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ADVANCED MATERIALS

EC Commission Submits New BRITE/EURAM Proposal

AN890120 Luxembourg OFFICIAL JOURNAL OF THE EUROPEAN COMMUNITIES in English No C67, 17 Mar 89 pp 7-15

[EC document: "Re-Examined Proposal for a Council Decision Adopting a Specific Research and Technological Development Programme of the European Economic Community in the Fields of Industrial Manufacturing Technologies and Advanced Materials Applications (BRITE/EURAM) for the period 1989 to 1992 (COM(89) 84 final—SYN 142), submitted by the Commission pursuant to Article 149 (2)(d) of the EEC Treaty on 24 February 1989"]

[Text] The Council of the European Communities,

Having regard to the Treaty establishing the European Economic Community and in particular Article 130 Q(2) thereof,

Having regard to the proposal from the Commission,

In cooperation with the European Parliament,

Having regard to the opinion of the Economic and Social Committee,

Whereas Article 130 K of the Treaty stipulates that the Framework Programme shall be implemented through specific programmes developed within each activity;

Whereas, by its Decision 87/516/Euratom, EEC, the Council has adopted a Framework Programme of Community Research and Technological Development (1987 to 1991) providing for activities in the field of science and technology for manufacturing industry and advanced materials;

Whereas that Decision provides that a particular aim of Community research shall be to strengthen the scientific and technological basis of European industry and to encourage it to become more competitive at the international level and that Community action is justified where research contributes, *inter alia*, to the strengthening of the economic and social cohesion of the Community and the promotion of its overall harmonious development, while being consistent with the pursuit of scientific and technical quality; whereas it is intended that the BRITE/EURAM [Basic Research in Industrial Technologies for Europe/European Research on Advanced Materials] programme should contribute to the achievement of these objectives;

Whereas Council Decision 85/196/EEC decided on a first multiannual research and development programme for the European Economic Community in the fields of basic technological research and the application of new technologies (BRITE 1985 to 1988);

Whereas Council Decision 86/235/EEC decided on a research programme on materials (raw materials and advanced materials) (1986 to 1989);

Whereas in cases where industrial progress is hampered by lack of basic knowledge, it is necessary to support focussed fundamental research projects;

Whereas it is necessary to react adequately to the interest shown by the industry in transnational cooperation;

Whereas it is necessary to involve small and medium-sized enterprises to the maximum extent possible in the development of industrial technologies by taking into account their particular and specific requirements while respecting the objective of the scientific and technical quality of the programme;

Whereas it is appropriate to undertake precompetitive research in aeronautics in order to meet medium- and long-term technology requirements; whereas such research should take particular account of economic, safety and environmental aspects;

Whereas it is necessary to underline the industrial and transnational nature of the programme by requiring applied research projects with at least two industrial partners from two different Member States;

Whereas it is necessary to ensure the industrial nature of the programme by requiring focussed fundamental research projects with industrial endorsement from at least two independent enterprises;

Whereas organizations from non-Community European countries which have concluded scientific and technical cooperation agreements with the Community in industrially oriented R&D projects may, by participating under appropriate conditions, contribute to the competitiveness of manufacturing industry as a whole;

Whereas the implementation of concerted actions in the COST [European Cooperation in Scientific and Technical Research] framework is an essential element to complement industrially oriented R&D projects;

Whereas the Scientific and Technical Research Committee (CREST) has expressed its opinion on the Commission proposal,

Has adopted this decision:

Article 1

A specific research and technological development programme for the European Economic Community in the fields of industrial manufacturing technologies and advanced materials applications, as defined in Annex I, is hereby adopted for a period of four years, from 1 January 1989.

Article 2

The funds estimated as necessary for the execution of the programme amount to ECU 499,500,000, including expenditure on staff whose cost shall not exceed 4.5 percent of the Community contribution.

The indicative internal allocation of these funds is set out in Annex IV.

Article 3

Detailed rules for the implementation of the programme and the rate of the Community's financial participation are set out in Annex II.

Article 4

1. In the third year of the programme implementation, the Commission shall undertake a review of the programme and report to the Council and to the European Parliament on the results of this review, together, if necessary, with any proposals for modification or prolongation.

In respect of research relating to aeronautics, a review will be carried out during the second year.

2. At the end of the programme, an evaluation of the results achieved shall be conducted by the Commission which shall report thereon to the Council and the European Parliament.

3. The abovementioned reports shall be established having regard to the objectives set out in Annex III to this Decision and in conformity with the provisions of Article 2 (2) of the Framework Programme.

Article 5

1. The Commission shall be responsible for the execution of the programme.

2. The Commission shall be assisted by a committee, hereinafter referred to as "the committee", composed of the representatives of the member states and chaired by the representative of the Commission.

3. Contracts concluded by the Commission shall govern the rights and obligations of each party, in particular arrangements for the dissemination, protection and exploitation of research results.

Article 6

1. In respect of research to be undertaken under Areas 1 to 4 of Annex I, the following procedure shall apply:

—The Commission shall submit to the committee a draft of the measures to be taken. The committee shall deliver its opinion within a time limit which the chairman may lay down according to the urgency of the matter, if necessary by taking a vote.

—The opinion shall be recorded in the minutes of the committee; in addition, each member state shall have the right to have its opinion recorded in the minutes.

—The Commission shall take the utmost account of the opinion delivered by the committee. It shall inform the committee of the manner in which its opinion has been taken into account.

2. In respect of research to be undertaken under area 5 of Annex I, the following procedure shall apply:

—The representative of the Commission shall submit to the committee a draft of the measures to be taken. The committee shall deliver its opinion on the draft within a time limit which the chairman may lay down according to the urgency of the matter. The opinion shall be delivered by the majority laid down in Article 148 (2) of the Treaty in the case of decisions which the Council is required to adopt on a proposal from the Commission. The votes of the representatives of the member states within the committee shall be weighted in the manner set out in that article. The chairman shall not vote.

—The Commission shall adopt the measures envisaged if they are in accordance with the opinion of the committee.

—If the measures envisaged are not in accordance with the opinion of the committee, or if no opinion is delivered, the Commission shall, without delay, submit to the Council a proposal relating to the measures to be taken. The Council shall act by a qualified majority.

—If, on the expiry of a period which may in no case exceed two months from the date of referral to the Council, the Council has not acted, the proposed measures shall be adopted by the Commission.

Article 7

The procedures laid down in Article 6 (1) and (2) shall apply, subject to the provisions of those paragraphs, in particular to:

—the establishment of the work plan for research to be carried out under Area 5 of Annex I,—the scientific and technical assessment of proposals received,—any departure from the rules for implementation set out at Annex II,—the participation in any project by non-Community organizations or enterprises referred to in Article 8,—any adaptation of the internal indicative allocation of funds set out in Annex IV,—the measures to be undertaken to evaluate the programme,—

arrangements for the dissemination, protection and exploitation of the results of research carried out under the programme.

Article 8

1. Where framework agreements for scientific and technical cooperation between non-Community European countries and the European Communities have been concluded, organizations and enterprises established in those countries may, on the basis of the criterion of mutual advantage, become partners in a project undertaken within the programme.

2. No contractor based outside the Community and participating as a partner in a project undertaken under the programme may benefit from the Community financing of the programme. The contractor shall contribute to the general administration costs.

Article 9

The Commission shall ensure that procedures are set up to allow for appropriate cooperation with COST activities related to the areas of research covered by the programme, by ensuring regular exchanges of information between the committee referred to in Article 5 and the relevant COST management committee.

Article 10

The decision is addressed to the member states.

ANNEX I

Programme Summary and Objectives *1. Advanced Materials Technologies*

The work in this area will focus on the development of improved or new materials and material processing for a wide range of possible applications except those directly related to information technology (IT) covered in ESPRIT. Developments of materials already covered by ESPRIT are, for instance, dealing with magnetic, magneto-optical, optical thin films for sensors, recording media and heads, optical layers and specific materials for opto-electronics, ceramics and polymers for integrated circuit packaging and specific substrates, superconducting thin films for low current applications and devices.

Including in particular:

1.1. Metallic materials and metallic matrix composites

Objectives:

- Extended working life of components,
- Higher operating temperatures for increased thermal efficiency,
- Better and more effective material processing techniques;

1.2. Materials for magnetic, optical, electrical and superconducting applications

Objectives:

- Improved materials and materials processing for optical, magnetic, electrical and superconducting applications;

1.3. High temperature non-metallic materials

Objectives:

- Design methodologies for products based on ceramics, glasses and amorphous materials,
- Improved monolithic and ceramic composites and metal/ceramic interfaces for industrial applications,
- Better processing techniques and quality control strategies;

1.4. Polymers/and organic matrix composites

Objectives:

- Development of polymers for specific applications,
- More cost-effective process techniques for parts made from polymer and polymer matrix composites,
- Design rules for the specification and manufacture of engineering polymers and composites,
- New polymers with improved recycling attributes,
- Improved product assurance techniques;

1.5. Materials for specialized applications

Objectives:

- Improved materials and their processing for specialized applications.

2. Design Methodology and Assurance for Products and Processes

The development of techniques to improve product quality and the reliability and maintainability of structures and manufacturing systems by clarification of the design aims for both product and process, and by refinement of the criteria against which the attributes are measured. The exploitation of materials for application in sensors and the reduction in the whole life costs of sensors are also included in this section. This will complement work in Community IT programmes, where on-line control is treated, including monitoring and diagnostics, predictive maintenance and quality assurance.

Including in particular:

2.1. Quality and reliability and maintainability in industry

Objectives:

- Improved performance measurement for manufacturing operations in a wide variety of industries,
- Improved and more predictable physical and environmental behaviour of products,
- Improved quality control strategies,
- Design rules for reliability and maintainability of components, structures and systems including machinery operating under varying conditions;

2.2. Process and product assurance

Objectives:

- Reduction of whole life costs of sensor systems for process control,
- Exploitation of materials properties for applications in sensors,
- Use of advanced measurement techniques for more cost-effective examination of topology,
- Improved energy control for industrial applications,
- Improved non-destructive testing methods for product assurance.

3. Application of Manufacturing Technologies

Here the task is to identify and address the needs of manufacturing industry and particularly the less advanced sectors, many of which have a major part made up of small and medium-sized enterprises (SMEs). It is to be expected that modelling of physical processes will be a valuable instrument for progress. Also addressed is the challenge to the industries based on the use of flexible materials. The work will mainly focus on product and process development, transferring and adapting technology already used in other sectors. This should complement work in ESPRIT where IT systems for advanced manufacturing and CIM [computer-integrated manufacturing] are being developed.

Including in particular:

3.1. Advancing manufacturing practices

Objectives:

- Identifying means for improving manufacturing practices in specific sectors,
- Transfer and adaptation of technology already used in other sectors;

3.2. Manufacturing processes for flexible materials

Objectives:

- Increased process flexibility,
- Reduced waste of material,
- Improved process and product quality.

4. Technologies for Manufacturing Processes

Improved techniques for shaping, joining and assembly, surface treatment, chemical processes and particle technology are fundamental needs for industry. Advancement of these processes is essential for securing manufacturing competitiveness.

Including in particular:

4.1. Surface techniques

Objectives:

- Cost-effective surface treatments for industrial applications,
- Techniques for quality assurance and control of the treatment process;

4.2. Shaping, assembly and joining

Objectives:

- Improved methodologies for shaping processes and assembly,
- Improved joining techniques to improve reliability and reduce defect levels,
- Methods for testing welded and bonded joints to improve reliability of results and service predictability,
- Design methodology for joining,
- Better understanding of beam/workpiece interactions for industrial power beam processes;

4.3. Chemical processes

Objectives:

- Improved predictability and yield in chemical processes,
- Membrane materials with improved characteristics,
- Improved performance of membrane processes,
- New systems for separation in hostile environments;

4.4. Particle and powder processes

Objectives:

- Improved techniques for particle production to optimize produce shape, structure and stability,
- Cost-effective techniques for particle categorization and process performance,
- Better approaches to handling and separation,
- Cost-effective routes for small lots of high-quality powder;

5. Specific activities relating to aeronautics

This section covers precompetitive research in technological areas which are of primary relevance to aeronautics (in particular aeroplanes and helicopters) and are not yet covered in other programme areas.

5.1. Aerodynamics

Objectives:

- Analysis and optimization of configurations for supersonic aircraft, including an estimation of aerothermodynamic heat loads,
- Investigation of laminar flow technology,
- Development of numerical methods,
- Integration of computerized design technologies;

5.2. Acoustics

Objectives:

- Noise source identification, prediction and reduction,
- Basic investigation of acoustic fatigue and related damage tolerance on advanced composites,
- Investigation of different construction methods,
- Development and application of simulation models for response calculations under selected acoustic loads;

5.3. Airborne systems and equipment

Objectives:

- Integration and operation of modern systems and equipment and corresponding new architectures,
- Investigations concerning the use of onboard intelligent knowledge base systems (IKBS),
- Investigations into the concept of the "all electric aircraft";

5.4. Propulsion systems

Objectives:

- Integration of advanced propeller and propeller-rotor systems,
- Provision of mathematical models for different design evaluation,
- Specification and design of wind tunnel models and their components,
- Specific aspects of air-breathing engine combustion.

ANNEX II

Rules for Implementation

The Commission shall implement the programme on the basis of the scientific and technical content set out in detail in Annex I.

The Commission shall distribute, in all Community languages, information packs to accompany the invitation to participate in order to guarantee equal opportunities for the undertakings, universities and research centers in the member states.

The programme is carried out principally by means of shared-cost research contracts to be awarded following a selection procedure based on calls for proposals published in the OFFICIAL JOURNAL OF THE EUROPEAN COMMUNITIES.

Participants may be industrial organizations, research institutes and universities, established in the Community. Each contractor will be expected to make a significant contribution to projects. The contractors shall be expected to bear a substantial proportion of the costs, 50 percent of which shall normally be borne by the Community.

Industrial Applied Research

The principal form of support for industrial applied research of a precompetitive character will be through shared-cost action. At least two industrial enterprises from different Member States and independent of each other must take part in each project. Each party is expected to make a significant contribution to the project. The contracting parties shall bear a substantial part of the costs, up to 50 percent of which shall, as a rule, be borne by the Community.

Alternatively, in respect of universities and research institutes carrying out projects, the Community may, within the abovementioned limits of its financial contribution, bear up to 100 percent of the additional expenditure involved.

Recognizing the important role of SMEs in developing the manufacturing base of the Community and the merits of their participation in the programme, the Commission will examine in consultation with the committee how research organizations can best act within the programme to meet the R&D needs of SMEs. Projects should include at least 10 man-years of activity, the realistic minimum for an effective collaborative project, and the total projects costs should fall in the range of ECU 1 million to ECU 3 million.

