of Industry—the Council of Ministers had made a decision on the reorganization of the domestic production of microelectronics elements including the state support to be given to a Hungarian-Soviet chip factory to be established in Hungary. After the initial buoyant reports a little speculation is in order: is the planned investment indeed as novel as it is said to be; will the new program succeed in avoiding the traps which the earlier ones failed to avoid?

Even a brief review of the history of the programs and of the centralized development of the domestic electronics parts industry suffices to justify a certain skepticism in hearing about the new program.

Shadow of the Past

The Economic Committee ruled, for the first time in 1971, on supporting the electronics parts industry from central sources. However, only 70 percent of the then projected 5-Year-Investment-Program was accomplished by 1975. At the same time, the use of electronics parts—and especially capitalist import—increased considerably faster than planned and, therefore, starting in the mid-seventies, several newer and more current programs were set up for the development of the parts industry. However, no decision was made concerning the central support.

Meanwhile, United Incandescent, investing on its own, has used U.S. technology to establish a plant for the assembly, casing and measurement of integrated circuits, hoping that this will promote the building of a domestic chip factory from central sources. However, the decision by the Council of Ministers to start a central development program, also incorporating the latter, was not made until 1981, at the time when the purchase of a complete chip factory, using Western technology, was no longer possible because of the embargo declared in the wake of the Afghanistan events.

At the Microelectronics Enterprise [MEV] established in 1982, the first production line working with Soviet equipment and the so-called MOS technology was unveiled in 1984. The second, so-called bipolar production line—with equipment from the GDR—was ready in 1985. On 26 May 1986—as we know—both production lines burned to the ground whereby nearly half of the investment projected for the 4.5 billion forints central development program was destroyed. (Fulfillment of the other parts of the program fell considerably behind the plans.)

Although—as was stated by Minister of Industry Frigyes Berecz in his latest interview with NEPSZABADSAG—"the tragedy has deeply shaken and disturbed the profession," the domestic users of the chips had no serious trouble with shifting to other sources of supply. Specifically, the MEV had great difficulty starting massive series production and the needs of the users significantly diverged from the expectations of those who prepared the development program.

After the fire, several possible variations for re-starting the domestic microelectronics parts production were aired by industry management. There was discussion about purchasing Western technology, the participation of Western capital, central investment constructed similarly to the earlier investment, and also a joint Hungarian-Soviet enterprise.

Finally, the government decided that, within the scope of the central development program, it will support with 1.7 billion forints an investment which—in the framework of the Hungarian-Soviet joint enterprise Intermos Ltd founded last year—will establish a parts manufacturing plant using the Soviet MOS technology. Additionally, without state support but under "state surveillance," under the name Interbit Corp, another enterprise is also being set up which will build a parts factory using bipolar technology. By the way, the capacity of the two factories will be double that of the production lines which had burned down two years ago.

Increasing Supply

In connection with the new investments, industry management again asserted its belief in favor of increased self-support in the domestic electronics parts industry. Currently, 40 percent of the demand for parts is supplied by the domestic industry and this ratio will increase to 50 percent by the early nineties, according to the plans. There will also be an increase in the ratio of socialist imports and the participation of capitalist imports will decrease from the current one-third to 20 percent. The question is whether, with the increase in the self-sufficiency in parts, the integration of the Hungarian electronics industry in the world market could be increased. (Its low level is attested to by the data in the table.)

Our Place in the "Microworld"

	Austria	Denmark	Finland	Ireland	Hungary
Population (per thousand)	7,552	5,114	4,855	3,508	10,697
GDP ($ million)	68,633	57,768	50,783	18,070	20,386
Electronics production ($ million)	1,081	937	802	1,941	1,136
Electronics export ($ million)	864	805	433	2,304	671
Electronics import ($ million)	1,381	1,202	985	1,678	391
Electronics foreign trade balance ($ million)	-517	-397	-552	626	280
Degree of electronics self-sufficiency (%)	13.6	9.9	27.3	27.6	54.3
Electronics import/production	127.8	128.3	122.8	86.5	34.4
Electronics export/production	79.9	85.9	54.0	118.7	59.1

The experiences of small countries similar to us in size show something else. For instance, In Denmark and Finland, less than 10 percent of the electronics parts used are manufactured domestically and this ratio is also below 30 percent in Austria. According to experience, the small nations can increase the competitiveness of their electronics industry precisely by working from the most modern parts base. This, however, can be imagined only with the high import ratio already mentioned.

In connection with the chip manufacturing to be built with state support, a further important question is how up-to-date the parts produced there will be. According to leaders in the industry, the three-micron resolution technology of MEV has been about 10 to 15 years behind world standards at the time. A one-micron resolution technology will be purchased for the new investment. This is indeed up-to-date, it will indeed reduce the backwardness to less than half. The question is, however, to what extent the new technology will be capable of also producing the projected parameters in industrial production.

World Standards—on an Industrial Scale?

The problem is not unknown to the leaders of the industrial sector—since with the MOS technology purchased earlier from the Soviet Union as well—the problem was precisely that those installations were not really suited for large-scale industrial production.

At the same time, the decision made on new investments also attests to a basic change in the earlier strategy of development. As we know, at the time the central development program for electronics parts production appeared to see the chances for catching up in a more narrow area of microelectronics, in the production of the so-called installation-oriented circuits [BOAK]. This strategy projected the manufacture of a small series of "individually fitted" integrated circuits. However, users failed to demand the new components to the planned extent and, therefore, their weight in the production of MEV was much smaller than expected by those who developed the concept. The industrial management finally appears to have made a break with the earlier strategy, even to the extent that at the press conference where the new technology was announced, BOAK was already judged to be an undesirable expression and the expression "application-specific circuits" was recommended instead.

However, if the chip factories will produce the so-called cataloque circuits which satisfy the broadest demands, then those problems must again be faced which earlier had justified the rejection of this strategy. Specifically, these circuits are being produced world wide in factories exceeding the capacity of the planned domestic chip factories by orders of magnitude, mostly under the supervision of giant electronics enterprises with strong capital, with murderous price competition. At the same time, the domestic demand for these components represent only a fraction of the lower limit of optimal series production. Therefore, the question is whether a domestic chip factory can be competitive under these conditions. Or even if its competitiveness can perhaps be achieved on domestic and CEMA markets surrounded by tight import possibilities, can then the installation-producing industry be competitive which mostly uses such "protected" components?

The beneficiary of the new investment, Intermos Ltd, is one of the first joint Hungarian-Soviet enterprises. The first reports did not yet address how the known accounting problems of this type of joint enterprise can be resolved in the case of a high-volume, extremely market-sensitive production such as chip manufacturing. According to the plans, investment will be born equally by the Hungarian and Soviet partners and they will also equally share the products. Thus, from the 120,000 a year pieces, 60,000 must be sold by the Hungarian and 60,000 by the Soviet partner. The question is whether, under the current, rigid accounting system, a flexible change in these ratios will be possible, whether the market can be divided and if yes, how, and will it be possible to move away from sharing in kind?

Embarrassment of Abundance

According to industrial management, after completion of the new investments, an as yet unknown problem will also have to be faced, namely, the abundance of microelectronics component supply. However, this problem, too, is not new in the domestic electronics component industry. In fact, after every major investment, the "embarrassment of riches" had to be struggled with. Toward the end of the 1970's the United Incandescent released 15 million pieces of integrated circuits per year and, although the investment was planned also then on the basis of estimates of domestic demands, less than one-third of the product could be sold on the domestic market. The product was non-competitive on the capitalist market, while their sale on the socialist market was initially not approved due to its high capitalist import content. Similar problems surrounded the starting of the MEV production lines in the mid-80's, as the domestic enterprises "were not buyers" of installation-oriented circuits. Thus the problem is not new, and on the basis of earlier experience, it cannot be called pleasant by any means, since the abundance has always come about in not truly competitive components aimed at satisfying naturally planned demands.