Focussed Fundamental Research

Focussed fundamental research projects shall involve at least two partners established in different member states. When the partners are universities or research institutes, the projects should be endorsed by at least two legally independent industrial enterprises and the Community could bear up to 100 percent of the marginal costs of universities and research institutes. Projects should include at least 10 man-years of activity and fall in the range of ECU 400,000 to ECU 1 million total project costs.

Feasibility Awards for SMEs

The Commission will introduce a pilot scheme of feasility awards aimed at assisting SMEs establish the feasibility of a device, process or concept as a means of enhancing their stature in finding a partner in a subsequent call for proposals under the shared cost action. The Commission will support up to 75 percent (maximum ECU 25,000) of the cost of research lasting up to six months. High standards of evaluation will ensure that the awards are highly competitive and recognized as prestigious.

Coordinated Activities

In cases where work, supported by national funds or entirely privately funded, is already going on, the Commission's role may be limited to simply organizing the coordination of the work and the Community funding confined to covering the cost of such coordination activities. However, in certain cases where it is clear that strategically important work requires more than simply coordination, the Commission could, in consultation with the committee, consider a higher Community funding.

Research Relating to Aeronautics

A work programme will be established to define precise objectives and determine priority themes for research in Area 5 of Annex I.

The Commission shall establish calls for proposals for projects in this area on the basis of the work programme.

Projects in the field of aeronautics must include two industrial enterprises from different member states. Particular attention will be paid to ensuring:

- The complementarity of research carried out in this area with activities carried out under the programmes of the member states and those carried out in other forums of European transnational cooperation, including EUREKA,
- The participation of research institutes, universities and small and medium-sized enterprises,
- The maximum benefit to technological areas outside the aeronautics sector.

The rules relating to the financing of industrial applied research and focussed fundamental research shall apply as appropriate to the financing of research projects relating to aeronautics.

ANNEX III

Programme Evaluation Criteria

The results against which the programme should be evaluated must reflect its objectives and the wider objectives of the Framework Programme.

1. As the principal objective is to enhance the competitive position of the Community's manufacturing industries, the evaluation should determine:

- The extent to which the projects were selected against credible and measurable industrial criteria,
- The extent to which substantial product or process development has resulted from the work supported.

2. A further objective is to encourage transfrontier collaboration in strategic industrial research. The evaluation should determine:

- To what extent, before and after project completion, there were continuing links between partners for research, development, manufacturing, marketing or staff formation.

3. A further programme objective is to encourage transfer of technology across Community frontiers and between sectors, particularly those with a high predominance of SMEs. The evaluation should determine:

- The extent to which SMEs have exploited technologies and new materials arising from successfully completed projects,
- The extent to which accomplishments are protected by patent action or are disseminated to raise awareness in the European research and technology Community.

As far as research relating to aeronautics is concerned, the evaluation will also include, in particular, the following criteria:

- The contribution of such research to the technological competitiveness of the European aeronautical industry,
- The benefits accruing to technological areas other than aeronautics,
- The added value of dedicated Community research in this area.

4. In the wider context of the Framework Programme, the evaluation shall be conducted in the light of all the selection criteria set out in Annex III of the Framework Programme, which include that of contributing to the strengthening of the economic and social cohesion of the Community.

This evaluation will be undertaken by independent evaluators.

ANNEX IV

Indicative Internal Allocation of Funds

I. Sectors R&D	Percent
1. Advanced materials technologies	28
2. Design methodology and assurance for products and processes	19

3. Application of manufacturing technologies	19
4. Technologies for manufacturing processes	20
5. Specific activities relating to aeronautics	7
II. Staff and administrative costs	
Staff costs	4.5
Administrative costs	2.5
	100.0

Between 7 and 10 percent of the budget shall be available for fundamental research in the above areas where industrial progress is impeded by gaps in basic scientific knowledge.

Up to 0.45 percent of the available budget may be devoted to the feasibility awards referred to in Annex II.

AEROSPACE, CIVIL AVIATION

Fokker Seeks Solution to Production Capacity Problem

36980178 Rotterdam NRC HANDELSBLAD in Dutch 6 Apr 89 supplement pp 1,6

[Report on interview with Fokker Production Manager Menno Van der Veen by Wim Brummelman: "Fokker Struggles with Record Number of Orders"; first paragraph is NRC HANDELSBLAD introduction]

[Text] The orders are streaming in at Fokker. But is the company able to handle the production of hundreds of new airplanes? One year ago Fokker was still wrestling with major problems which were delaying the delivery of their airplanes. Now the production process is well in hand, the production manager assures us. Expansion possibilities are being looked into so that all orders can be executed.

Aeronautical engineer Menno van der Veen (48) is a representative of the new enterprising style at Fokker. On a cabinet in his office in Schiphol-East there are two books: "Thriving on Chaos" and "Never Play a Game Away from Home." To illustrate his argument more clearly, he tears sheets of paper from a scratch pad and pencils in graphs and curves on those.

"As an industrial enterprise, Fokker will experience a development which is unique in the Netherlands," he says with determination.

Van der Veen possibly has the toughest function which exists at Fokker right now: he is responsible for production. The Dutch aircraft builder has booked large sales successes during the past months with, as the high point for the time being, the mammoth order of American Airlines for delivery of 75 airplanes of the Fokker 100 type. Fokker trucks these days carry the proud message: "Netherlanders build world-class airplanes." Van der Veen must make sure that all those airplanes also leave the plant on time.

He, as no one else, knows that that will be a big job. Last year he was confronted with all sorts of setbacks in initiating the series production of the Fokker 100. Therefore the delivery to important customers such as Swissair and KLM suffered distressing delays. And now, too, not all problems have been solved yet. It is even doubtful whether the planned number of 33 Fokker 100's will be achieved this year.

But that number of 33 for this year is not too important to Van der Veen in the light of everything in store for Fokker. "The big challenge will be whether we shall succeed in making the transfer to a substantially higher level," he says. Already just to be able to process the orders for 390 Fokker 100's which have come in so far (including options), Fokker wants to increase production in the plant at Schiphol-East to the maximum viable number of 46 per year. With the current order file Fokker is filled up until 1994-95. Not too long ago Fokker delivered an F 28 Fellowship every 17 working days and an F 27 Friendship every 20 days. In about 2 years' time that will have to be one Fokker 100 every 5 working days and, moreover, one Fokker 50 every 7 days.

But that is not all for Fokker. In the market introduction of the Fokker 100, the aircraft manufacturer stated that sales totaling about 450 units were being counted on.

Boeing

Meanwhile expectations have grown considerably. Van der Veen mentions a number of 1000 machines being attainable, 600 of which in the United States. "We expect that the Fokker 100 will follow the trend of large successful programs of manufacturers such as Boeing and McDonnel Douglas," he says. That has big consequences for the planning of the production. In a period of about 7 years Fokker must seize its big opportunity in the market, Van der Veen summarizes. That means that in a relatively short period of time as many airplanes as possible must be built; Fokker takes as a basis about 70 per year. After the peak period the annual deliveries will decrease to a "stable" level of 30 to 40 machines (versions which are partly derived from the current Fokker 100) for 10 to 15 years. Those numbers can be manufactured at Schiphol-East. But to take care of the coming boom, a supplementary final assembly line is needed for the Fokker 100 for a number of years.

Fokker has not yet decided where that second assembly line will be located. Lockheed in the United States was proposed as a serious possibility. Van der Veen: "There are good arguments for keeping the final assembly here. It is high-tech work and requires relatively few man hours. One would preferably keep that in the Netherlands. But there is a good possibility that we will come to the conclusion that we cannot manage that with respect to investment costs, logistic problems or engineering problems.

It is in any event certain that the coming peak in production will furnish little additional work opportunity in the Netherlands, Van der Veen predicts. "One would have to attract well-trained people for a lot of money, and it is socially unacceptable to subsequently eliminate them after 7 years. Then you have lost the profit which you obtained by increasing production."

Underestimate

Van der Veen was appointed "production" manager at Fokker last year. But prior to that, as the person responsible for "development," he was already very closely involved with the joy and sorrow of the Fokker 50 and the Fokker 100. Both machines originally were to become modern versions of their predecessors, the F 27 and the F 28. Initially Fokker started from approximately 7,000 drawings to build the Fokker 50, but ultimately about 20,000 drawings were needed. Similarly the development of the Fokker 100 was underestimated: compared to the F 28 it was to be a new aircraft for 50 percent, but that percentage ultimately turned out to be over 80 percent.

The result was that also the development costs of both machines came out much higher than estimated: about 1.5 billion guilders instead of about 1 billion guilders. Thanks to a support operation of the government in October 1987, Fokker was able to survive that financial attack. Van der Veen: "That excess was something terrible in Dutch proportions; we really sweated it out here, but when you look at the international aircraft industry those expenditures are definitely not high.

In the same manner Van der Veen relativizes the obstacles Fokker had to overcome in the conversion to production. "What we experienced is an absolutely normal process in aircraft manufacturing. The only unusual thing is that a machine such as the Fokker 100 has received its certificate of airworthiness in such a ridiculous short period of time and that it turned out much better than the indicated specifications," he says. "The problems we are experiencing in production are not unique to Fokker. Just have a talk with Boeing. They speak a different language there, but you will hear exactly the same story."

Part of the problems in the plant are a result of Fokker's decision to simultaneously manufacture three versions of the Fokker 100 which deviate from each other considerably on some points: the versions for Swissair, for USAir, and for KLM. Furthermore, especially at the beginning all sorts of improvements were added to the designs while the first machines were already being built for customers. Therefore some components had to be disassembled again.

Moreover Van der Veen was confronted last year with numerous logistical problems. Just as any aircraft industry, Fokker's plant at Schiphol is actually nothing more than a Lego building kit. From all over, contractors and suppliers bring in parts and components by truck, ship and airplane. Of the Fokker 100, only 25 percent of the added value originates at Fokker itself. Almost half is British; the wings come from Shorts, the engines from Rolls Royce, and the chassis from Dowty Rotol. Large parts of the fuselage and tail are manufactured in West Germany (MBB), and the American Grumman furnishes the cowlings for the engines.

Orchestra

The designer of the aircraft manufactures itself the cockpit and the middle part of the fuselage (in Dordrecht and in Papendrecht). All these components and the steering systems are built together at Schiphol-East into airworthy, quality machines with the Fokker label. "We are the conductor of the orchestra," says Van der Veen.

It is clear that in the widespread network of supply lines all sorts of things can go wrong. And that is exactly what happened last year. Shorts sometimes was late with its wings. MBB was unable to carry out modifications in certain components on short notice. In the final assembly at Schiphol-East, structural planning errors were made.

"The delays are caused by a combination of everything everywhere," Van der Veen says. "Our predecessors at Fokker have left us excellent airplanes, but also a very archaic production system. That system worked for the F 27 and the F 28, but not for the current number of airplanes."

When he took over, Van der veen immediately started with the modernizing of the steering system and the streamlining of production in the plant at Schiphol-East. Amongst others, he consulted the firm of Booz, Allen & Hamilton for advice on automatization and the training of personnel. About 20 experienced production people from the American Lockheed were contracted. Former manager Smith van Fairchild currently supervises the final assembly line of the Fokker 50 and the Fokker 100 on the work floor.

"We now have firm control over the production process, even though we are still being hampered by the fact that we are making three different versions of the Fokker 100," says Van der Veen. For about 2 years one worked also on Sundays at Fokker in order to lessen to some extent the acquired gaps." That is no longer being done, but especially in the final assembly line of the Fokker 100, much overtime is being worked, also on Saturdays.

Van der Veen does not want to get ahead of himself on the question of where the second final assembly line of the Fokker 100 is going to be located. Many scenarios are possible to realize the expansion of production. Much also depends on the position of MBB and Shorts who are involved in the Fokker 100 as venture partners.

In any event he is not too interested in the suggestion to transfer the final assembly line of the Fokker 50 to the Shorts plant in Northern Ireland (which is for sale). Although production space would become available at Schiphol-East through that, he thinks that that solution might also mean the death-blow to the Fokker 50. "Competition is great, and that means that one works with ridiculously low prices. We are the Mercedes among the 50-seaters, and therefore we get considerably better prices than our competitors. But that Mercedes image will disappear if you start producing elsewhere. Moreover, the drawings of the Fokker 50 are not easily accessible to outsiders. If you start producing elsewhere, costs will rise immediately. That also makes it not too attractive to remove the Fokker 50 from the Netherlands.

Bench Testing of Rafale Engine Begins

AN890126 Paris LE BULLETIN DU GIFAS in English 9 Mar 89 pp 1-4

[Article: "SNECMA M88: First Bench Operation"]

[Text] The lead-off M88-2, designed as power plant for the Rafale D, was mounted to the test bench on 23 February 1989. It operated for the first time on 27 February 1989, in exact compliance with the schedule set up when the program was actually launched.

The following described the background and features of this engine, which outclassed any comparable engine presently in service in the Western world.

Origins of the program date back to 1979, when a complete technological demonstration program was launched.

Since then, ten years of uninterrupted work have ensued, as well as tens of thousands of hours devoted to research, study and bench testing, which have given SNECMA [National Company for Aircraft Engine Studies and Construction] full mastery of all the pilot technologies embodied in this engine.

This mastery was to a great extent gained through computer-assisted methods and 3-D computation, plus, of course, 40 years of experience in the operation of SNECMA military engines by more than 35 countries.

Among the highly advanced technologies employed for the M88-2 is the technique of cooled monocrystalline turbine blades, which opens the way to extremely high front turbine temperatures.

Since the 1970's, this temperature has been rising an average of 10 degrees annually, from 1500 to 1550 K (approximately 1250 degrees Celsius) for engines that started service at the end of the 1970s to 1700 K (approximately 1400 degrees Celsius) by the dawn of the 1990s, an example being the F404-RM12 jet. In this climb towards higher temperatures, the M88-2 (first production unit to be delivered in 1995 for the French Air Force's and Navy Air Force's Rafale ACT/ACM) represents a true breakthrough, since it will reach 1850 K (approximately 1550 degrees Celsius). This temperature was actually reached during demonstrations made in February 1987.

Such performance has made it necessary to develop highly complex internal geometry blades of monocrystalline alloy, unique in their kind today, coupled with a sophisticated cooling system involving a flow temperature approximately 300 degrees higher than the fusion point of metal.

Another highly advanced technology employed for the M88-2 is redundant full-authority digital regulation, which authorizes the use of highly precise optimized regulation rules with exploitation of all engine possibilities without restriction of throttle movement throughout the flight envelope, regardless of flight configuration.