Finally, in connection with the new investments, the question has arisen whether the production of integrated circuits is indeed a field of the domestic electronics industry which demands maximum state support and state supervision. In fact, as far as shortage or "exploitability" by the capitalist market is concerned, the domestic electronics installation manufacturers have no fewer problems with the purchase of numerous components other than the chips. But these have at least as great an impact on the competitiveness of the Hungarian electronics products as the chips.

But if by chance this—the increase of the competitiveness of the Hungarian electronics industry—is not really the goal but, let us say, the goal is "simply" the domestic manufacture of X thousand TV sets, Y thousand computers, and the Z million chips needed for them, then most of the above questions can be considered irrelevant.

Ultimate Decision on Hungarian Microelectronics

25020057 Budapest MAGYAR ELEKTRONIKA in Hungarian No 4, 1988 p 62

[Article by Bela Laczko: "A Decision About Microelectronics"]

[Text] We have dealt frequently in the columns of MAGYAR ELEKTRONIKA with the domestic supply of electronic parts and with the status of the microelectronics industry therein. It is well known that up to the beginning of this year—since the fire at the MEV [Microelectronics Enterprise]—there was no government level decision about reconstruction or a solution in another direction. A committee created by the Ministry of Industry made a recommendation to the government in 1986 [as published, 1987 was probably intended]; the solution included reconstruction of chip manufacture and modernization and expansion of the assembly-testing plant. A decision was made in February and we were briefed on it by Sandor Bognar, deputy minister of industry.

After the IC factory burned down the Soviet Ministry of Electronics immediately offered aid and—recognizing our difficult material situation—recommended creation of a Soviet-Hungarian mixed enterprise which would make high complexity MOS integrated circuits for both parties. The proposal was taken further by Mikhail Gorbachev personally; he directed the Soviet professional leaders that a modern, large capacity plant to manufacture modern MOS integrated circuits—approaching the (present) world level—must be established in Hungary. The plant will serve not only domestic needs but will provide a quantitative and—primarily—qualitative improvement in parts supply to the socialist countries. INTERMOS will be a complete vertical IC factory (chip manufacture, assembly and testing) which will operate in part as a mixed enterprise and in part—from the Hungarian side—in the form of a joint stock company. The present shareholders are the MEV, the Communications Engineering Cooperative and the Hungarian state. It is an interesting new form of state participation that the state will handle the money given for investment as outlaid capital.

On the Hungarian side the shareholders will provide the total of about 3.5 billion forints necessary for the investment in the form of money and existing assets. (The big question here is whether the MEV will take its existing assets into the mixed enterprise or use them for its own manufacture, possibly doing contract work—e.g., mask manufacture—for the new enterprise. We consider it conceivable that the MEV will stand on its own feet and thus could be a competitor for the new IC maker.)

An interesting development is that Hungarian users are not sure that the MOS IC factory—which will begin production in 1992—will solve their parts supply problems. Knowing the distribution of Hungarian parts use—the ratio of bipolar devices is around 60-70 percent—it is not surprising that there is a need to start bipolar IC manufacture as soon as possible. Organization of a bipolar IC factory has started, with the Communications Engineering Cooperative in the fore, so parallel with INTERMOS they may establish INTERBIP, with the capacity to process 12,000 4-inch wafers per year with a technological resolution of three microns. Three Western firms have made bids, the factory would cost about 1.5 billion forints, a large part of it foreign exchange. It would build basically on the microelectronics plant of the HT [Communications Engineering Cooperative]; primary material and chemicals would come from socialist import. A preparatory committee under the leadership of Lajos Koveskuti has been formed and has begun work. It is assumed that the user enterprises and cooperatives and the banks would contribute the capital. The plant—according to the plans—would be producing by the end of next year. In this five-year plan INTERBIP can be created only without state participation, so it is questionable how the domestic electronics enterprises, not in an exactly good material situation, will be able to contribute the necessary 1.5 billion forints and—what is an even bigger question—how they will convert the forints into capitalist foreign exchange.

So there has been a government level decision in the matter of microelectronics, but some of the problems still remain.

SCIENCE & TECHNOLOGY POLICY

Nature of Trade Union for Hungarian Scientists Studied

25020056 Budapest FIGYELO in Hungarian No 19, 12 May 88 p 6

[Text] Is it possible to find an answer to the question why the distrust toward trade unions has developed particularly strongly among the intellectuals engaged in the field of sciences?

The budget of the Hungarian Academy of Sciences was reduced by an average of 15 percent at the end of 1987. The spectre of liquidation of research institutes was looming over many research places. The employment of many researchers became uncertain. The unions—according to the advocates of efforts to form new trade unions—have done very little toward preventing the erosion of financial support for research. Most of the criticism was levelled at the Union of Public Employees, which counts among its members 10,000 of the approximately 75,000 people employed in research. The others, scattered in 16 different branch unions—thus without a comprehensive representation of interest—have been waiting and are still awaiting for the solution to their problems. "Conforming to the transformation of the entire institutional system, it is quite certain that the trade union policy must again face a few basic concepts, they must be reinterpreted or different emphases must be acknowledged. These are autonomy, the two-fold function, problems of the defining role of membership"—declared Mrs Kosa, Magda Kovacs, secretary of SZOT [National Council of Trade Unions] (MAGYAR NEMZET, 30 March).

For action to follow the recognition, the initial step had been taken already at the end of last year at the general union meeting of the Institute of History, where an issue was raised for establishing an independent union of academic workers— outside of the Union of Public Employees but as a member of the SZOT. However, the independent representation of interests, initiated by a few scholars, started to become known in wider circles only when—recognizing the urgent demand—the Union of Public Employees came out with its own divisional proposal. At the delegate convention in February, the introduced divisional proposal was not accepted by the majority of the delegates present, because it would have allowed only a pro forma realization of greater organizational autonomy, while the mechanisms of management decisions would have remained untouched.

According to Tibor Polgar, political scientist, "...in the current social and political reform situation, the way out within a coherent development of the political system—as an organic part of it—can be represented by a basic reform of the organization, the management's decision-making system and function of the trade union movement, which also has to be consistent and coherent, aimed at critically surpassing the current organizational conditions in its content." (MAGYAR NEMZET, March 22, 1988.)

It was expressed at several places that the renewal of trade union activities can be achieved only with the participation of the membership, through their will, initiated from below.

During the weeks past, at the trade union meetings in research institutes, at universities and research establishments, several kinds of new organizational possibilities were debated by those affected. Four concepts were proposed. The first, to leave everything as before, is certainly receiving little support. The second, the divisional concept already mentioned, is the proposal by the Union of Public Employees. The third, the establishment of a Union of Scientific Workers (TDSZ) within the Union of Public Employees, is appealing to both the branch union involved and the SZOT. The association, organized from below to protect employee interests, advocates as a first step the transformation of the Union of Public Employees into a coalition, with TDSZ functioning within it as an independent trade union, the membership of which could include the active and retired employees of every scholarly research institute and other establishments engaged in scholarly work—even if they are union members of another branch. The higher management bodies would be established by the basic workplace organizations. The trade union functioning within the coalition would essentially fight to improve the living and working conditions of workers in research institutes. Its primary aim would be to maintain real wages. It would set as its goal the increase of the real value of the money allocated for research in the budget and to raise the ranking and appreciation of scholarly work. They consider it important that every question affecting researchers receive increased publicity.

In addition to the coalition idea and the establishment of a division, the idea of establishing a new, independent trade union was also formulated, simultaneously. Calling themselves the Democratic Trade Union of Scholarly Workers, they organize themselves with essentialy the same goals as the advocates of a coalition system, however, they want to establish a relationship with other horizontal unions and the SZOT outside of the existing organizational framework, somewhat like an independent horizontal union. According to their plans, their statutory meeting is planned in the next few days. The organization, established as a part of the Hungarian trade union movement, can be joined by anyone who accepts their bye-laws and desires to have his or her interests represented.

The workers of research institutes have not yet formulated their final position on which new organizational form would best suit their interests.

Opinions are as yet divided on the efforts at renewal, which can also be evaluated as the initial steps toward a reform of the trade union movement.

It appears, however, that there is a general demand for horizontal organization and for sharper projection of professional interests. The initiative by scholars and researchers toward renewal has met with a sympathetic response also from among higher officials of the trade union movement. Of course, it is understandable that they favor the kind of renewal initiative that does not want to make a complete break with the existing organizational structure.

GDR-PRC Cooperation with Sciences Academy

AU2410153388 East Berlin NEUES DEUTSCHLAND in German 20 Oct 88 p 2

[Text] Berlin (ADN)—Prof Dr Ulrich Hofmann, first vice president of the GDR Academy of Sciences, and Prof Li Zhensheng, vice president of the Chinese Academy of Sciences, signed a plan for scientific cooperation between the two institutions from 1989 to 1990 in Berlin on Wednesday [19 October—FBIS]. Prof Dr Werner Scheler, president of the Academy of Sciences, and Zhang Dake, PRC ambassador extraordinary and plenipotentiary to the GDR, were present during the signing.

The plan continues the contractual cooperation between the two academies. It focuses, among other things, on laser research, informatics, scientific apparatus construction, and carbon-based petrochemistry. The document was signed during the 2-week visit of a delegation of the Chinese Academy of Sciences to the GDR, during which it acquainted itself with the research facilities of the Academy of Sciences. Prof Dr Horst Klemm, first secretary of the SED kreis leadership of the Academy of Sciences, and Klaus Herrmann, state secretary in the Ministry of Science and Technology, also participated in the signing.

SUPERCONDUCTIVITY

Czech High-Temperature Superconductivity Research Reviewed

24020015 Prague POKROKY MATEMATIKY FYZIKY & ASTRONOMIE in Czech No 2, 1988 pp 65-80

[Article by Vladimir Gregor, Jan Kuznik, Milan Odehnal, Josef Sebek: "High Temperature Superconductivity—Revolution in Solid State Physics." Passages in italics as published]

[Excerpts]

3. High Temperature Superconductivity Research in the CSSR

In the past, superconductivity research was done at several centers in the CSSR. In the field of high temperature superconductivity, it should be mentioned that in 1970, Nb-Al-Ge substance with the critical temperature of T_c = 21 K, highest one known at the time, was prepared and later thin layers of Nb_3Ge with $T_c = 22.5$ K were also prepared. The technology for manufacturing multi-layer superconductors, NbTi and Nb_3Sn (National Institute for Substance Research, Prague), was developed for application purposes and the manufacture of Nb_3Sn, prepared by vapor deposition, was introduced (The SAV Electro-Technical Institute in Bratislava). Electro-technical plants in Bratislava commercially manufacture superconductive magnets and the Institute for Instrument Technology in Brno has developed superconductive solenoids with a highly homogeneous magnetic field for nuclear magnetic resonance.

A fair amount of research capacity has been devoted to low temperature superconductivity. The research has focused on the study of the properties of Josephson structures and on the practical use of quantum sensors utilizing this phenomenon (measuring the magnetic field of human heart and brain, geophysical measuring, JMR, etc.). The leaders in this research are the following laboratories: SAV Electro-Technical Institute, SAV Institute for Mensuration Technology, and the Physics Institute of the CSSR Academy of Sciences. Moreover, the CSSR has started manufacturing a basic magnetometer with the Josephson Sensor (squid) (SAV Institute for Mensuration Technology and Tesla Vrable).

At the Physics Institute of the Czechoslovak Academy of Sciences in Rez, superconductivity of the Y_9Co_7 which belongs to the exotic superconductors was discovered. This substance shows a ferromagnetic arrangement at 6 K and at the temperature of 2 K it reaches the superconductive state.

This experimental base has been very useful in setting up new high temperature superconductor research at various Czechoslovak centers. As mentioned above, the preparation technology is relatively simple. Therefore, it has been possible to utilize all previous experiences and successfully begin the research. One big disadvantage has been the lack of information concerning worldwide research on superconductors. Obviously, that research has progressed fastest in centers with good connections with centers abroad. In particular, the participation of researchers from the Mathematics and Physics Department of Charles University at Prague in the Swiss conference held at the end of March helped to skip an entire stage of research of the composition of superconductive phase in the Y-Ba-Cu-O system. As early as the beginning of April, three original publications, documenting successful obtaining of superconductive materials in the area of 90 K were sent to the Czechoslovak Physics Journal—from FzU CSAV [Physics Institute of the Czechoslovak Academy of Sciences], MFF UK [Mathematics and Physics Department of the Charles University in Prague], and the Research Institute for Communication Technology in Prague. These publications dealt with the optimization of the annealing time for the multi-phase system in oxygen under pressure, as well as temperature dependency of electrical resistance and alternating magnetic susceptibility, and with measuring magnetization at 4.2 K in the field of up to 5 T. The latter work describes radiographs of the material after calcination, which is not yet superconductive and after being pressed and further annealed, when superconductivity occurs. The publication points to the splitting of the lines in the superconductive phase radiograph, caused by the distortion of the crystal lattice which is closely connected with the occurrence of superconductivity.

A. Phase Diagram of Y-Ba-Cu-O Research

Even at the time when this research was started the following stable phases were identified: $Y_2BaCu_5O_7$ and $YBa_2Cu_3O_{7-y}$. The former is an insulator and the latter has been designated as the superconductivity carrier in this system. A Japanese group identified another superconductive phase $Y_2BaCu_2O_y$ not identified in any other literature. It must be remembered that inside this phase diagram (see Figure 3) are other phases which, because they are unstable, would be very difficult to prepare. When preparing a substance with different stoichiometries other interesting phenomena were observed, such as breaks in the resistance temperature dependency, etc., which change in time.

The VUEK [Research Institute for Electro-Technical Ceramics] in Hradec Kralove has taken it upon itself to research this area. Figure 3 shows a phase diagram, marking compositions which have been prepared. Some compositions studied showed superconductivity, despite of contradictory publication data. According to the present results, the preparation of the substance with the desired properties is dependent not only on the initial composition but on the technological process as well. This has greatly complicated the search for stable phases.