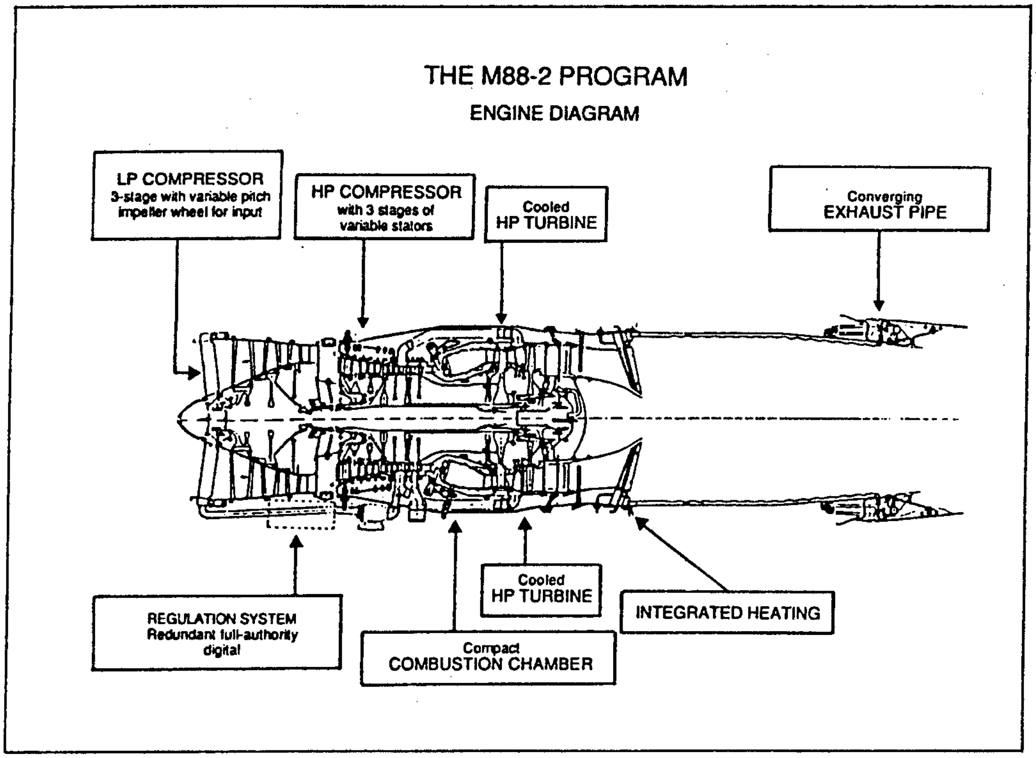
An idea of the technological strides made by SNECMA in the past 20 years will be gained by comparing the ATAR 9K50 (power plant of the Mirage F1 and Mirage 50) against the M88-2, both SNECMA engines of comparable thrust categories. The M88-2 is 40 percent shorter than the ATAR 9K50 and 45 percent lighter; thus thrust ratio improved by 88 percent, from 4.5 to 8.5, and 13 percent better than that of the F404-GE-400.

Aside from these improvements, maintenance has been taken into consideration right from initial conception stage: optimized modularity, as-needed maintenance, computation of life span of parts, improved access to equipment and accessories, thereby limiting engine interventions and the number of engines and modules grounded, while at the same time eliminating all bench adjustments and other bench operations.

Moreover, all engine handling operations are greatly simplified by replacement of modules or subassemblies with horizontal engine and hoisting of engine to aircraft.

SNECMA is planning a complete line M88 engines beyond the 7.5-ton-thrust M88-2. These versions will have thrusts of from 7.5 to 10.5 metric tons and will be built around the same "high pressure" body, by gradually replacing the "low pressure" compressor, "low pressure" turbine and afterburner system. With this line of multi-purpose turbojets it will be possible to power either twin or single engine interceptors or penetration aircraft. The SNECMA catalogue ensures a strong position for itself and for possible partners in the market of engines for future combat aircraft.

The M88-2 Program—Engine Diagram



EC, ESA Coordinate Space Technology Projects

AN890105 Brussels EC PRESS RELEASE in English No IP(89) 62, 9 Feb 89 pp 1-4

[Report: "Creation of a More Systematic Basis for Cooperation Between the European Community and the European Space Agency"]

[Excerpt] On 7 February 1989 Professor Reimar Luest, director general of the European Space Agency (ESA), was received by President Delors, Mr Andriessen [responsible for external relations and trade policy], Mr Bangemann [responsible for the internal market and industry], Mr Pandolfi [responsible for science, R&D, and technology], and Mr Ripa di Meana [responsible for environment and nuclear security].

This visit represents a direct sequel to the Commission communication of July 1988, entitled "The Community and Space: A Coherent Approach," which had highlighted the close integration of the space effort in the mechanics of the building of Europe. It should also be seen in the context of the prospects opened up for Europe following the adoption in late 1987 of the ESA's long-term programme.

The Commission and the Agency have stressed the need for Europe to take global account—against the background of the completion of the internal market—of the industrial, commercial, and technological aspects of the development and use of space technologies resulting from the efforts and successes of the ESA, in order to defend and promote jointly Europe's space interests on the international stage.

Against this background, the Commission and the Agency are delighted with the outcome of the specific cooperation projects already undertaken. In particular, they have expressed their satisfaction at the prospect of developing more comprehensive, systematic and global forms of cooperation aimed at pooling the general skills of the Community and the specific skills of the ESA.

Discussions on this point have taken the form of a review of the main areas in which enhanced cooperation of this kind could take place. Essentially, three major areas of space technology applications are involved: earth observation, telecommunications and microgravity. In addition, there is scope for cooperation covering the entire range of problems linked to the industrial aspects of space exploitation and the need for Europe to launch a more systematic and better coordinated effort to meet growing international competition, notably at the commercial level.

It was also agreed that the Commission and the ESA would join forces in preparing a European initiative to promote environmental research and monitoring through the exploitation of the opportunities offered in this area by space technology.

The following main areas of cooperation were selected:

—Earth Observation

The meeting concluded with the Commission and the ESA agreeing to prepare a joint initiative in the field of the environment, involving an environmental research and monitoring project on the synoptic scale permitted by space technologies. In addition to research, this would cover operational applications (e.g., study and monitoring of pollution in the Mediterranean), and would include, in particular, Europe's contribution to international cooperation for the global study of our planet and the International Space Year celebrations (1992). The other fields of cooperation concern preparations for the use of the ESA's ERS-1 [European Remote Sensing] satellite as well as concerted-action projects covering applications in the developing countries.

—Telecommunications

Priority will be given to the integration of the "satellite" component in the Community's telecommunications policy (statutory and regulatory aspects). The other main areas of specific cooperation cover the use of the Olympus satellite for demonstration experiments involving the technological development programmes and the Community policies (e.g., high-definition television), studies on possible synergy between the Community's RACE [R&D in Advanced Communication Technologies in Europe] programmes and the Agency's PSDE [Payload and Spacecraft Development and Experimentation] programmes, mobile communications and an examination of the role of satellites in organizing assistance in the event of accidents or natural disasters.

—Microgravity

An initial cooperation project will take the form of a joint analysis of prospects in the field of microgravity, of the elements necessary for a genuine long-term European strategy for the utilization of the infrastructure developed by the ESA, and of the Community's role in this strategy.

— Synergy Between the Basic Technology Development Programmes of the Community and of the ESA

The object will be to step up information exchange and ensure greater coordination of the two organizations' technological development programmes in order, on the one hand, to promote technologies developed under the Community programmes (ESPRIT [European Strategic Program for R&D in Information Technologies], BRITE [Basic Research in Industrial Technologies for Europe], etc.) and, on the other, to make better use of space technologies in the industrial sector as a whole.

—Industrial Aspects

The Commission and the ESA will carry out a joint study on the problems of competition affecting the European space industry and the effects on the latter of the completion of the internal market (standardization, liberalization of markets and protection of intellectual property).

—External Relations and Commercial Policy

The Commission and the ESA will try to draw up the effective cooperation procedures for tackling problems posed by the repercussions of European space activities in the international context, notably in the commercial sector, taking into account the respective responsibilities of the ESA and the Community.

In particular, the Commission is ready to examine with the ESA what forms of support its external delegations could give to the ESA's non-European activities. [passage omitted on ESA's contribution to environmental monitoring and research]

Selenia Spazio's Status, Future Programs Described

MI890162 Rome AIR PRESS in Italian 14 Feb 89 pp 291-295

[Text] "To date, the lack of decisions has not led to a substantial marginalization for the country, the users (and I am referring to satellites for the direct broadcasting of TV signals), or the industrial sector. However, the situation is going to change and Italy risks being colonized—not by troops, as used to be the case in the 19th century—but from a cultural point of view, given the advanced stage of initiatives taken in this field by countries in our geographic vicinity." This was the concluding statement of a conversation held between AIR PRESS and Mr Andrea Pucci, managing director of Selenia Spazio, in which Italian space initiatives were discussed from the viewpoint of what is defined in a company pamphlet as "the largest Italian space company, the only one that operates exclusively in this field for the design and developlment of complete space systems, subsystems, and equipment for satellites, earth stations, and orbiting infrastructures."

Selenia Spazio was created in late 1982 as an independent company within IRI-Finmeccanica's Selenia-Elsag group. Since its establishment, the company's volume of business increased from 50 to 240 billion lire, and the total number of employees rose from 500 to 1,100. It has participated in space programs at the international level (the Intelsat, Insat, Arabsat, Goes, and JSC satellites), the European level (OTS, Meteosat, Sirio 2, ESC, Esro IV, COS B, and Exosat), and the national level (Sirio 1). AIR PRESS reports that Selenia Spazio is currently responsible for systems in the Italsat and Olympus programs and for the development of important subsystems and equipment for telecommunications programs (Intelsat VII), meteorology and Earth observation programs (Meteosat, ERS-1, S-SAR, and Helios), as well as scientific programs (ISO, Hipparcos). The company is participating in the development of the European orbiting infrastructure with major responsibilities in the Hermes and Columbus programs (Aeritalia's space division is predominant in Italy in this area of research). Furthermore, Selenia Spazio is prime contractor for the DRS and SAT-2 programs.

"Electronic components dedicated to telecommunications and teledetection systems," Mr Pucci stated to AIR PRESS, "are at the heart of our cooperate interests. We are, however, also interested in the electronic components of, for example, orbiting space stations. Our commitment to these fields (and I am referring in particular to microwave and radar equipment for satellites) is considerably supported by the fact that we are part of the Selenia group, although much of the research and development is strictly in-house."

Telecommunications and teledetection are therefore at the heart of Selenia Spazio's interests. Who are the targeted users? "In Europe we work in accordance with the ESA [European Space Agency]," Mr Pucci stated, "and in Italy, with the ASI (the newly-established Italian Space Agency, born of the National Space Plan—editor's note). The latter, however, is not yet operational. In addition, users include the telecommunications and teledetection market for military, civil protection, environmental control, and other applications. Finally, our interests are focused on the "free" market of those third countries that have no space capacity of their own and must turn to others, including us Italians. We are also working in fields where international bodies such as Itelsat and Eutelsat provide users with services shared by various countries."

AIR PRESS reports that involvement at the European level is the aspect of greatest interest for an Italian company's space activities. As Mr Pucci indicated, "ESA has been in existence for a long time with the French predominating, followed by the Germans and the British." In the past, Italians had remained in the background, in a manner of speaking. Now, however, the minister for research, Prof Antonio Ruberti, claims that Italy must play a more important role which should at least match its contribution to European space plans (Italy ranks third in finanical commitment). Minister Ruberti's request contrasts with the different attitude of the last few Italian governments, which have become more attuned to the need for Italy to play an active role in this sector, considering as well the tangible development opportunities that are now emerging.

Mr Pucci told AIR PRESS: "A fact also to be considered is that the UK decided to step aside somewhat for domestic reasons. Accordingly, fields such as telecommunications, in which the UK had been leader until recently, were left open. Furthermore, if you also consider that Italian industry has in the meantime established an international reputation, you will see that the situation looks extremely favorable for Italy, provided Italians are able to seize opportunities as they come up."

In addition to the "central" role of Selenia Spazio, Mr Pucci mentioned other Italian companies operating in the aerospace field: Aeritalia (primarily involved in scientific research in space), BPD (for propulsion), Laben, FIAR, Galileo Telespazio (acting as licensee for transmissions to and from satellites), etc. Mr Pucci remarked with some humor: "There is space for everyone in space."

Discussing more specific programs, Mr Pucci reported that his company's most outstanding commitment is to DRS (Data Relay Satellite), which is similar to the United States' T-DRS program. This integrated system of high-quality communications for the European orbiting infrastructure consists of two satellites in geostationary orbit plus one spare located on earth; terminals for space-based users, to be placed on fixed-orbit satellites; an operational control center for systems management; and terminals for earth-based users for various connections. The program will cost about 1.2 trillion lire and is expected to be implemented this year. Mr Pucci stated: "The importance of DRS lies in the development of a safe telecommunications system able to handle a great quantity of data with absolute reliability." The implementation outline stipulates the use of Ariane (launcher), Hermes (earth-to-space communication vehicle), and Columbus (manned orbiting station), with the DRS connecting everything.

Mr Pucci told AIR PRESS: "Italy has claimed a leadership role for this program." Contracts have already been drawn up for the preliminary stage involving both earth and space segments. This request was not favorably received by some partners. Politicians and industrialists must therefore be vigilant to avoid possible surprises."

Mr Pucci also stated: "In general terms, I would like to emphasize that the telecommunications sector was mistakenly considered by some to be consolidated. However it still requires much attention and a deep commitment to research and consequently, a significant financial commitment as well. Italy needs to make up for lost time, even though the absence of earlier decisions is not a totally negative element. Now we may have clearer ideas on what must be done and what commitments to undertake."

Direct television broadcasting is another extremely interesting and rapidly evolving sector. RAI [Italian Broadcasting Corporation] held a meeting on this subject in Milan, which Selenia Spazio attended. Discussions centered around telecommunications systems for domestic use which are now part of our daily lives and which had already been the subject of Italian attention many years ago at the time of Sirio 1.

Selenia Spazio is fully responsible for the satellite and the earth-based stations of Italsat (the satellite that will permit the experimental and preoperational handling of domestic telephone traffic). Mr Pucci referred to the "Italsat line," which may lead to further important achievements, since the project has "more to offer than its European counterparts because it allows on-board switching of various channels." This will help to avoid inconveniences such as those experienced by the Germans, who had to cancel five channels of one of their telecommunications satellites because of a fault that was only detected in orbit.

Two opposing trends emerged at the Milan meeting. One reflected the belief that TV satellite broadcasting would be best achieved if concentrated on large earth-based stations transmitting signals through a land network (it would be an optical fiber network, with all the costs this involves). The other would involve the installation of several small parabolic antennae (50 cm in diameter) allowing the user to receive the preferred signal among the many signals that are present in space.