B. One-Phase Substance—$YBa_2Cu_3O_{7-y}$

Multi-phase material is not suitable for physical research because the properties of individual phases can overlap and thus complicate the evaluation. Therefore, great attention has been devoted to the preparation of one-phase samples. This substance has been prepared at various Czechoslovak centers. Figures 4 and 5 show temperature dependencies of electric resistance and alternating magnetic susceptibility of $YBa_2Cu_3O_{7-y}$ prepared at the Chemical and Technical University at

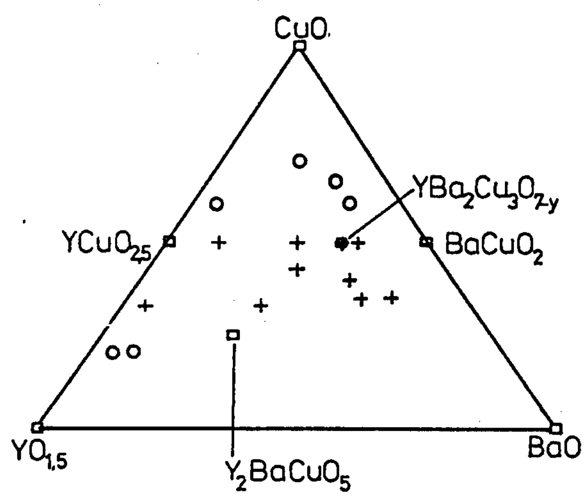

Figure 3. Phase Diagram of the Y-Ba-Cu-O System. The squares are individual phases which have been identified. Circles are compositions which are not superconductive, and crosses are compositions which are superconductive but multi-phased.

Prague. The temperature in the change from the normal to the superconductive phase is dependent not only on chemical purity but other factors as well, such as mechanical stress.

Figure 6 shows microcrystalline structure of material formed by sintering individual crystals of $YBa_2Cu_3O_{7-y}$. Measurements were made which were to indicate how in the course of sintering the material's minute particles the superconductive phase occurs.

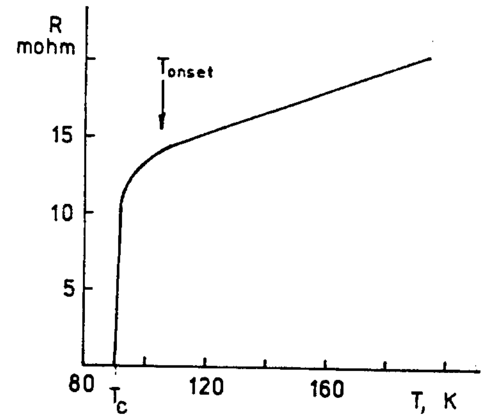

Figure 4. Temperature Dependency of Electrical Resistance of $YBa_2Cu_3O_{7-y}$.

T_c is the temperature at the midpoint of the sharp resistance decrease. T_{onset} are the beginning indications of superconductivity.

It seems that increasing the pressure over 10 MPa does not significantly influence the density of the prepared materials. For superconductivity to occur, layers of Cu atoms with oxygen positions not fully loaded are very important. In these layers are copper ions with alternating valence Cu^{2+} and Cu^{3+}. By chemical methods the following ratio was determined: Cu^{3+}/Cu^{2+} approximately equals 10^{-1}.

The study of infrared spectra makes it possible to determine the energy gap. The experimental values obtained using $YBa_2Cu_3O_{7-y}$ are several times lower than the

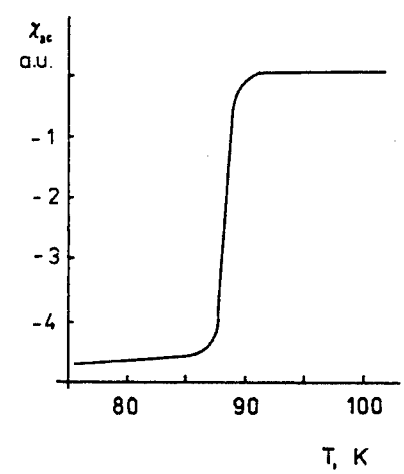

Figure 5. Temperature Dependability of Magnetic Susceptibility of $YBa_2Cu_3O_{7-y}$.

Unlike electrical resistance, susceptibility gives information about the volume properties of the sample.

Figure 6. A photograph of the Microcrystalline Structure of the Ceramic $YBa_2Cu_3O_{7-y}$.

In the right corner, the scale of 10 μm is noted.

values given in the BCS theory; this could be caused by the highly anisotropic properties, presumed in these superconductors.

Interesting substitutions are made when an element with a magnetic momentum is built into the lattice. From the BCS theory, we know the negative influence of magnetic additives on superconductive properties. It was, therefore, surprising that replacing yttrium with rare earths, which have a substantial magnetic moment because of an infield shell of 4f, has practically no influence on T_c. Moreover, they show an interesting combination of superconductive and magnetic properties.

The VUST [Research Institute for Communication Technology] in Prague prepared two series of $REBa_2Cu_3O_{7-y}$ with RE = Y, Ho, Dy, Gd, Sm, Nd and Ce. All substances, except the sample with cerium, show superconductive properties, as known from present-day literature. Figures 7 and 8 show specific magnetizations of Y-Ba-Cu-O and Gd-Ba-Cu-O measured at 4.2 K. The curves occur because of a combination of two competing properties. In weak magnetic fields ideal diamagnetism manifests itself, caused by the Meissner-Ochsenfeld phenomenon, which, in strong magnetic fields, is overpowered by paramagnetic behavior of the gadolinium ion. In case of $GdBa_2Cu_3O_{7-y}$, a specific heat increase has been noted, attributed to the transition to the antiferromagnetic state with T_N = 2.2 K. This interesting behavior supports the opinion that superconductivity in these substances lies not in the entire crystal but only in the

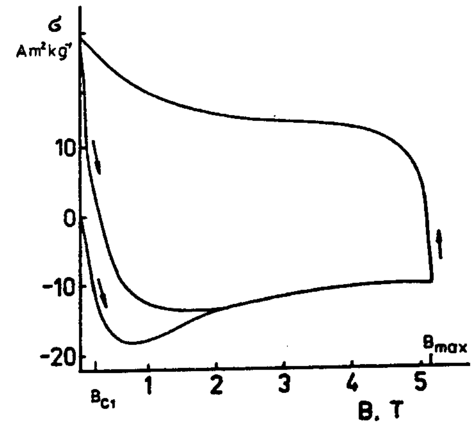

Figure 7. Magnetization Field Dependency of $YBa_2Cu_3O_{7-y}$.

B_{c1} is equal to the magnetic field at which the magnetization curve deviates from the straight line at the beginning. B_{c2} is the field where the magnetization is equal to zero. When the field drops from B_{max} the induction of shading currents in the sample occurs and the magnetic flow-pipes are anchored, which results in the overmagnetization of the sample. Arrows show the course of the curve.

Cu-O layer with a strong anisotropy with superconductive properties. The superconductive Sm-Ba-Cu-O has also been prepared at the Institute for Experimental Physics of the Slovak Academy of Sciences in Kosice.

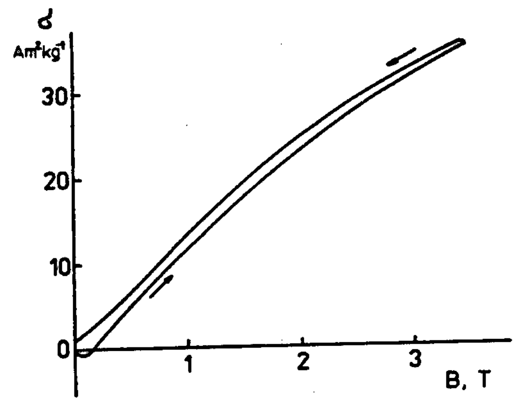

Figure 8. Magnetization Field Dependency of $GdBa_2Cu_3O_{7-y}$.

In weak fields the diamagnetism of the superconductor presents itself similarly to the graph in Figure 7. Following this, the magnetic properties of the Gd ion begin to prevail. The cause of the hysteresis of the curve is the same as in Figure 7.

Using materials Y-Ba-Cu-O, the first measurements of the electronic paramagnetic resonance from the temperature of 77 K to 300 K and measurements of current densities were taken at the EU SAV [Slovak Academy of Sciences] in Bratislava.

4. Josephson and Tunnel Effects

In two superconductors, separated by a thin dielectric layer (approximately 5 nm thick) the macroscopic wave functions overlap, enabling the tunnelling of paired electrons through a potential barrier created by the dielectric layer. The tunnel current depends on the difference between the phases of the two wave functions. This is the so-called direct-current Josephson effect. A similar weak transition in the superconductive ring forms the base for the most sensitive superconductive quantum magnetometers, the so-called squids. Because the weak transition has a low critical current I_c (1 μA to 10 mA), when the transition occurs in the circumference of the ring, it enables the "transfer" of quanta Φ_O in and out of the squid ring. Of course, when the current is I greater than I_c, voltage U flows across a weak junction and the transition is generated by alternating current with the frequency $f_J = 2eU/h$. This is the substance of alternating Josephson effect. When radiating such junction with I greater than I_c by an external electromagnetic radiation, with a frequency f equal to double the value of f_J, the synchronization of both frequencies occurs and current steps are formed in the current-voltage transition, the so-called Shapiro steps. When, during radiation at zero current, quantum voltage $U = hf/2e$ occurs at the tunnel transition, it is called inverted Josephson effect.

When the bond between two superconductors is very weak (a thick barrier, for instance), then the Cooper pairs cannot tunnel, but with sufficient voltage unpaired electrons are observed to tunnel at the transition. There is a sharp increase of tunnel current at the voltage of $2\Delta(T)/e$ of the superconductor. To know this parameter is very important for the microscopic description of the superconductive state. The tunnel experiments give us the direct value of this gap.

The energy gap was measured using the so-called microcontact spectroscopy in Charkov and then using a scanning electron tunnel microscope by many authors. The vast majority of measurements today are made using the latter method which makes it possible to use as a barrier a vacuum between the scanner and the material being measured. The values of the parameter $\delta = 2\Delta(0)/k_BT_c$ are in a surprisingly broad range of 1.5 to 13. These results are probably caused by a strong anisotropy of the superconductive properties of superconductive oxides.

In Birmingham, English physicists reached interesting results. On a ceramics ring Y-Ba-Cu-O, they noted quantizing of the magnetic flow. Magnetic flow quantizes in the quanta of $\Phi_O = h/2e$ which once again confirms the pairing of electrons with the value 2e!

The existence of macroscopic quantum phenomena is connected with the basic characteristics of superconductivity. Undoubtedly, Josephson effects demonstrate the wave character of superconductivity and the distance macroscopic coherence. It is, therefore, natural that their existence in the new materials is extraordinarily important for the identification of superconductive phases. At the present state of technology of these high temperature superconductors, the ones to be considered are mainly the scanner point contacts and internal contacts in the percolating structure of the sample. The thin superconductive layers of these oxides have been prepared in only few laboratories. Work in this field began at FzU CSAV [Physics Institute of the Czechoslovak Academy of Sciences] in Prague and Rez and at the EU SAV [Energy Institute of the Slovak Academy of Sciences] in Bratislava.

One of the first groups of scientists which was able to observe transitions in oxides, showing Josephson effects, were the French, Esteve, et al. The results with the samples La-Ba-Cu-O and partially Y-Ba-Cu-O, showing direct-current and alternating Josephson effect, confirm that the electron pairing of these superconductors does not differ from the single pairing in BCS theory. By choosing superconductive and normal points against conductive ceramics it was proven that weak contacts are formed inside the sample among individual crystal grains or percolating islands and not between the point and the ceramics. The alternating Josephson effect and Shapiro steps confirmed that in both materials the pairing is of the type with value 2e. Critical current reached values of only several μA.

Practically at the same time, independently from the above-mentioned authors, scientists at the FzU CSAV [Physics Institute of the Czechoslovak Academy of Sciences] in Rez observed Josephson effects at $T = 4.2$ K using ceramics Y-Ba-Cu-O with $T_c = 92$ K. In the structure in which ceramics were placed between two single superconductors (Nb point and ceramics holder from PbSn alloy) scientists observed a quasi-particle tunnelling between materials with varied energy gaps, Josephson tunnelling with a critical current of several μA and Shapiro steps during radiation with the frequency of 18.5 GHz. The step distances and the existence of a non-zero current of Cooper pairs point to pairing to a single state with the charge value being 2e. By measuring the noise characteristics at these transitions the percolating character of the conductivity of these materials was confirmed.

In this article Josephson direct-current and alternating effect was also observed, confirming the above-mentioned conclusions. In this article the authors observed critical current up to 80 μA.

In a sample with two "critical temperatures," inversion Josephson effect was observed in the granular structure Y-Ba-Cu-O already at the temperature of 240 K and below. The values of the measured voltage corresponded

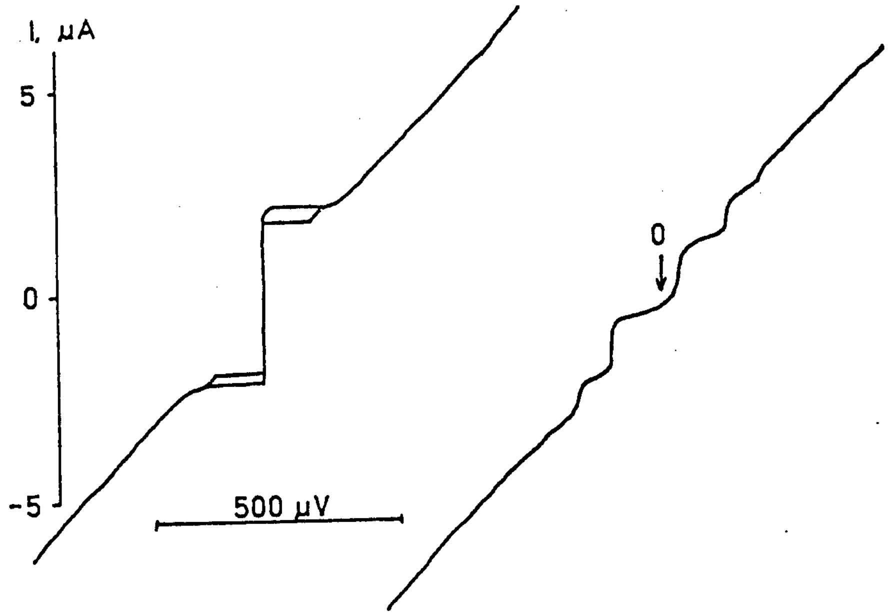

Figure 9. On the left is the I-V characteristic of the direct-current Josephson transition with a critical current of several A. A slight hysteresis is visible. The result was obtained in the structure Nb point-$YBa_2Cu_3O_{7-y}$-alloy PbSn at the temperature of 4.2 K. On the right is the I-V characteristic of the same structure while under microwave radiation with the frequency of 18.5 GHz. Shapiro steps are apparent, corresponding to the pairing with a value of 2e (approximately 19.3 GHz per 20 V).

to the sum of the voltage from a large number of weak transitions joined in a series. At the FzU CSAV [Physics Institute of the Czechoslovak Academy of Sciences] in Rez, they observed in a sample Y-Ba-Cu-O at T = 4.2 K, during radiation at 36 GHz, Josephson effect and for the first time in these materials I-V characteristics with chaos were observed. Also at 18.5 GHz Shapiro steps and noise instabilities were observed. At the frequency of 9 GHz Shapiro steps did not appear.