Selenia Spazio favors the latter system both in terms of cost (no optical fiber network would be required), and the time it would take to implement. AIR PRESS points out that there is also the issue of upgrading the technology. At the Milan meeting, Mr Pucci said: "I personally believe that we would lose the opportunity for thoroughly upgrading the reception quality of television signals and eventually achieving high resolution—commonly believed to be the solution of the future—if we were to be satisfied, possibly for short-sighted protectionist reasons, with a very partial improvement such as the one provided by MAC D2" (this is an update of existing broadcasting systems that partially neglects an improved image resolution).

The global scenario for satellite television does not look good for Italy which, pursuant to the 1987 WARC agreement, was assigned five channels that have not yet been used. However the same agreement, if observed by all signatories, does permit "invasion" zones for signals coming from other countries' satellites. Accordingly, unless something is done immediately, the "colonization" process we mentioned earlier will soon take place (in part, it has already occurred). It should be remembered that Italy, with its large number of television broadcasting companies, is one of the most lively and open markets in Europe. This appeals to those who intend to flood Italians with images and lifestyles, together with commercials that would certainly not advertise domestic products. According to Mr Pucci, this is one of those "trains that should not be missed," for the additional reason that late this year six television satellites will be in orbit around Europe, three of which will be able to reach most of Italy. What are we waiting for?

Similar observations may be made for military programs and for those earth-observation programs that are also oriented toward civil and environmental protection. The former include SICRAL (Italian Satellite for Confidential Communications and Warning), and Helios (a teledetection system to be developed by France, Italy, and Spain). At a meeting with UGAI [Italian Aerospace Journalists Association] members on 9 February, General Franco Pisano, chief of staff of the Italian air force, stated: "After the start of the first program, which was intended to replace and supplement traditional radio communications, the first practical steps were taken to implement the second program." AIR PRESS, however, feels that these steps have not yet been determined or are not sufficient for industry.

Selenia Spazio carried out the feasibility study for SICRAL based on the development of two satellites derived from Italsat (one in orbit, the other held in reserve), as well as the development of a control center and the relevant fixed and mobile traffic stations. The launch is expected to take place in 1992 with an Ariane rocket. Italy has a 14% share in Helios, and Selenia Spazio will be responsible for the on-board and the earth-based sections.

Selenia Spazio is also involved in the ARGO project for the Civil Protection Agency (ARGO is a system that will guarantee fast and reliable communications during natural disasters). Selenia will provide 120 stations that will be installed throughout the country; these stations will use the ECS satellite on the SMS (Multi-Service Satellite) transponder that is dedicated to serving business. In the meteorological and teledetection sectors, as we have already mentioned, Selenia will develop the Meteosat satellites and design and develop a radar altimeter for the first European teledetection satellite (ERS-1), which will study polar caps and the oceans. Finally, Selenia Spazio is participating in the X-SAR program as the developer and manufacturer of an X-band synthetic aperture radar to be used on the Shuttle for geological and agricultural observations of the Earth.

Indeed, Selenia Spazio does not lack commitments and projects at the industrial and research level. As often happens in Italy, however, it does lack decisions because once again, too many bodies are involved in the same area (Ministries for Research, Posts and Telecommunications, Civil Protection, Environment, etc.). This situation is certainly not conducive to rapid decision-making processes. But we must hope.

BIOTECHNOLOGY

EC Commission Proposes BRIDGE Biotech Program

AN890123 Luxembourg OFFICIAL JOURNAL OF THE EUROPEAN COMMUNITIES in English No C70, 20 Mar 89 pp 1-5

[EC document: "Proposal for a Council Decision Adopting a Specific Research and Technological Development Programme in the Field of Biotechnology (1990 to 1994)—Biotechnology Research for Innovation, Development and Growth in Europe (BRIDGE) (COM(88) 806 final), submitted by the Commission on 5 January 1989"]

[Text] The Council of the European Communities, Having regard to the Treaty establishing the European Economic Community, and in particular Article 130 Q(2) thereof,

Having regard to the proposal from the Commission,

In cooperation with the European Parliament,

Having regard to the opinion of the Economic and Social Committee,

Whereas Article 130K of the Treaty stipulates that the framework programme shall be implemented through specific programmes developed within each activity;

Whereas, by its Decision 87/516/Euratom/EEC, the Council has adopted a framework programme of Community research and technological development (1987 to 1991), providing *inter alia* for activities ensuring the exploitation and optimum use of biological resources;

Whereas, for the selection of Community actions, the framework programme sets out criteria among which is that of contributing to the stengthening of economic and social cohesion of the Community consistent with the pursuit of scientific and technical quality;

Whereas the activities provided for in the framework programme include, in particular:

—The establishment of Community R&D for contributing a transnational dimension to national efforts and for facilitating technology transfer towards industry and agriculture in the areas of infrastructures, basic biotechnology and risk analysis,

—The continuous evaluation of the strategic significance of new developments in biotechnology and promotion of the essential coherence between the different areas of Community policy concerned with biotechnology;

Whereas the multiannual research and training programme for the European Economic Community in the field of biomolecular engineering and the ongoing multiannual research action programme for the European Economic Community in the field of biotechnology (1985 to 1989) have clearly demonstrated the utility of Community actions in biotechnology and the need for their expansion;

Whereas the participation of European non-member States wholly or partially with projects in this programme is desirable;

Whereas it is desirable to involve small and medium-sized enterprises to the maximum extent possible in the biotechnology research and development programme;

Whereas the implementation of research and training actions in the COST [European Cooperation in Scientific and Technical Research] framework is an essential element to complement R&D projects in the field of biotechnology;

Whereas the Scientific and Technical Committee (CREST) has been consulted,

Has adopted this decision:

Article 1

A specific research and technological development programme for the European Economic Community in the field of biotechnology, as defined in the Annex, is hereby adopted for a period of five years, from 1 January 1990.

Article 2

The amount deemed necessary for the execution of the programme is 100 million ECU, including expenditure on a staff of 30.

Article 3

Detailed rules for the implementation of the programme and the rate of the Community's financial participation are set out in the Annex.

The contracts entered into by the Commission shall regulate the rights and obligations of each party, in particular the methods of disseminating, protecting and exploiting the research results.

Article 4

In the third year of implementation of the programme, the Commission shall review it and shall report to the Council and to the European Parliament on the results thereof, together, if necessary, with any proposals for modification, or prolongation.

An evaluation of the results achieved shall be conducted by the Commission, which shall report thereon to the Council and the Parliament.

The abovementioned reports shall be established having regard to the objectives set out in the Annex to this Decision and in conformity with the provisions of Article 2(2) of Decision 87/516/Euratom/EEC.

Article 5

The Commission shall be responsible for implementing the programme.

The Commission shall be assisted by a Committee of an advisory nature, hereinafter referred to as "the Committee", composed of the representatives of the Member States and chaired by the representative of the Commission.

Article 6

The Commission shall submit to the Committee a draft of the measures to be taken. The Committee shall deliver its opinion within a time limit which the Chairman may lay down according to the urgency of the matter, if necessary by taking a vote.

The opinion shall be recorded in the minutes of the Committee; in addition, each Member State shall have the right to have its position recorded in the minutes.

The Commission shall take the utmost account of the opinion delivered by the Committee. It shall inform the Committee of the manner in which its opinion has been taken into account.

Article 7

The commission is hereby authorized to negotiate, in accordance with Article 130N of the Treaty, agreements with non-member States and international organisations, in particular with those countries participating in European cooperation in the field of scientific and technological research (COST), and those having concluded framework agreements in scientific and technical cooperation with the Community with a view to associating them wholly or partly in concerted actions within this programme.

Where framework agreements for scientific and technical cooperation between non-member States and the European Communities have been concluded, organisations and enterprises established in those countries may participate in a project undertaken within this programme.

Article 8

This Decision is addressed to the Member States.

Technical Annex

Action I: Research and Training

Content

1. Information Infrastructure

1.1. Culture Collections

Development of a communication system for easy and rapid access to the most important service culture collections within the Community; to be achieved through support to:

—A Promotion Center for Culture Collections, specifically designed for providing to European users (distribution of catalogues, patent regulations, printed and visual material, etc.) adequate information on expertise and services available in different European Culture Collections; and a Centralized European Data Bank, primarily on micro-organisms and subsequently extended to other biotic materials (animal and plant cells, viruses, plasmids, etc.). The first phase towards this objective to involve the harmonisation of formats and data in the main service culture collections of the European Community.

1.2. Processing and Analysis of Bio(techno)logical Data

—Applications of information technology (specialised software and equipment) such as required for the implementation of the activities in protein engineering and gene sequencing (see also 2.1 and 2.3 below); and

—Updating and design of knowledge bases for storing and classifying bio(techno)logical data such as sequences, genetic maps, protein and biopolymer structures, risk assessment data; and

—Exploitation of existing or newly developed information technology for rapid access to European knowledge bases and closed sequencing networks via an electronic network including electronic input, on-line catalogues, electronic ordering, etc.

2. Enabling Technologies

2.1. Protein Design/Molecular Modelling

—Multi-disciplinary approaches including genetic engineering and advanced structural methods aiming at improving the properties (such as stability, pH optimum, substrate specificity, etc.) of interesting proteins and their complexes (including glycoproteins); and

—Development of methods to understand and predict structure/function relationships of proteins, such as those involved in folding, stability, crystalisation, including theoretical methods for simulation of these properties, and their interactions with other related molecules.

2.2. Biotransformation

—Development of biological reactions using new strains of cells or novel enzymes for synthesis of key intermediates needed for the production of high added value substances (particular attention to be given to the bioconversion of agricultural surpluses) and for converting pollutants to innocuous compounds; and

—Research addressing the problem of genetic and physiological stability of the free or immobilised genetically modified microbes or cells under biotransformation conditions; and

—Research addressing the problem of enzymatic activity under extreme environments (organic solvents, pHs, temperatures, immobilisation); and

—Development of methods for the isolation and purification of biotransformation products (up- and downstream processing); and

—Development of specialised software and mathematical modelling for the control and analysis of biotechnological processes.

2.3. Gene Mapping, Genome Sequencing, Novel Cloning Methods

—Sequencing the genome of yeast (*Saccharomyces cerevisiae*) or parts thereof and of *Bacillus subtilis*; and

—Development of molecular genetic techniques to identify new meaningful plant genes, using the *Arabidopsis* genome as a resource; characterisation of the identified genes; and

—Development of advanced sequencing procedures and technology (see 1.2) and integration of these procedures and technology in the sequencing projects.

3. Cellular Biology

3.1. Physiology and Molecular Genetics of Industrial Micro-Organisms

—Gene stability and expression, post-translational processes, genetic and metabolic regulation of overproduction, transport and secretion. These studies, adapted in each case to the current state of the art, will concentrate on some industrially interesting micro-organisms such as the general lactic acid bacteria, *Streptomyces, Pseudomonas, Bacillus, Clostridium, Corynebacterium*, and including the larger groups of lactic acid bacteria, extremophiles, yeasts and filamentous fungi.

3.2. Basic Biology of Plants and Associated Organisms

—Core processes for sexual breeding: mechanisms of flower initiation and evocation; differentation of sex cells; molecular bases of gamete recognition and selection systems; and

—Fundamentals of plant cell regeneration: genetics and molecular biology of somatic and zygotic embryogenesis; perception and transduction of growth-promoting signals; and

—Molecular interfaces of plants and associated organisms: molecular bases of host-range and virulence; characterisation of plant defence reactions; development of genetic techniques for pathogenic fungi or mycorrhizae; regulation from plant/microbial signals of the expression of microbial/plant genes; structural and functional identification of genes involved in N2-fixing symbioses; and

—Physiological attributes of crops: storage processes; stress physiology; nitrogen use efficiency.

3.3. Biotechnology of Animal Cells

—Animal cell engineering and culture technology leading to new or improved productions of important substances for industrial zootechnical purposes; and

—Animal genetics: mapping and sequencing of important genes; methods of gene transfer; gene expression and regulation; and

—Animal husbandry: improved immunity through genetically engineered vaccines of second generation.

4. Pre-Normative Research

Pre-normative research in biotechnology places itself at both ends of the research-development exploitation chain.

4.1. Safety Assessments Associated With the Release of Genetically Engineered Organisms

—Monitoring and control techniques: sampling and probes for engineered organisms and introduced segments of DNA; methods and instrumentation for high resolution automated microbial identification and the establishment of adequate data bases; creation of a bank of specific probes and chemical signatures for a large number of specific micro-organisms; eradication methods; and

—Assessment techniques: biological containment; gene stability and gene transfer; development of microcosms and simulating methods for impact analysis; and

—Acquisition of fundamental knowledge on gene behaviour (horizontal transfer between species, rearrangement of introduced genes in the host organism) and on the survival and adaptation of released organisms, in particular soil bacteria, and including modification of host range and tissue range for engineered viruses; and

—Novel constructions: biologically contained organisms; suicide vectors or constructions which cannot develop outside the host organisms; engineered organisms which can be destroyed in the environment by known and specific techniques.

4.2. In Vitro Evaluation of the Toxicity and Pharmacological Activity of Molecules

—Development of cellular an multicellular systems as surrogates for *in vivo* tissues and organs; and

—Research addressing the problems of preparation, storage maintenance and growth of human cell cultures; and

—Development of cell lines in which functional properties are better preserved.

Implementation

Training actions shall be implemented through training contracts and courses for any of the themes defined above. The cost of these actions shall be borne by the Community.

Research actions are to be implemented through cost-shared research contracts for each of the themes defined above. The Community financial contribution shall not normally exceed 50 percent of total allowable project costs. Alternatively, in respect of universities and similar institutes of higher education, the Community financial contribution shall normally be 100 percent of the marginal costs.

Two types of transnational projects are foreseen:

—N projects, for the integration in adapted Community structures (European Laboratories Without Walls: ELWW) of research efforts in areas where the main bottlenecks result from gaps in basic knowledge. The contribution of the Community in such projects shall not exceed ECU 400,000 per year per project, and

—T projects, for the removal, through a significant investment of skills and resources, of important bottlenecks resulting from structural and scale constraints; the contribution of the Community in such projects may vary from 1 to 3 million ECU per year per project.

Cost Activities (Category II) Associated to Action I

Content

—Marine primary biomass

—*In vitro*-cultures for the purification and propagation of plants

—Methods for early detection and identification of plant diseases

—Vesicular-arbuscular (VA) mycorrhizae

—Development of vaccines againsts coccidiosis.

Implementation

Implementation shall take place through the organisation of meetings, consultation of experts, publications, exchange of research workers between laboratories, and coordination contracts.

Action II: Concertation

Content

In conjunction with the relevant Commission services and the Member States, the following tasks will be executed:

—Monitoring developments in biotechnology, particularly in the field of R&D, assessing their implications, and hence informing services of the Commission and interested public authorities having related responsibilities,

—Identifying possible ways in which the contextual conditions for the beneficial development of biotechnology in Europe may be improved, and the effectiveness and coherence of Member State and Community biotechnology programmes and related policies enhanced; including those involving international collaboration,

—Disseminating knowledge and helping to increase public awareness and understanding of the nature, potential, and possible risks associated with biotechnology,

—Identifying the need for, and helping to promote greater activity in the biotechnology small firm sector in the Community.