It would seem that considering the above-mentioned difficulties with the preparation of undoubtedly defined Josephson contacts and superconductive loops, it will be difficult to prepare squids from these materials. However, independently of each other, several laboratories determined that quantum interference, i.e., periodic dependency of the output signal of the squid on external flow, on which these instruments are based, can be observed directly in the material. Josephson contacts between individual crystal grains randomly connect and form various superconductive loops which can be used as internal quantum loops. This phenomenon of quantum interference was first observed in Charkov at the temperature of 68 K and below. At the FzU CSAV [Physics Institute of the Czechoslovak Academy of Sciences] in Rez this phenomenon was observed at nitrogen temperatures and parameters of this stochastic loop were analyzed. Similarly, in Glasgow this phenomenon was observed in the Y-Ba-Cu-O material at 77 K. The sensitivity of these squids with a random internal loop is so far substantially worse than in the classic squid. At the FzU CSAV in Rez they measured the sensitivity of 1.10^{-9} $THz^{-1/2}$ and differentiation of $5.10^{-3}\Phi_O$ $Hz^{-1/2}$. Commercial squids with classic superconductors usually have a differentiation smaller than $1.10^{-4}\Phi_O$ $Hz^{-1/2}$. It is apparent that technological problems connected with the preparation of thin layers, based on these oxides, will eventually be overcome. IBM in the United States has shown very promising data—they constructed a squid with such a thin layer but it only works at a temperature lower than liquid nitrogen.

5. Theoretical Models and Conclusion

In terms of theoretical clarification of the observed high temperature superconductors the matter is not clear. According to Prof N. Mott, laureate for the Nobel prize for physics, there are almost as many theories as there are theoreticians. However, some results can be considered final. The results of the experiment with quantizing magnetic flow in the superconductive Y-Ba-Cu-O, confirming that magnetic flow quantizes by quanta of Φ_O = h/2e and not h/e, undoubtedly prove the existence of pairing in this material. Similarly, experimental results obtained from measurements of direct-current Josephson effect and the existence of Shapiro steps with quantum voltage values of V = nhf/2e, where f is frequency and n is a whole number, in the case of La-Ba-Cu-O as well as Y-Ba-Cu-O, show single pairing into the states with a charge of 2e. We suppose, that all theories which oppose these experimental facts are thus invalidated.

These oxides become superconductive near the metal-insulator transition, a fact very important for many theories. The electron structure of superconductive oxides has a two-dimensional character. Bivalent element doping and changing the density of oxygen lattice vacancies changes the ratio of copper valance Cu^{3+}/Cu^{2+}, which is important for superconductivity to occur. The state of mixed valencies is responsible for the metal conductivity of these oxides. Value T_c is the function of the ratio Cu^{3+}/Cu^{2+}. Therefore, it is very important to calculate the banded two-dimensional electron structure of the semiconducting, metal and superconductive phases of these materials.

Because it seems that the parameter of the electron-phonon interaction λ will exceed 0.3 by a large factor, a question arises, whether a modified BCS theory with a strong bond could not explain such high T_c values. Analyzing these new superconductive theories would require an extensive article of its own. We will, therefore, limit ourselves to a sort of an excerpt from the various mechanisms, phonon and non-phonon. Of course, we are excluding theories with triplet or no pairing.

a) Conventional phonon mechanism with a strong bond (much greater than 0.3) with additions from low frequency and optic phonons. The value of $N(E_F)$ is relatively small, according to calculations of banded electron structure. However, the small mass of the oscillating oxygen atoms can substantially increase the value of T_c.

b) Two-dimensional superconductivity at one level of Cu-O atoms and a quasi-one-dimensional superconductivity in Cu-O chains at another level. Oxygen vacancies have a decisive significance for this type of superconductivity. Decreasing the superconductivity from a three-dimensional to a two-dimensional one, underlines the singularity in the phonon spectrum and increases T_c. The formula $\exp(-1/\lambda)$ in (1) changes to $\exp(-1/\lambda^{1/2})$.

c) Mechanism of polaron and bipolaron superconductivity resulting from the existence of localized and delocalized Jahn-Teller polarons within the limit of a strong bond.

d) Mechanism of electron-electron superconductivity with an antiferro-magnetic changeable interaction. Magnetic single electron pairs can move or resonate (see Pauling's chemical resonant structures) in the structure of the insulator. At a certain level of doping they can become charged Cooper pairs, which can condense into a superconductive state. The presence of mixed valence states of Cu^{2+} and Cu^{3+} is important. This theory is based on the "half filled Hubbard model" with a medium repulsive energy and with an antiferro-magnetic interaction. On account of this interaction between electrons, T_c could increase up to Neel temperature of T_N much greater than T_c. This approach is called resonating valence bond state and it is being developed by Nobel Prize winner P.W. Anderson. Similar conclusions were reached by Prof M. Noga from MFF [Mathematics and Physics Department] in Bratislava. The superconductivity mechanism is, therefore, not the phonon type, even though a slight phonon interaction can strengthen and stabilize this state.

e) Electron pairing at the presence of excitors and plasmons.

f) The increase of T_c because of spin waves.

g) Hybridization of wide and narrow bands of electrons with local and itinerating electron pairs.

h) The increase of T_c because of anomalous fractional dynamics in the percolating structure of polycrystallic oxides.

i) Because of the strong granularity of the prepared samples, much time is spent on the theory of granular superconductivity with Josephson bonds between grains or domains, which is very similar to the spin glass theory.

The number of problems is not small, and according to P.W. Anderson "1 kg of sample contains 2 kg of anomalies." It is a matter of a rich mixture of superconductivity, structural changes, mixed valencies, transitions from insulator to metal, magnetism, phonon anomalies, crystal lattice instabilities, two-dimensional band electron structures, oxygen vacancies, etc.

High temperature superconductivity has opened a can of worms in physics. With the rising critical T_c temperature of new materials grows the feverish activity in the entire world among chemists, technologists, electrical engineers, metallurgists, and last but not least, politicians. The effect of these findings on the whole world's energy system and on microelectronics is not negligible and it must be taken into account. The application possibilities are great and a world without an energy crisis is not infinite. It has been said that superconductivity findings mean as much for the world as the invention of the wheel. Is this wheel really beginning to turn today? The entire scientific world should help it move. Without exaggeration, this superconductivity can touch every one of us. There are many problems and this "ceramic wheel" is fragile.

The authors apologize to all whose work and efforts have been left out of this article. The fault is on our side. We are aware, that to write a report on superconductivity today is unwise and daring.

TELECOMMUNICATIONS R&D

'Automation Facilities' Data Base Described in GDR

23020025 East Berlin MESSEN STEUERN REGELN in German No 6, 1988 pp 273-277

[Article by L. Blackert: "Performance of the Computer-Assisted Information Fond 'Automation Facilities' in the VEB combine Construction of Automated Facilities]

[Text]

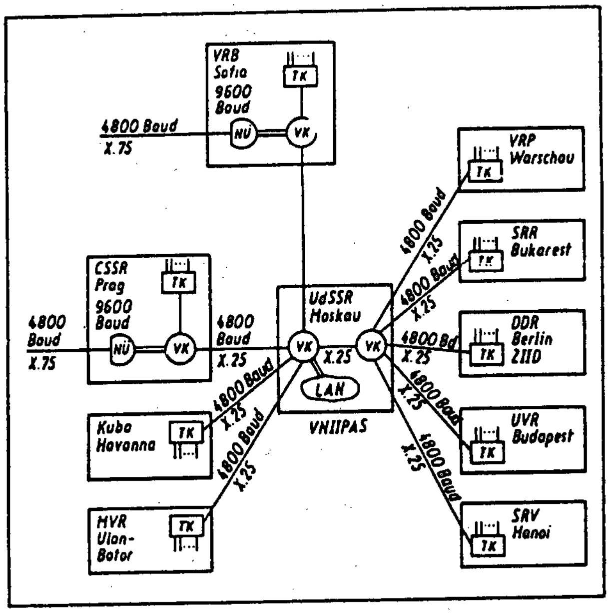

Figure 1. International Automation Information Exchange System (simplified representation)

VK =	Switching node (3/5 synchronous line connections)
NUe =	Network transfer device
TK =	Terminal node (packet switching, 4/8 asynchronous connection)
LAN =	Local area network
ZIID =	Central Institute for Information and Documentation

Introduction

At present, technical knowledge is doubling every five years. According to estimates, at the turn of the century technical knowledge will double every 2 years, even faster in certain disciplines such as electronics. Ninety percent of all scientists ever having worked in science are our contemporaries and produce approximately 6 million new results per year, which are published every year in

—more than 30,000 scientific and technical journals with more than 2 million technical articles
—approximately 800,000 patents
—approximately 75,000 scientific and technical books
—approximately 700,000 dissertation, research and development reports.

It is the task of scientific-technical information (WTI) to use modern computer technology and efficient methods to fully acquire world-wide knowledge and make it available for science and technology. In line with the available research potential, approximately 1 to 1.5 percent of the international scientific results are produced in the GDR. This means that large parts of the international scientific and methodology fund has to be imported. All highly developed industrial nations place great importance on the establishment of powerful information funds because they have come to realize that information

—on the state of technology and the competitive situation is a necessary prerequisite for the selection of scientifically successful projects
—helps avoid expensive and time-consuming double efforts and thus keep development costs and times low
—on existing products and standards helps lower manufacturing costs.[1]

Internationally, avoidable research cost losses caused by duplication of efforts are estimated at 5 percent. In addition, as part of science and technology, scientific-technical information provides purposeful and current information, preferably for shortening the cycles of

—research and development
—technology
—design
—projections
—manufacturing/assembly
—management and planning
—market research/sales in industry to ensure a high renewal rate. This information, in particular on the advanced international state of the art, serve both to increase the performance and efficiency and decision-making in the reproduction process.

The progressing development of new information and communicationtechnologies as well as increased quality and speed requirements for the processing and provision of information have led to the use of computer-assisted working methods worldwide. The international system of automated information exchange is shown in Figure 1.[2]

In the GDR, the ministries and combines are organizing the establishment of computer-assisted information funds and information supply. They do so independently according to their line of products including technology and methods. The information funds for automation technology are basically provided by the combines Electrical Appliances Plants "Friedrich Ebert", Robotron and Construction of Automated Installations.

Structure, mode of operation, and use of the fund "Automation Facilities" by the combine Construction of Automation Facilities is described below.

1. Main Focus of "Automation Facilities" Fund

The document-oriented fund "Automation Facilities" contains documentation which provides information on certain key areas shown in Table 1.[3]

2. Sources

As of the first quarter of 1988, the document memory bank which has been maintained since 1972 contained approximately 150,000 documentation references, with 800 new document references per month.

Table 1. Key Areas of the "Automation Facilities" Fund

1. Automation of Industrial Processes

—Facilities structures, reliability
—Microprocessor systems, assemblies and components for process automation
—Optoelectronics in automation facilities
—Automation problems and power electronics in rolling mill facilities, cement plants, at machining and processing equipment, in traffic technology
—Open/closed loop control in climatology, chemical technology, traffic technology, in technical building equipment and sequence control at machining and processing equipment, industrial robots, hydraulic and pneumatic controls

2. Manufacture, Assembly, and Start-up of Electronic Equipment and Facilities Including CAM, CAQ, CAT,...

—Closed-loop control drives
—On-board network centers, energy generation for smaller island networks (Diesel or gas turbine drive)
—Power plant equipment
—Electronic and non-electronic controls as well as performance test facilities
—Equipment for strip mining hauling equipment and conveyer installations
—Light signal facilities, devices and installations of railroad signal and safety technology

3. Improving Efficiency, Automating Technical Preparation of Installation Production for "Electrical/electronic equipment and installations"

—Projection and design of measuring and control facilities, process controls, controls for machining and processing equipment, signal and safety installations
—Application of catalog- and computer-assisted projection and design (CAD)
—Technical preparation of facilities assembly

Table 2: Processing Available Information

	Retrospective research	Selective information processing (SIV)	Subject matter information (TI)
Request for available information	Search request	User profile	Subject information (9 complexes)
Polling cycle	Polling as required	Monthly polling	Monthly polling
Search in memory content	Complete memory	Monthly memory additions	Monthly memory additions
Distribution of computer retrieved data to user	Computer printout "Search"	Computer printout "SIV"	Microfiche "TI"

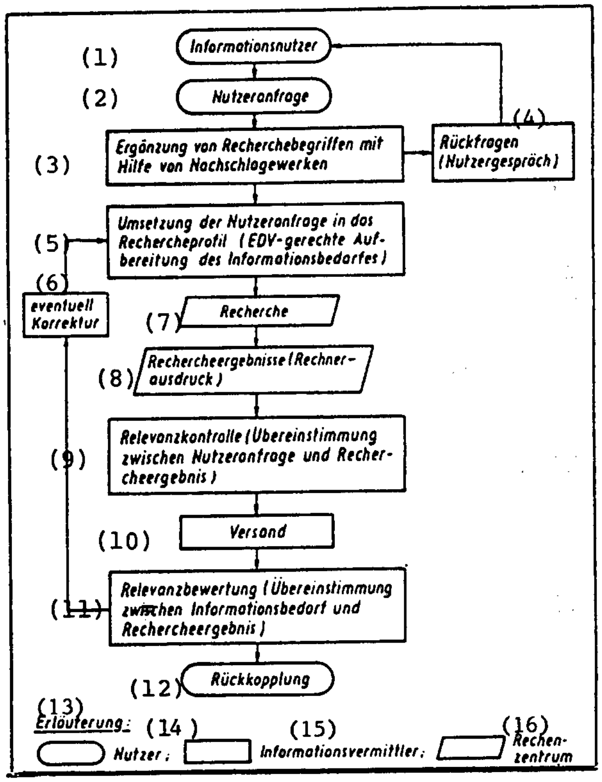

Figure 3. Search Sequence (selective and retrospective)
Key:—1.Information user—2.User request—3.Adding to search terms using reference works—4.Questions (user discussion)—5.Transfering user request to the search profile (processing of required information into EDP format)—6.Any corrections—7.Search—8.Search results (computer printout)—9.Relevancy check (agreement between user request and search result)—10.Mailing—11.Relevancy evaluation (agreement between required information and search result)—12.Feed-back—13.Explanation—14.User—15.Information Transfer—16.Computer center

The fund contains approximately:

—80 percent professional and trade journals, of those:
* GDR............................94
* Socialist economic region........80
* Non-socialist economic region...136
—10 percent technical books of the socialist and non-socialist economic
area
—5 percent company publications of the socialist and non-socialist economic area
—3 percent conference reports
—2 percent dissertations.

In order to keep current, the percentage of literature not coming from the regular publishing trade is increasing. The available source basis is evaluated by technically knowledgable personnel along EDP-lines primarily from the viewpoint of the automation of continuous and discontinous processes. Thirty-five percent of the information references are processed by personnel of the VEB GRW "Wilhelm Pieck",Teltow. The information sources requested by the users are made available by the scientific special libraries based on the pattern shown in Figure 2.[2]

3. Information Provided by Document-Oriented Information Fund "Automation Installations"

3.1. Overview, Modes of Operation

The information provided which is geared to different user requirements, is illustrated by the processing cycles in Table 2.