Implementation

The action will continue to develop the work (begun under BAP) of *ad hoc* collaboration between groups and individuals with interests and capabilities in the life sciences and biotechnology, so creating networks, as informal and flexible as possible, adapted to the needs of encouraging coordination through the exchange of information between the participants, and assisting the broader diffusion of information required by the above tasks.

Specifically, the work will involve in-house analysis, the setting-up and the exploitation of an organised information base, and missions. It will also include as necessary the commissioning of study reports, the organisation of workshops and meetings, and support for the production of reports and diffusion of information.

EC Commission Studying Biotechnology Databases

AN890125 Luxembourg INFORMATION MARKET in English Feb-Apr 89 p 10

[Article: "Commission Launches Biotech Info Study"]

[Text] Access to information in the field of biotechnology will have a major strategic impact on the future of bio-industries in Europe. The EC Commission (DG XIII-B) has, therefore, initiated a definition study on the development of an information infrastructure for the European bio-industries. Costing ECU 225,000, of which half will come from Community funds, the project brings together for the first time the bio-industries, a number of major publishers, and information service providers.

The main contractor is CEFIC, the European Council of Federations of the Chemical Industry, and publishers include Elsevier, Springer-Verlag, Oxford University Press and others.

The project calls for the production of a plan for the collection, collation and exploitation of Europe's biotechnological databases. Biotechnological information, such as nucleic acid sequences or the potential structure of an amino-acid chain, is of crucial importance to academic and industrial research. Europe lags behind the USA and Japan in the infrastructure and funding required to support such databases.

A long-term plan, taking account of the various needs, restrictions and requirements (e.g. concerning intellectual property rights and exploitation) of the varied users and depositors, as well as funding agencies, is required to ensure that Europe continues to develop and make effective use of the data collections concerned.

Europe has no central body guiding or coordinating the wide variety of information relevant to the bio-industries. This lack of focus is leading to duplication, a dilution of effort, and difficulties in locating and obtaining the data required. This will become more important as the huge national and international programmes aimed at deciphering the genetic codes of man as well as other organisms become operational and begin to accumulate data.

The plan will concentrate initially on three areas: genetic-related information, structures (such as biopolymers) and strain, cell line and specific molecular data bases.

The first phase will inventory the needs of the user community and relate them to present and future information technology developments and policies. The US and Japanese systems will be compared and analyzed. A number of workshops will be held to consider development of strategic alternatives and evaluate results against commercial and public parameters.

A second phase will translate the principles defined during phase one into one or two specific working models. These will include the needs of users and producers, establish guidelines for cooperative and competitive exploitation of information, cover financial aspects and deal with security and confidentiality.

COMPUTERS

Netherlands To Expand Supercomputer Base

AN890101 Amsterdam COMPUTABLE (PRODUCT-INFO supplement) in Dutch 27 Jan 89 pp 1-3

[Article by Hans van Raaij: "No Advanced Science Without Supercomputers; Data Communication Is Essential"]

[Excerpts] "In order to keep up to date, scientific research in the Netherlands must have access to the top segment of the supercomputer market. To this end, the Netherlands should acquire top facilities, either on its own or jointly with other countries." This statement by the Working Group on the Use of Supercomputers (WGS) leaves no doubt: The Netherlands scientific community cannot do without supercomputers.

For several years, the WGS has been making policy recommendations with regard to powerful computer facilities. By mid-1987, it had made some proposals for the short- and medium-term acquisition of supercomputer equipment. Demand for supercomputers is increasing because, on the one hand, they offer greater research possibilities, and, on the other, more and more disciplines need high-speed computers.

Since the only supercomputer available to the academic world—the Cyber 205, at SARA, the computer center of the Amsterdam universities and of the Mathematics Foundation—is already working to capacity and is already outdated, the WGS proposes to purchase a new, top-of-the-line supercomputer by mid-1990. A team of experts will prepare a list of specifications for this supercomputer and invite manufacturers to submit bids. The bidding process will be completely open.

Present Situation

Several supercomputers are currently in operation in the Netherlands, including the aforementioned Cyber 205 at SARA, a Cray-1S at Shell Research in Rijswijk, and a NEC SX-2 at the National Aviation and Space Laboratory (NLR) in Noordoostpolder. Until recently, computer time was available from Shell's Cray—a Cray X-MP EA/264 has been purchased lately—but this is no longer the case. From the outset, the WGS has had access to the Netherlands' supercomputer base. Through the WGS, universities can obtain user time on the NLR's SX-2 computer. For the time being, supercomputer facilities in the Netherlands are considered adequate.

SARA has always served as a national supercomputer center for scientific research. Last year, its Cyber 205 was extended, and it now also serves as an intermediary providing access to the NLR's SX-2. Furthermore, SARA also acts as a data communications node for accessing other supercomputers.

Along with SARA, the ENR [not further identified] computing center also offers supercomputer facilities. The ENR is linked to the Cray-1S at Shell Research and to the Cray X-MP/28 at Cray's Bracknell Data Center in the UK. Until recently, the ENR was an obvious partner for SARA. However, the decision by the ENR computer center to purchase an ETA-10P computer, despite the WGS' advice to the contrary, has eliminated SARA's complementary function. In terms of its performance, the WGS does not regard the ETA 10/P as a supercomputer. The ENR will ensure access to the Bracknell Data Center's Cray until April of this year. After that date, SARA will take over this service. The transfer will coincide with the transition at Bracknell from the Cray operating system (COS) to the Unix-based Unicos operating system.

Huge Gap

The WGS focuses on supercomputers, which are the fastest machines currently available. They do not include minisupercomputers and the like. [passage omitted]

The WGS also advocates the establishment of a center that would develop and disseminate specific know-how about the use of parallel and vector computers, and that could identify research areas in which parallel architectures could best be implemented. Such a center could also focus on the integration of information science, the development of mathematical methods, and on possible applications. So it would be more of a science center than a computing center.

Lagging Behind

Major technological institutes such as the Organization for Applied Scientific Research (TNO) and NLR are also helping to formulate recommendations. The WGS noted that these institutes, with the exception of NLR, are hardly trailblazers in the field of supercomputers and that they cannot be compared to their foreign counterparts. However, their interest in supercomputers is apparently growing, as witnessed by their requests for computing time on supercomputers.

By purchasing the NEC SX-2, NLR is taking the lead. Investments in expensive measuring equipment were postponed to finance this machine. This can be seen as a sign that computer simulation is gradually replacing actual testing.

It is striking that researchers of major technological institutes generally prefer Cray equipment. This is probably because it can run many application packages. Researchers from technological institutes make more use of standard applications than do university researchers. In addition, within the context of cooperative projects with foreign institutes, data can be exchanged more easily when all the equipment is the same—usually a Cray.

Industry has not shown very much interest in academic supercomputers in recent years. A company generally buys a supercomputer strictly for its own use while little scope is left for scientific use. However, the availability of very powerful supercomputer facilities in the Netherlands might encourage industry to use them.

Multidisciplinary Use

Supercomputers are used in the Netherlands for different research purposes. Requests for computer time come from all universities and from the major technological institutes. By July 1988, almost 150 projects had been submitted to the WGS, which coordinates the use of supercomputers. Both the number of requests and the amount of computer time have substantially increased. Most requests are related to physics or chemistry/biochemistry. Mathematics, information sciences, and astronomy are also major users. Still, given the distribution of computer time among the disciplines, the working group feels that supercomputer facilities should not be limited to one particular discipline, but should remain "multidisciplinary." This is considered to be particularly important for boosting the use of computational sciences within econometrics, medical sciences, and pharmacology.

Efficient data communication is considered essential for accessing central computer facilities, because of the heavy data traffic to and from supercomputers. At present, data is often stored on magnetic tapes and sent by mail. This method, though acceptable for incidental cases, will eventually become impracticable.

When the new supercomputer is purchased in 1990, provision will have to be made for adequate data communications facilities (with a megabit capacity) between users and the supercomputer center. A proposal for a pilot project involves the establishment of a 2-Mb/s link between NLR and the Technical University of Delft. To ensure interactive access to supercomputers by the 1990s, an eventual 50-Mb/s link between supercomputers and users has been proposed. Possible links with foreign supercomputers could be established through the Cooperation University Computer Centers (SURF) network.

[Box, p 2]

Working Groups

In 1985, the Working Group for the Use of Supercomputers (WGS) was set up. It identifies the need for supercomputers, promotes their use, and monitors technical and commercial developments. The WGS issues reports on this subject and makes policy recommendations.

The ad hoc Working Group on Supercomputer Investments (WIS) has recently published a report in which it advocates the implementation of WGS recommendations. The report also makes some proposals regarding the financing of a new supercomputer, whose cost is budgeted at 12.5 million Dutch guilders a year. The WIS recommendations are endorsed by the SURF Foundation (which formed the working group) and have been submitted to Minister of Education W. Deetman. The only point at issue is the distribution of expenses among the different institutes. Dr P.J.C. Aerts of the SURF Foundation, who is also secretary of the WIS, expects to have everything sorted out by March or April.

DEFENSE INDUSTRIES

European Military Research Cooperation Proposed

36980151 Paris LE MONDE in French 1 Mar 89 p 5

[Article by Jacques Isnard: "France To Propose Military EUREKA to Its European Partners"]

[Excerpts] The General Delegation for Armaments [DGA] is examining the possibility of proposing to the Europeans the creation of a military EUREKA in the sphere of basic research, modeled on the one which already exists in civilian research. Yves Sillard, who was recently appointed as head of the DGA and who was French coordinator for the civilian EUREKA program from 1986 to 1988, discussed this idea with Peter Levene, his British counterpart, before they discuss the possibility with their counterparts in Europe. [passage omitted]

A military EUREKA would be concerned with so-called exploratory developments, in other words, experimental models (maquettes or demonstration models) which make it possible to assess the ability of a new technical concept to meet an operational need. There would be no joint state funds. Basic cooperation would be a decision for the industrialists alone and they would choose their partners with complete freedom. The only guarantee in this a la carte cooperation would be that states could announce their readiness to provide public funding if the demonstrated concept interests them.

Such arrangements could be made on the basis of bilateral of multilateral agreements among the member countries of the Independent European Planning Group which groups NATO's European members (aside from Iceland) for cooperation in the arms sphere.

MICROELECTRONICS

Netherlands Postpones Decision on JESSI Funding

AN890099 Amsterdam COMPUTABLE in Dutch 27 Jan 89 pp 3, 10

[Article by unidentified COMPUTABLE correspondent: "Minister Postpones Decision on JESSI Funding"]

[Excerpt] The Hague—The decision on a government grant to Philips for the Joint European Submicron Silicon Initiative (JESSI) project is not likely to be made very soon. Minister of Economic Affairs R.W. de Korte considers a short-term decision unfeasible, in spite of earlier expectations. The decision has been postponed because the actual structure and content of this ambitious multibillion-guilder project are not yet known. The definition phase has not yet been completed.

The minister communicated this to the Second Chamber in a letter concerning the Megabit-I project. Now that SGS-Thomson, the Italian- French microelectronics giant, has decided to join Philips and Siemens, the project has become much more complicated. It is those parts of JESSI that interest non-IC manufacturing companies in particular which seem to present problems in terms of project definition and elaboration and are running behind schedule.

Apparently, all parts of the project can be defined at the same time. Definition of the "technology" subproject and the closely related "supply" project seems likely to be completed sooner than, for instance, the subproject "CAD and applications." [as published] These developments have led to delays in the feasibility studies scheduled for 1988 and for which Philips receives government grants.

Philips has asked the ministry to extend the deadline for the grant, which was set in the spring of 1988 for 1 July 1989. Philips' request for continuation of the funding for its preliminary studies in the present year will be examined in consultation with the Advisory Council for International Projects. The Second Chamber will also have its say on this matter. A possible extension of the grant for preliminary studies will partly depend on information still to be provided by Philips to the minister. Philips is expected to express an opinion on the recently published "Green Paper," which outlines the JESSI Planning Group's planning proposals for the coming period. Another factor determining the decision on Philips' funding request is the way in which the concern plans to contribute to subprojects other than the one for technology. The funding levels of the other member-state governments involved in JESSI will also play a role. The European Commission is also willing to sponsor JESSI. Minister De Korte mentioned that the JESSI project is also catching on well in the Netherlands. A few dozen or so Dutch companies and institutes would like to participate in JESSI once the project has been defined. [passage omitted]

SCIENCE & TECHNOLOGY POLICY

Italian Participation in ESPRIT 2 Outlined

MI890167 Turin MEDIA DUEMILA in Italian Feb 89 pp 90-91

[Text] ESPRIT 2, which launched its first "routine" projects last summer, is now entering the field of basic research. Meanwhile, ESPRIT 1 displays its jewels. All of this is taking place in Brussels, the capital of the EC's information processing initiative, the crossroads for the results of the "mature" projects and for hopes of success for those in the early stages.

By the end of 1988, the European Commission had selected 62 projects for the second generation of the ESPRIT program—the first to focus on basic research (the main fields of interest are high-temperature superconductors, optical information processing, the specification and verificiation of complex program systems, robotics, and voice and image handling).

In response to the first call for bids for basic research, the European Commission received 283 proposals for "valid" projects, that is, those meeting the basic requirements. To accept all of these, the Commission would have had to allocate 485 million ECU, approximately 750 billion lire. However the funds available within ESPRIT 2 for this segment of basic research amounted to 65 million ECU.

According to the Commission's experts, all of the European research teams that are already fully committed to basic research have shown interest in the call for bids. Only 21% of the proposals submitted were actually selected, and the choice was made on the basis of their scientific relevance. The duration of funding, for which the standard ESPRIT guidelines apply (the EC covers a part of the costs and the research institutes provide the rest), has been reduced to 2 and ½ years.

When the negotiations on drafting the agreements are over—which is expected to happen shortly—the 62 projects should combine 285 different programs: 74% by universities, 20% by research institutes, and 6% by industry; a very different mix from the traditional ESPRIT research projects, in which industry—especially small- and medium-sized companies—plays a leading role.

A list of Italy's research centers and universities that are involved in basic research is provided in the box. Many Italians, particularly representatives of industry, were present at the exhibition held in the Congress Building in Brussels, a major event during the 1988 ESPRIT Conference, the fifth in the series. Among the exhibition's visitors were operators, researchers, officials, and on this occasion, the research ministers of the twelve EC members. The conference offered the opportunity for assessing the results of some ESPRIT 1 projects, which quickly passed through the research phase and have now reached the market.