The organizational sequence of selective information processing (SIV) or a search from its initiation to delivery to the user is shown in Figure 3 using a program sequence as an illustration.[2]

In this context, the use of standardized reference words or descriptors plays an important part.

Obtaining relevant information which contains a minimum of unnecessary data requires organizing the request logic in such a way that an optimum search result is obtained with a minimum of computer time.

The computer logic to be used permits the following logic symbols for connecting the descriptors:

—A (AND), AND-operation
—O (OR), OR-operation
—N (NOT), NOT-operation
—AN(AND/NOT), AND/NOT-operation

Two examples for creating simple request logics for searches are shown below. They require three steps:

Network tools for power provision?

1st Step
Analysis of request and assignment of descriptors and system points:
—System point: power supplies, current supply = h43 (alphanumeric system coding)
—Descriptors: power supply, current supply, current supply device

2nd Step
Numerical coding of descriptors and system point
01 h43
02 power supply
03 current supply device
04 current supply unit

3rd Step

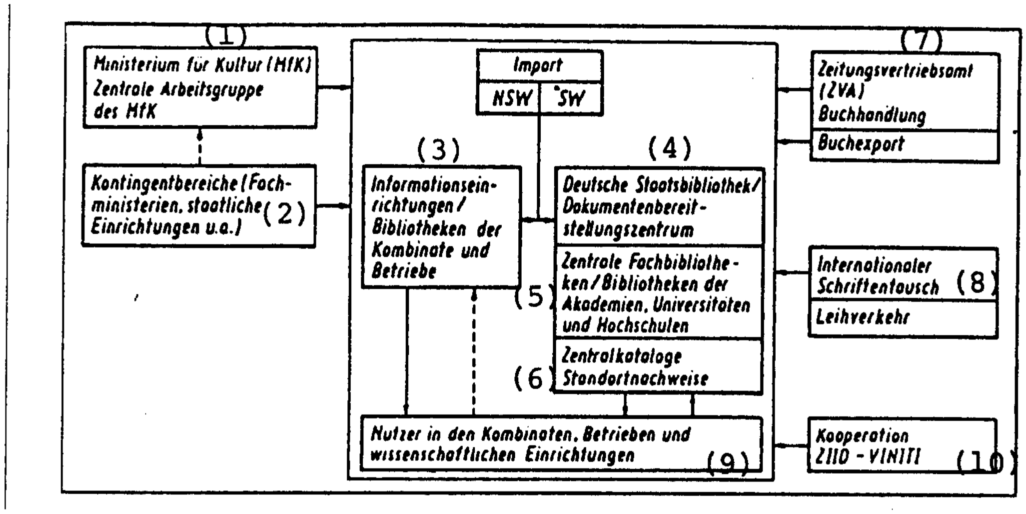

Figure 2. General Outline for the Provision of Information Sources (——Provision; - - - Ordering)

Key:—1. Ministry for Culture (HfK), Central HfK Study Group—2.Allocation areas (specific ministries, state institutions, etc.)—3.Information institutions/ libraries of the combines and firms—4. German National Library/document procurement center—5. Central Technical Library/libraries of the academies and universities—6. Central catalogs, site documents—7.Newspaper distribution office (ZVA), bookstore, book export—8.International document exchange; loan exchange—9.Users in combines, plants and scientific institutions—10.Cooperation ZIID-VINITI

2
Logic operation using Boolean algebra:
01 A(02 03 O 04)

Microcomputer in Automation Installations?

1st Step
Analysis of request and assignment of descriptors and system points:
—Descriptors: Microcomputers, automation, installation

2nd Step
Numerical coding of descriptors and system point:
01 microcomputer
02 automation
03 installation

3rd Step
Logic operation using Boolean algebra:
01 A (02 O 03)

The document references contained in the information categories Search, SIV, and Subject Information have identical structures.

The regular users of the automation installation fund require that the fund can completely and quickly reference all relevant domestic and foreign information sources of the special area of automation technology.

This enables the users at all times to make informed statements and decisions on the current international state in the field of automation in their respective work and task areas. Therefore, those technical cadres who are responsible for structure, maintenance and use of the "Automation Installations" fund must meet high technical and organizational requirements.

3.2 Retrospective Search

Retrospective search is a one-time check of the complete memory for document references which are relevant for a subject matter. Restrictions with regard to time period, type of source, etc. are possible.

Retrospective searches can be processed in request complexes with up to 15 searches per computer run. The search is retroactive by annual fund. A maximum of 1000 relevant document references are permitted per request complex and annual fund. Print-out of a maximum of 100 relevant references per search request is standard. The user receives the search result as a computer printout which shows the search title field and the request logic. Searches are obligatory in support of the opening defense of research and development subjects and when subject matter collectives assume new areas of responsibility.

Frequency of publication: on request

Type of display: computer printout A 4 format

It is possible to reuse retrospective searches which have already been done and thus reduce cost. These are offered on microfiche. New lists of these reusable searches are published periodically.

In 1987, the fund management processed 90 retrospective search requests, 22 of those for the VEB GRW Teltow.

3.3 Selective Information Dissemination (SIV)

SIV is the monthly processing of a complex of requests based on the monthly additions of document references to the fund. The user receives all references which are relevant for his specific requirements from the monthly addition to the "Automation Installations" fund in the form of a computer printout.

The project was limited to a maximum of 500 requests and a maximum of 10,000 relevant document references for SIV. Changes in the request complex are limited to 50 per computer run.

The address of the user and the wording of his request are stored in the computer as a user profile (NP), processed and delivered monthly. A user profile is recommended if the information requirement will remain unchanged over a longer period of time. SIV should be provided following a retrospective search. User profiles are changed if there are changes to content and form. SIV is preferably intended for those working in research and development as well as subject matter collectives to familiarize themselves with the international state of knowledge.

Frequency of publication: monthly
Form of publication: computer printout, A 4 format

In 1987, the fund management processed approximately 335 SIV per month. Of those, approximately 40 SIV per month were delivered to users outside the combine Automation Installation Construction. 125 SIV are regularly sent to the employees of VEB GRW Teltow.

3.4 Subject Matter Information (TI)

The subject matter information consists of checking the monthly addition to the fund once a month for 10 special subject questions. The request complex can only be corrected by processing the complete complex. TI is used to supply a larger circle of users outside the combine. Therefore, the computer printouts are intended for duplication.

The TI of the information fund "Automation Facilities" is offered on microfiche A 6.

Frequency of publication: monthly
Form of publication: microfiche, A 6 format

Utilizing Available Information

Requests from users outside the combine Automation Installation Construction are only processed by the Central Fund Management, and, if necessary, must be channelled to:

VEB Eletronic Project and Installation Construction Berlin Parent plant of the combine Automation Installation Construction Center for Scientific-Technical Information Rhinstrasse 100 Berlin 1140

Summary

As a modern form of computer utilization in the area of scientific-technical information, the computer-assisted fund "Automation Installation" helps increase the usefulness of intellectual and creative work, in order to meet the high-level scientific and economic goals. The computer-assisted information services Search and SIV in particular constitute a considerable improvement in the supply of users with information compared to previous, conventional services. The experience gained with current operations will be used to perfect the information supply in the combine further and also as a basis for applying microcomputer technology to the scientific-technical information with the goal of establishing a network of automatic information services and databases by using office and personal computers as connecting terminals, moving host computer capacities to local workstations and thus bringing information services to the user directly. Thus, timely access to world knowledge becomes possible which is the prerequisite for achieving top performances in the area of science and technology.

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