During their visit, the ministers listened to explanations and asked questions, sometimes with a firm grasp of the subject, as in the case of Minister Antonio Ruberti, and occasionally with the curiosity of one who approaches information processing for the first time. All of them found evidence of the effectiveness of the ESPRIT program, first developed in the early 1980's, launched on an experimental basis in 1982, and by now capable of setting Europe on a par in many sectors with its competitors, the United States and Japan.

[Box, p 91]

Outline of Italian Participation in Basic Research for ESPRIT 2:

- Natural language processing systems, University of Pisa;
- AI and Cognitive Science, Speech, CNR [National Research Council] Phonetics Research Center;
- Algorithms and Complexity, La Sapienza University of Rome;
- Categorical Logic in Computer Science, University of Parma;
- Computational Logic, La Sapienza University of Rome and University of Pisa;
- Demon-Design Methods Based on Nets, University of Milan;
- Dialog Models for Explanation and Learning, CNR Institute of Computational Linguistics and the University of Pisa;
- Electrical Fluctuation and Noise in Advanced Microelectronics, University of Modena;
- Epioptic-European Project, University of Messina and Tor Vergata University of Rome;
- FIRST, Fundamentals of Intelligent Reliable Robot Systems, University of Genoa;
- Formal Design and Verification for Provably Correct VLST hardware, Turin Polytechnic;
- Formally Integrated Data Environment, University of Pisa and CNR-IEI [Institute for Computer Science];
- Heterostructure of Semiconducting Silicides on Silicon Applications, Tor Vergata University of Rome and CNR;
- Innovative Architectures for Neurocomputing Machines and VLSI Neural Networks, Turin Polytechnic;
- Integrating the Foundations of Functional, Logic, and Object-Oriented Programming, University of Pisa;
- Limiting Factors in Semiconductor Devices Due to Donor-Related Deep States, University of Pisa;
- Logical Frameworks, University of Turin;
- Mechanizing Deduction in the Logics of Practical Reasoning, University of Turin;
- Models, Languages and Logics for Concurrent Distributed Systems, University of Pisa;
- Multisensory Control of Movement, CNR;
- Predictably Dependable Computing Systems, CNR-IEI;
- Quantum Noise Reduction Schemes in Optical Systems, INFM [National Interuniversity Consortium for the Physics of Matter];
- Structure and Transport Properties of Organic Low-Dimensional Systems for Application to IT, University of Genoa;
- Traverse Optical Patterns, INFM;
- Vision Systems For a Natural Human Environment, University of Genoa.

EC Commission Amends SPRINT Proposal

AN890121 Luxembourg OFFICIAL JOURNAL OF THE EUROPEAN COMMUNITIES in English No C68, 18 Mar 89 pp 10-15

[EC document: "Amended Proposal for a Council Decision Concerning the Implementation at Community Level of the Main Phase of the Strategic Programme for Innovation and Technology Transfer (SPRINT) for the period 1989 to 1993 (COM(89) 105 final), submitted by the Commission pursuant to Article 149 (3) of the EEC Treaty on 24 February 1989"]

[Text] The Council of the European Communities,

Having regard to the Treaty establishing the European Economic Community, and in particular Article 235 thereof,

Having regard to the proposal from the Commission,

Having regard to the opinion of the European Parliament,

Having regard to the opinion of the Economic and Social Committee,

Whereas, under Article 2 of the Treaty, one of the major responsibilities of the Community is to ensure the harmonious development of the economy, together with continued and balanced growth throughout the Community; whereas, under Article 130A of the Treaty, it is required to achieve such harmonious development of the entire Community by developing and pursuing actions leading to the strengthening of the Community's economic and social cohesion;

Whereas, under the terms of Article 130F of the Treaty, the Community has as an objective the reinforcement of the scientific and technological bases of European industry and the encouragement of the development of its international competitivity; whereas the attainment of this objective involves, in particular, a determined effort to promote innovation and technology transfer;

Whereas the strategic Community programme for innovation and technology transfer (SPRINT) 1983 to 1989 has demonstrated the need for, and added value to be derived from, an ambitious Community policy for innovation, and technology transfer, particularly with a view to achieving the internal market by the end of 1992;

Whereas it is essential for the future of the Community to adopt appropriate measures to stimulate the innovative capacity of companies and to promote rapid application of new technologies as soon as they become available;

Whereas many recent technologies have yet to achieve their full potential diffusion in certain traditional industrial sectors in certain regions of lagging development or industrial decline; whereas their rapid adoption could permit these sectors and regions to make up some of the leeway, thus strengthening not only the competitive position of the Community but also its economic and social cohesion;

Whereas the Member States have developed specialized services for the support of innovation, technology transfer and consultancy in innovation management, financing and industrial cooperation; whereas these infrastructures have a significant multiplier effect in promoting innovation and technological development in companies, especially smaller ones, while the institution of transnational liaison, cooperation, training and transfer mechanisms optimize these national schemes;

Whereas the Community itself, in complement to the actions of the Member States, has also undertaken initiatives to support innovation and technology transfer, as important elements in the implementation of other Community policies;

Whereas it is appropriate to maximise these initiatives in order to reinforce their effectiveness and coherence;

Whereas in this principal phase of the programme it is necessary to give greater prominence to the role of companies and their organizations, finance companies, specialized consultants and the professional personnel involved;

Whereas in view of the importance of technology transfer and innovation for SMEs [small and medium-sized enterprises] it is appropriate to coordinate the actions in this area with the policy in favour of SME's developed by the Commission within the framework of its action programme;

Whereas it is essential to have access to instruments providing a better understanding of the innovation and technology transfer process, in order to identify more clearly the obstacles to be encountered and to evaluate the impact of instruments and policies;

Whereas reciprocal information flows, the exchange of experience and concentration between the Member States and the Commission with regard to innovation policies are essential to enhance their own effectiveness and the cohesion of the entire Community;

Whereas there is a need to improve access to technologies, capital and markets in order to stimulate innovation;

Whereas Community action appears necessary in these fields; whereas the Treaty makes no provision for corresponding powers of action,

Has decided as follows:

Article 1

The main phase of the strategic programme for the promotion of innovation and technology transfer, hereinafter referred to as the "SPRINT programme" (Strategic Programme for Innovation and Technology Transfer), is hereby adopted for a period of five years from 1 January 1989.

Article 2

The aims of the proposed programme are as follows:

1. To strengthen the innovative capacity of European producers of goods and services, in view of the 1992 single market;

2. To promote rapid penetration of new technologies throughout the economic fabric of the Community, particularly in those regions and industrial sectors where they are as yet not fully integrated, thus stengthening, in close liaison with other policies, instruments and bodies promoted by the Community, its economic and social cohesion in the field of innovation and technology transfer;

3. To enhance the effectiveness and coherence of existing instruments and policies, whether regional, national or Community, in the field of innovation and technology transfer.

Article 3

With a view to achieving the aims set out in Article 2, the following actions will be undertaken, taking careful account of initiatives already underway, as provided for in Article 5:

Strengthening of the innovation services infrastructure in the Community by the consolidation of existing transnational networks, and by the formation of further networks, paying particular attention to those areas of the Community where a suitable framework does not yet exist or is inadequate, and building upon existing organizations in the regions;

Supporting intra-Community pilot projects for information transfer where these are of value to the Community as a whole,

Improving the innovation environment by a better understanding of the processes involved and increased concertation between the Member States and the Commission.

These actions are described in detail in Annex I.

Article 4

The Community's contribution to the activities set out in Article 3 is estimated at ECU 130 million over the lifespan of the programme.

A significant part of this amount will be employed, as a priority, to the benefit of regions of lagging development or industrial decline.

Annex II provides an indicative breakdown of expenditure for the various actions set out in Article 3.

Article 5

1. The Commission is responsible for implementing the SPRINT programme.

2. The Commission is assisted by a committee, known as the "Innovation Committee", comprising representatives of the Member States and chaired by the Commission's representative.

The Commission's representative submits to the committee a proposal on measures to be taken. The deadline by which the committee must give its opinion on this proposal is set by the chairman in the light of the urgency of the issue. The opinion is adopted by the majority laid down in Article 148 (2) of the Treaty concerning the adoption of Decisions by the Council on a proposal from the Commission. For the purposes of voting within the committee, the votes of the national representatives will be weighted in accordance with the above Article. The chairman has no vote.

The Commission adopts measures with immediate effect. Nevertheless, if these are not in accordance with the committee's opinion, these measures are immediately communicated to the Council by the Commission. In this case, the Commission may defer application of the measure it has promulgated for a maximum of one month from the date of this communication.

The Council, acting by a qualified majority, may reach an alternative decision within the period set out in the above paragraph.

3. With respect to the implementation of the plan of action outlined in Article 3, the Commission will consult the committee in particular with regard to:

- priorities of the above plan of action,
- evaluation of projects,
- evaluation of the programme for the purposes of preparing the report called for under Article 8.

4. The Commission will ensure close liaison between the SPRINT programme and other related or complementary Community initiatives, in course or in preparation.

Article 6

1. The financial contribution of the Community will be adapted to the characteristics of the specific case. It may take the form of a direct or indirect subsidy, an advance on own capital, a contribution to a guarantee arrangement or any other appropriate form. This contribution,

as a percentage of total costs, shall be the lower the greater the proximity of the action or project to the market.

2. The Commission will, in general, implement the SPRINT programme by way of calls for proposals.

3. In implementing the programme, the Commission will also make use of the instruments and bodies promoted within the framework of other Community policies, in particular regional policy, in order to reinforce the efficiency of the programme and overall coherence.

4. The Commission's contractors will, as a general rule, bear the major share of financing, and at least 50 percent of total costs. In exceptional cases, and after an opinion by the Innovation Committee, a contribution in excess of this percentage shall not be excluded, in particular for the purposes of taking account of the specific difficulties encountered by regions of lagging development or industrial decline in participating in transnational activities.

Article 7

In accordance with a procedure to be drawn up by the Commission, and after an opinion by the Innovation Committee, the Member States and the Commission shall conduct regular exchanges of all useful information with a bearing on the aims of the programme referred to in this decision.

Article 8

During the third year of the programme's operation, the Commission will draw up a report assessing the results achieved and, after an opinion by the Innovation Committee, submit it to the Council, the European Parliament and the Economic and Social Committee. This report may be accompanied by proposals for modifying the programme, should these appear necessary in the light of the results.

The European Parliament wil be asked to give its opinion on this report and any accompanying proposals for modifications.

On completion of the programme, and after an opinion by the Innovation Committee, the Commission will submit to the Council, the European Parliament and the Economic and Social Committee a report on the programme's implementation and results.

Article 9

The Commission shall use the most appropriate means to disseminate information throughout the Community on activities conducted in implementation of this decision and the results of such activities.

Article 10

This decision is addressed to the Member States.

ANNEX I

Strategic Programme for Innovation and Technology Transfer (SPRINT) for the Period 1989 to 1993—Aims and Definition of Actions

Aims

The aims of the programme are as follows:

1. To strengthen the innovative capacity of European producers of goods and services with a view to the 1992 single market;

2. To promote rapid penetration of new technologies throughout the economic fabric of the Community, particularly in those regions and industrial sectors where they are as yet not fully integrated, thus strengthening, in close liaison with other policies, instruments and bodies promoted by the Community, its economic and social cohesion in the field of innovation and technology transfer;

3. To enhance the effectiveness and coherence of existing instruments and policies, whether regional, national or Community, in the field of innovation.

The proposed actions, comprising three priority lines of action, will make the most of the Community dimension and optimize national efforts in the field of innovation and technology transfer, thus accelerating the technological development of European industry.

Lines of action

A. Strengthening the European Infrastructure for Innovation Services by the Establishment of Intra-Community Networks

In particular, this involves:

1. The strengthening of intra-Community networks for innovation:

a. Consolidation and development of existing networks, particularly involving:

- Technology and innovation management consultants,
- Sectoral collective research centers,
- Innovation financing institutions;

b. Formation of new networks, particularly between:

- Contract-research organizations,
- Engineering consultants,
- Quality and value-analysis specialists, etc.;

c. Strengthening intra-Community communication between:

- Research/industry and university/industry interface,
- Technopoles and science parks;

d. Implementation of linkage mechanisms between the various innovation and technology transfer networks.

2. Networks support measures:

a. Actions of information, awareness, promotion and the transfer of know-how in innovation management and related measures:

Transnational and inter-regional exchanges of experience across national boundaries, in particular through support for studies, specialist seminars and the formation of networks of experts in relevant management disciplines (quality, value analysis, marketing, etc.),

Diffusion of these management techniques by appropriate promotional activities (conferences, exhibitions, European prizes, "success stories", etc.),

Actions of information, awareness and the transfer of know-how, of a transnational character or purpose, for actors involved in the diffusion and transfer of technology and in innovation management—these actions to be developed in close liaison with the COMETT [Community Program for Education and Teaching in the Field of Technology] programme;

b.Specific instruments to enhance the effectiveness of networks, involving particularly:

—Bringing together future network participants (for example by means of visits and professional exchanges, introductory seminars, etc.),

—Exchanges of technology opportunities, especially through measures aimed at:

—Enhancing the transnational impact of technology exhibitions and fairs (cooperation between organizers in different regions, visits by manufacturers from other regions, etc.),

—Developing means of communicating these technology opportunities and appropriate use thereof (catalogues, exhibitions, exchanges, data banks, conferences and seminars, video conferences, etc.),

—Identifying "best practice" with respect to technology transfer,

—Specific measures to ensure that those regions of the Community with a less well-developed service infrastructure for innovation can participate more fully in the various intra-Community networks;

c. The launching of innovation emerging from networks by improving the dialogue between sources of funding technical experts and innovators identified by the networks (for example, through a data bank of projects, intra-Community "investment forums" and "brokerage meetings").

B. Supporting Pilot Projects for Intra-Community Innovation Transfer, Particularly by Means of:

—Support for pilot projects of transnational character, emphasizing industrial cooperation and, in particular, involving the application of generic technologies to target industrial sectors in regions of lagging development or industrial decline of the Community,

—Accompanying measures to heighten awareness of these technologies and to train companies adopting them, emphasizing the transnational dimension,

—The provision of technical support for companies, particularly small and medium-sized enterprises, potentially able to use these technologies, in particular by employing specialized technology transfer networks and advanced-technology centers,

—Support for the effective execution of projects, particularly by mobilizing available funding from the public and private sectors.

Twin approaches can be followed:

—One of these identifies available technologies with a cost-benefit ratio suiting them for widespread adoption by companies in regions of lagging development or industrial decline, and is therefore designed to promote the use of these technologies in the sectors concerned,

—The other is based on identifying a problem, for which a solution can be found, common to a group of companies in a given industrial sector or region. It encourages the identification and possible adaptation of available technologies to deal with the problem.

The planned projects must be on a large enough scale to act as a catalyst in the development of the industrial sectors and the use of the technologies concerned. They must also meet, wholly or in part, the following criteria:

—Be model projects inasmuch as they employ a "systemic" overall approach to the introduction of technological change, not only in purely technical terms but also with regard to such aspects as company organization, the training and motivation of personnel and the use of such management methods as value analysis, industrial design and the assessment of market potential,

—Provide an optimum combination of skills through transnational (between several Member States of the Community) and, wherever possible, transfunctional (between partners of differing specialist skills) and inter-regional cooperation,

—Involve industrial sectors or technologies chosen to guarantee a significant economic impact,

—Make an active contribution to reducing regional disparities in the availability of—and access to—technologies,

—Be based as far as possible on existing infrastructures and enhance the use made of these,

—Include follow-up and evaluation provisions, based in particular on stated and readily verifiable quantitative aims,

—Ensure feedback of the experience gained, preferably directly by the companies benefiting from the scheme, in order to maximize the multiplier effect.

C. Improving the Innovation Environment Through a Better Understanding of the Processes Involved and Increased Concertation Between the Member States and the Commission

1. Monitoring of innovation in Europe (European innovation monitoring system) and evaluation of support measures.

2. Strengthening concertation and the exchange of experience between the Member States and the Commission in the field of innovation policy and technology transfer, in particular with the aim of establishing a regulatory, legal, economic and fiscal environment favourable to innovation and technology transfer.

European Information Technology Certification Committee Established

AN890100 Amsterdam COMPUTABLE in Dutch 27 Jan 89 p 12

[Article by Peter Mom: "Fourteen Countries Now Officially Represented in ECITC: Testing and Certification Begin To Take Shape"]

[Text] Brussels—Eleven months after its first meeting, the European Committee for Information Technology Testing and Certification [ECITC] was officially established last week with the signing of the final documents.

The ECITC, which seeks to develop a European system for testing and certification of IT products, has already agreed on a memorandum of understanding. However, some of the 14 participating countries wanted to wait until the document was available in all three officially adopted ECITC languages. This allowed France to sign a French copy, in addition to the already available German and English texts.

The 14 ECITC member-countries are Belgium, Denmark, the FRG, Britain, Finland, France, Ireland, Italy, the Netherlands, Norway, Austria, Portugal, Sweden, and Switzerland. The countries are represented by a national body, also called the coordinating member. The Netherlands is represented by the Institute for the Certification of Information Technology [ICIT].

In addition to the previously elected president, W.K. Wiechers of the Netherlands, the ECITC also appointed two vice presidents. This double vice presidency was established to handle the divergent opinions on certain topics that became apparent within the ECITC in recent months. It also ensures that both the EC and the EFTA countries are represented within the presidium. The two vice presidents are Sten-Ingvar Nilsson from Sweden (EFTA) and Jan Fialla from Denmark (EC).

COMPUTERS

GDR: 4 Mbit Memory Circuit Model on Display at Leipzig Fair

23020063 East Berlin NEUES DEUTSCHLANDinGerman14 Mar 1989 p 3

[Excerpt]Manfred Schneider, general director of the Hermsdorf Ceramics Works Combine, recently announced the development of East Germany's first 4 Mbit memory circuit. The circuit is on display at the spring technological fair in Leipzig.

The 4 Mbit hybrid memory circuit from Hermsdorf contains sixteen 256 Kbit chips from the Carl Zeiss Combine in Jena and 16 pinhead-sized multilayer ceramic capacitors froma the VEB Electronics in Gera. The new Memory circuit is slated for application in computer technology, industrial measurement and logic/feedback control.

Terminals for GDR's ROBOTRON K 1840 Computer Described

23020055 East Berlin NEUE TECHNIK IM BUERO in German No 2, 1989 pp 33-34

[Article by Wolfgang Branitz, VEB Robotron-Elektronik Dresden: "Terminals for the RVS ROBOTRON K 1840"

[Text]

1. Introduction

The RVS computer system ROBOTRON K 1840 (RVS = Virtual Memory Computer) is used as a central or master computer. Communication between user and computer takes place via terminals. To achieve universal use of the RVS K 1840, a series of different terminals is offered.

The ROBOTRON K 8911.80 video terminal permits

- starting user programs and servicing in the multiprogramming regime (e.g., simultaneous text processing is possible on several terminals),
- transaction-based work with databanks,
- interactive development (entering and compiling) of new programs, and
- input of data in real-time processes.

For processing CAD tasks, the interactive graphics terminals (IGT) ROBOTRON K 8918 and K 8919.11 are used. These medium and high resolution video terminals differ in their level of intelligence.

A variety of communications capabilities can be accessed through the connection of personal computers. Operational modes available for this are computer-to-computer link with file transfer (ISCMAN program), terminal emulation, and LAN connection.

Terminal Characteristics

2.1 ROBOTRON K 8911.80 Video Terminal

The alphanumeric terminal K 8911.80 is a monitor for communication with the K 1840 computer. It can be used as a console terminal and as a user terminal and implements the VT100 mode. It is a tabletop device with a 31-cm-diagonal screen. The operator communicates with the terminal via an alphanumeric keyboard. Using this, the operator selects the processing states "Test Mode" or "Operations Mode." In the "SET-UP Mode", internal processing states of the computer can be displayed and selected. Connectible printers are the dot matrix printers K6313/6314 with ISO commands. The terminal is connected to the ROBOTRON K 8081 multifunction controller or the controller of the console computer via the IFSS interface. The modified model K 8911.81 has a V.24 interface and can only be connected to the computer via the DNUe K 8172.

2.2 ROBOTRON K 8918 Interactive Graphics Terminal (IGT)

The K 8918 IGT is a tabletop terminal designed for color graphics. In the graphics mode it operates as a GKS workstation. The screen display is achieved with full-screen processing on the K 7229.25 monitor or a color monitor. A screen image buffer with 32 lines of 80 characters each is used for alphanumeric character display. The graphics screen image buffer has four image levels of 640 x 640 bits each.

The monitor display has 640 x 480 pixels. Combined and alternating display of alphanumeric and graphics data are possible. Each pixel can be displayed in one of 16 shades of gray or 16 colors.

The image displayed can be defined, manipulated, and selected interactively. This is done via the keyboard and/or the K 6405 graphics tablet. Printing is possible using the K 6313/6314 dot matrix printers with graphics capabilities connected to the K 1840 computer via the IFSS interface or to the K 8081 via the V.24.

2.3 ROBOTRON K 8919.11 Interactive Graphics Terminal

The primary application of the K 8919.11 IGT is for processing high performance graphics including alphanumeric text. It can also be used as a pure alphanumeric terminal for text input/output. Compared to the K 8918 IGT previously used, it has significantly improved graphics processing and display capabilities. On the 51-cm-diagonal (20-inch) screen, 1,280 x 1,024 pixels can be displayed in a maximum of 256 colors, selectable from a palette of over 16 million colors.

The K 8919.11 IGT is connected to the K 1840 via the IFSS interface or to the K 8081 via the V.24. To obtain a higher transmission speed and, consequently, more efficient graphics processing, an additional connection via the DMA parallel interface of the K 6081 controller is possible. In this configuration, the control signals are transmitted via the serial interface and the data via the parallel interface. The K 8919.11 is presented in detail on the following pages of this volume [not included].

3. Connection of Personal Computers

The link between the K 1840 computer and a personal computer or workplace computer is made via a serial interface (IFSS/V.24 directly or via DNUe K 8172) as a point-to-point link.

As a software component, the ISCMAN program has special importance since with it the complete range of the ROBOTRON-personal computer can be operated in the same way. In principle, various types and performance classes and those with different operating systems can be connected to it, if an ISCMAN program system or one compatible with it runs on them. The ISCMAN program system permits data transfer (ASCII and binary files) and a simple virtual terminal connection between the linked computers. Thus, the user can temporarily access the processor output and resources of the other computer. Furthermore, ISCMAN offers the capability of storing the files transferred between the linked computers to their respective external memories. The KERMIT transfer protocol is used for file transfer. This operates using a simple block transfer with ACK/NAK responses for each block and time-out control. Block length is 96 characters. The data in the block are checked by check sums. In the link using ISCMAN, the two partners are equal. The partner designated as active can initiate a connection. The other partner waits for incoming connection specifications. This arrangement is based only on the capability of establishing a connection and initiating a transfer. Files can be transmitted in both directions under the control of the operator from the active side. Implementation of the link and the data transfer takes place via an interactive command interface between ISCMAN and the operator. This interface includes, among other things, commands to start ISCMAN, to create a virtual terminal link, to manage files for the file system both remotely and on local computers, to transfer files, and to set connection parameters. The following computers may be linked to the K 1840 with the SVP 1800 or MUTOS 1800 operating systems:

EC 1834 with DCP and ISCMAN via the IFSS or V.24 interface asynchronously

A 7100 with SCP and ISCIFSS via the IFSS interface

A 7100 with SCP and ISCV24 via the V.24 interface asynchronously

A 7150 with DCP and ISCMAN via the IFSS or V.24 interface asynchronously

A 7150 with SCP and ISCIFSS via the IFSS interface

A 7150 with SCP and ISCV24 via the V.24 interface asynchronously

ROBOTRON 1715 with SCP and ISCMAN via the IFSS or V.24 interface asynchronously.

For the DCP operating system, the VT100 emulation program is offered [3], permitting operation of the A7150 and EC 1834 computers as an alphanumeric video terminal on the K 1840.

Further connection capabilities are under development (e.g., A 5120/30, K 1630). Using the off-the-shelf hardware and software components for the K 1840, which are briefly mentioned below, additional computer links can be configured. A detailed presentation is reserved for a later article.

Interface:	Software components:
IFSS/V.24	SKRNET of SVP 1800
	(DDCMP procedure)
	UUCP of MUTOS 1800
ROLANET2	SKRNET of SVP 1800
	TCP/IP of MUTOS 1800
ROLANET1	NETSERV of SVP 1800
IFLS	ATP18 Driver of SVP 1800

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GDR's ROBOTRON K 8919.11 Interactive Graphics Terminal Described

23020056East Berlin NEUE TECHNIK IM BUERO in German No 2, 1989 pp 34-38

[Article by Dr. Horst Schroeter and Dr. Matthias Schulze, VEB Robotron-Electronics, Dresden: "Interactive Graphics Terminal Robotron K 8919.11]

[Text]

1. Introduction

With the interactive graphics terminal (IGT) K 8919.11 the VEB Combine Robotron introduces another terminal with graphics capability. The features of this terminal will certainly place it among the top models for 2-D applications. The K 8919.11 is primarily intended for the 32 bit computer series of the VEB Combine Robotron. This article describes the most important device parameters from an applications standpoint.

2. Device Components

The performance of the unit is based on a fast graphics processor which handles a graphics memory with 8 memory levels (bit levels) with 1280 x 1024 bits each. This value corresponds to the visible pixel resolution of the attached monitor. The master processor constitutes the basic computer unit of the K 8919.11. It controls all modules and devices and offers the user complex graphics functions. A serial interface (IFSS/V.24) and a parallel interface with DMA-capability are available for connecting the K 8919.11 terminal to the host computer. The serial host interface is used for the application specific control of the terminal. The parallel interface is used for implementing the fast exchange of large amounts of data between host computer and terminal.

3. Communication with the Host Computer

3.1 Communications Parameter

Due to a variety of configuration parameters, the K 8919.11 terminal can easily be adapted to a broad range of host computers. The transmission parameters can be set by the operator via the keyboard (SET-UP mode) or through appropriate instructions by the host computer. The parameters are saved in a battery-powered CMOS-RAM and are retained when the device is turned off. To provide flexibility for constantly changing applications, the specific parameter settings can be loaded from a user disk after system initialization.

The basic configuration of the terminal includes:

—baud rate
—(50 baud to 19,200 baud)
—maximum (effective) baud rate
—parity check (even, uneven, no parity)
—number of stop bits (1 or 2)
—length of BREAK signal
—(1 to 65535 ms)
—transmission protocol (CTS/DTR or DC1/DC3 mode)
—size of the receiving queue.

In addition, there are other settings which define, for instance, the response mode of the terminal (prompt) or special character strings as a termination indicator for transmission sequences. All units are delivered with preset default values assigned to all changeable terminal parameters. It should be noted that on the host interface, control characters and data are always transmitted with a 7 bit code. This requires special algorithms for transmitting information parameters with 8 or more bits (up to a maximum of 32 bits).

3.2 Basic Operating Modes

The K 8919.11 terminal has two basic operating modes: the EDIT mode and the TRM mode. The latter is the actual graphics working mode of the terminal. The EDIT mode, on the other hand, is a typical alphanumeric operation which is particularly for working with screen editors. The terminal responds only to the control characters and commands of the operating mode which is active at the time. The terminal can be switched between the TRM mode and the EDIT mode through host commands.

There is an independent SET-UP mode for the IGT K 8919.11 which makes it possible to work off-line with the terminal and to enter characters, command sequences and parameters via the keyboard. A number of commands can be activated using simple codes. The SET-UP mode can be activated and deactivated via the terminal keyboard.

As to interaction with the host computer, the host sends out commands, transmits data and receives data from the terminal. Commands consist of a command code followed by one or several parameters. However, they can also be omitted. The commands of the K 8919.11 can by organized into the following three groups:

—single-character commands:
These include all printable characters as well as the ISO code control codes (0 to 31). They are used for functions such as positioning the alphanumeric cursor, switching between operating modes and for special functions.

—double-character commands:
They always start with the character ESC (27) followed by a single character without parameter.

—three-character commands:
This largest group of commands always starts with the ESC sign followed by two single characters representing the actual operational code. Any parameters required for the command follow the second character of the operational code.

The information parameters contained in the commands are coded according to type (integers, point coordinates, etc.). This is called "packing". The goal is to convert all numerical values to the 7 bit format, to make decoding at the receiver end relatively simple. The K 8919.11 terminal uses three basic types of parameters for the command syntax:

—integer parameters for coding integer parameter values (positive or negative),
—XY-parameters for transmitting 12 bit or 32 bit dot coordinates, as well as
—character parameters for printable characters.

3.3 Terminal Reports

When requested by the host computer, the IGT K 8919.11 is able to independently send a variety of status information and dialogue data to the host. These response data sequences of the terminal are called reports. Terminal reports are available for the following requirements:

3.3.1 Device status report

This report ist used to transmit status information on logic devices, e.g. the host port, a disk drive or a peripheral connector.

3.3.2 Error report

This report reports the last eight errors detected, how frequently they occurred and their significance.

3.3.3 Point input report

When this report is requested the terminal sends point coordinates originating from a graphics input. They can be the result of a LOCATOR action, a PICK event or, for instance, a STROKE input (series of points).

3.3.4 Port status report

The host uses this command to request a status report and the current settings of the terminal's peripheral port. They include data such as baud rate, parity check, active transmission protocol, and more.

3.3.5 Segment status report

This report makes it possible to call up information on the segments currently stored in the IGT K 8919.11 or the cross-hair cursor. The status of individual segments or certain selected classes can be selected based on segment attributes (visibility, position, pivot point, transformation parameters, etc.).

3.3.6 Terminal status report

This report makes it possible to check all current terminal statusses which can be set by a command (e.g. baud rate, line type, etc.). Reports have the same syntax as the host commands, however, some of them have a quite different structure depending on the type of information to be transmitted. The parameters included in terminal reports are also transmitted in "packed" form.

3.4 Macros

A macro is a command which replaces a whole series of commands and combines them under a substitute code. By calling up this substitute code, the so-called macro name, a whole group of commands or instructions can be activated. The K 8919.11 terminal supports the use of three types of macros:

3.4.1 Host macros

A host macro is activated in the terminal if the host computer uses the appropriate command to request execution of a stored macro.

3.4.2 Byte macros

A byte macro is executed by the terminal if it finds a byte (character) in its queue which has been defined as a macro. Then, the command interpreter understands this byte to be a macro name and executes it.

3.4.3 Keyboard macros

The terminal activates a keyboard macro if a certain key (or combination of keys) is depressed for which the macro has been defined. When activating a keyboard macro the terminal enters the data content into its output buffer for transmission to the host computer. However, it is also possible to send the data stream of a keyboard macro directly into the input queue of the terminal (e.g. for direct entry of a command sequence). Macro commands can be nested, i.e. they can contain a command for activating another macro. However, a macro cannot activate itself again.

3.5 User interface

The K 8919.11 terminal makes it possible to operate a host computer in an alphanumeric dialog mode and at the same time provide the graphics screen for the user. Joint use of the screen for graphics and alphanumeric output is supported by an additional memory level for the dialog area (dialog scroll) which is physically separated from the actual graphics image memory (bit levels). Position, size and form of the dialog scroll can to a large extent be programmed and adapted to user requirements by the user and via the host computer. In addition, number of lines and length of lines in the dialog buffer, display position, font size, color, etc. can be changed. Using the vertical thumbwheel on the keybard, the "text window" can be changed within this memory, and the dialog area can be displayed and removed via the keyboard.

4. Graphics Functions

4.1 Graphic primitives

Graphic primitives are the basic components of an image which the terminal can generate after having received the appropriate command. The IGT K 8919.11 provides the following graphic primitives: vectors, graphic text, markers and panels.

4.1.1 Vectors

A vector is a straight line which connects two points. Vector representation can be influenced by the following attributes: type of line, line index (color) and space index. The K 8919.11 supports 8 line types (full line and 7 different dotted line types). The line width cannot be changed.

4.1.2 Markers

Markers are symbols which are drawn at a location set by the program and are used to mark specific display locations. Markers have about the same size as standard alpha text. They are defined more closely by the marker type attributes (11 different types including cross, star, square, etc.) and the marker index (color).

4.1.3 Graphics text
The terminal can generate two types of graphics text: string quality and stroke quality.

The terminal treats graphics text with string quality the same as alpha text. It is generated by a dot matrix and can be manipulated by the same attributes as alpha text:

—text index
—text background
—text size.

Stroke quality graphics text is generated by a sequence of short vectors. It is used to manipulate text, e.g. in drawings (change in position, direction and size). The appearance of stroke text can also be changed by attributes. They are:

—font
—text index
—rotation
—size
—slope.

The user can either define his own fonts or use a predefined alphabet. User-defined characters or symbols can also be used to modify the standard charater set of the terminal at certain locations.

Vectors, markers and graphics text can be specified by the user both in the implied and explicit command mode. The explicit command mode is based on the continuous output of ESC sequences to generate individual graphics elements. It is always available and independent of the terminal command mode set. The implied command mode of the terminal, on the other hand, is only available when the corresponding implied command mode has been activated.

If, for instance, the terminal is in the vector mode it interprets each incoming coordinate as a command to continue drawing a vector for this coordinate. The implied command mode works similarly with regard to the drawing of markers and writing of texts. Introducing the implied command modes considerably reduces the load on the controlling computer.

4.1.1 Panels
A panel is a closed area with any kind of border which can have several boundaries. Before a panel can be displayed it must first be opened which requires the coordinate of the starting point and information on the visibility of the border line. Then, any number of vectors can be sent to the terminal for defining the border. The panel is automatically closed with an end command. This also fills the panel, either with color, a user-defined pattern or one of 16 pre-defined patterns.

A rectangle is considered a special panel. A special command is provided for generating rectangular areas.

Just like all other primitives, panels can be affected by attributes. They include:

—fill patterns
—border overlap
—pattern adaptation
—border visibility
—visibility of rectangle borders.

4.2 Segment processing

A segment is any number of graphic primitives including the related attributes. A segment is stored in the terminal under a name, i.e. a number from 1 to 32,767 which has been assigned by the programmer. These segment names are used explicitly in connection with the segment commands. In addition, there are a few segment names with special meanings:

0: for a cross hair
—1: for all "currently defined" segments
—2: for all "future segments"
—3: for all segments assigned to a specific search class.

The segment properties can be determined by a number of attributes:

—reference point
—position
—scaling
—rotation
—write mode
—visibility
—blinking
—detectability
—priority

In addition, there is an attribute defining the segment class. The write mode is of particular importance. It determines how the terminal enters the segments into the graphics memory. Usually, the color index for each segment pixel is entered into the image regeneration memory and the pixel already in memory is overwritten. In an alternate write modes, the terminal executes a corresponding logic bit connection for each pixel to be displayed (e.g. AND, OR or XOR) between the index already in memory and the index to be displayed. Segments are formed in the following sequence:

1. Determining the segment attributes
2. Opening the segment
3. Creating the segment body
4. Closing the segment.

The segment body can consist of any graphic primitives and their related attributes, e.g. vectors, texts, markers, panels, and the pick identifier (pick-ID) as well as other segments. A pick-ID is a numerical value which can be selected by the programmer from 0 to 32,767. In case of graphic input operations, for instance, it is used to tell the host which graphic primitive the user selected within a segment. Segments with identical properties can be combined into classes. This is necessary if groups of segments are to be manipulated by a single command. This becomes necessary, for instance, if the user wants to identify all segments with identical properties (tolerances, material, standard parts, etc.) on a large display without having to know the individual segment numbers.

4.3 Surface concept

The graphics memory of the IGT K 8919.11 is made up of a maximum of 8 bit levels. These bit levels can be combined into groups by the user. Such a group is called surface. The number of bit levels which are combined into a surface determines the number of usable colors. Every time another bit level is added to a surface, the number of available color indices doubles. By selecting appropriate parameters, the terminal can be made to display surfaces visibly, invisibly and flashing. If several surfaces have been defined, the visible display on the monitor is an overlay of all surfaces which have been defined as visible.

When displaying several surfaces, parts of images or complete images of individual surfaces can be covered. The effect of such overlays, for instance, on color displays depends on the sequence in which the surfaces are displayed on the monitor. If the programmer did not set a sequence, the default sequence (priority) is used automatically. Further, it is possible to choose between an additive (RGB-system) or a subtracting (CMY-system) color mix. The surface concepts supports two specific applications: One, an application where the complete image is generated by overlaying the partial images to be processed (e.g. PC board design, construction, dimensions), and where related information is saved on a surface, and processing of this information does not affect the information in other surfaces. Secondly, there is the possibility of dual buffer processing. This method stores different image contents under separate surfaces and makes them alternately visible and invisible under program control. While the content of a surface is displayed, the content of the other surface can be processed, and vice versa.

Surfaces can also be combined. This combination is called super surface.

4.4 Window, Viewport and View

A window is a rectangular, user-definable area in the coordinate field of the terminal. It can take up part or the whole coordinate field. It does not matter whether the graphic primitives inside the window are included in segment definitions or not. When the window content is subsequently displayed on the screen, all primitives outside the window are cut off at the window borders (clipping). Thus, the window offers the user an important tool for working with partial images or image sections.

The viewport is a display area on a surface which has been defined as a rectangle. This area can take up part or all of the surface. By defining the viewport the user determines the "display window" for a representation, i.e. its position and size on the screen. We now have a transformation mechanism which ensures that the content of the coordinate field area marked by the window definition will be displayed in the viewport. This mechanism is called window viewport transformation.

The window viewport transformation makes it possible to move partial images on the screen, change the aspect ratio of figures and enlarge or reduce them (zoom).

A view in its most general sense is a partial image which is defined more closely by a number of attributes including a defined window-viewport transformation. The user is able to define up to 64 of such views and to display them on the screen either individually or together. This makes it possible to view in succession various predefined partial images (views) or to "switch" between these views. Several views can be combined into a group (cluster). Any change made to a view within a group applies equally to all group members.

4.5 Color

The IGT K 8919.11 does not store colors, but color indices which are bound to a certain surface. These color indices are again pointers to a user-programmable color map. At the same time, the color indices are attributes of graphics primitives and are stored as part of the segment definition. The maximum number of color indices depends on the number of bit levels which make up a surface. The terminal supports four color systems. Each of this color systems can be used alternatively by the applications programmer, and he can select them for his specific application or according to his wishes, habits or ideas. Basically, the color selected by the user is created by mixing the three primary colors red, green and blue.

4.5.1 HLS system

The HLS-system uses a definition of the hue, lightness and saturation. One point within a color cone which is composed of the components just mentioned corresponds to a specific color. With the HLS system, 3.6 million colors can be specified. Since the HLS system best corresponds to the human color perception, the terminal uses the HLS system as a default upon power-up.

4.5.2 RGB system

In the RGB system, colors are formed by adding and mixing the three basic colors red, green and blue (additive color system).

4.5.3 CMY system

The CMY system is a so-called subtractive color system where the colors are created by mixing the three subtractive primary colors: cyan, magenta, and yellow. In the two color systems RGB and CMY, the colors are defined by specifying the three color components and their integer portions between 0% to 100% . Thus, 1 million colors can be specified with these two color systems.

4.5.4 Machine RGB

The largest number of colors can be created with the machine RGB color system. With this system, the full color capabilities of the K 8919.11 terminal with more than 16 million colors can be used. This is possible by selecting each of the three primary colors with 8 bits so that 256 intensities per primary color are possible which then results in the number of colors mentioned.

4.5.5 Grey tones

The programmer can choose between a color and a grey tone display. The IGT K 8919.11 can display 256 different gray tones. The terminal executes the conversion of the color values into grey tones.

4.6 Pixel Operation

The user can write directly to the graphics memory of the IGT K 8919.11 using pixel commands. These pixel commands are used primarily to

—continuously generate rectangular areas and fill them with colors;

copy a rectangular area in the graphics memory to another area or another surface;

—define user-specific fill patterns.

4.7 File System

In addition to the central host interface (serial and parallel), the IGT K 8919.11 has three serial ports for connecting peripheral devices as well as two disk drives. Ports and disk drives are supported as logic devices by the terminal file system and can be used in commands for data transfer operations. Here, it is of particular interest that segments or screen contents can be saved and reloaded and that command sequences saved on disk can be processed. Data can also be transferred as background operations while the terminal is performing other tasks (spooling).

All file commands can be given by the host or entered by the user. They allow displaying disk contents, formatting disks, deleting and renaming files and copying files between logic devices.

In addition to the ususal logic devices, the K 8919.11 terminal also supports a few pseudo devices. They include, for instance, the pixel viewport, the segment list and the color map. Such pseudo devices can also be used in copying operations both as a source or as a target for the data transfer.

4.8 Graphics Entry

For graphics entries, the IGT K 8919.11 has the graphics tablet K 6405.10 as well as two thumbwheels available on the keyboard. These are two wheels, arranged vertically to each other, which can be user-adjusted and are used to position the graphics cursor (cross hair) on the screen. Graphics entries are possible only if they are preceded by a special command which specifies the graphics input device desired and the input function. For graphics entry functions, the IGT K 8919.11 supports the LOCATE, PICK and STROKE functions. The LOCATE function is used to located individual points. It applies to the tablet and the thumbwheels. As a result of a LOCATE entry, the host receives a report with a coordinate point entered by the user.

The PICK function is used to select a segment. In addition to the XY-coordinate of the graphics cursor, the report sent to the host also contains a key code, the segment number of the segments selected, as well as the pick identifier for the corresponding graphic primitive. With this type of entry, a special command can be used to define a resolution in the form of a small square which is used to detérmine the precision of the cross hair position when picking the picture element.

The STROKE function is used for the continuous entry of point sequences as they are required, for instance, when scanning a graphics master. Therefore, it works only in connection with the tablet. To reduce the amount of data generated when moving the cursor, two filters are available, a distance filter and a time filter. Both can be used separately and in combination. The distance filter suppresses a STROKE report until a minimum distance to the subsequent input point has been exceeded. The time filter has a similar function. It ensures that the actual input position is scanned only at discrete, user-programmable time intervals. As a visual acknowledgement to the user, the terminal can automatically connect the points entered by lines visible on the screen..

To facilitate interactive work, the K 8919.11 terminal is able to define a separate graphics cursor as a segment for each of the various input devices. On the one hand, this ensures good differentiation when input requests change constantly (dialog mode) and it is also required for the real-time placement of segments by the user (immediate effect).

By defining an invisible grid in the entry area the number of possible entry positions for the LOCATE and PICK functions can be limited so that only those entry values will be accepted which are within the grid positions.

GDR Applying Digital Imaging Techniques to Production Quality Control

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[Article by Dr A. Geschke and B. Eckelt of VEB Robotron-Sales, East Berlin: "Digital Image Processing for Production Quality Control"]

[Text] Automated production demands, among other things, visual inspection systems that provide reliable quality information free of subjective influences. In many cases here, the creation of highly specialized image detection systems—to monitor the position and completion of work pieces or to recognize tolerance deviations, surface irregularities, etc.—is regarded as the only solution. However, since such systems demand high expenditures in development, and with their fixation on stationary types of objects or fixed object parameters are in conflict with the flexibility of modern automated production systems, their area of application is limited. In addition, digital image processing is a very young field of science, and is continuing to develop at a consistently rapid pace; however, new image processing methods and algorithms can scarcely be taken into account in existing special equipment.

A remedy is offered by universal image processing systems (BVS), which with corresponding basic software can be easily adapted to special requirements, thus ensuring a high level of flexibility for the entire system. Even if such a BVS cannot be immediately incorporated into the production process in the event of time constraints, it still offers excellent possibilities for algorithm development and testing, as well as indispensible assistance in designing or adapting special image processing components.

Both in the research and development phase and in direct production applications, a universal BVS can be used to achieve high economic effects and to attain the variability necessary for production with a high rate of replacement.

1. Equipment Technology of the Robotron Combine

The Robotron combine has for several years produced image processing systems of various capacities, under the model number A6470. All the systems are based on the K1630 small computer with the peripherals (cassette-disk memory, magnetic tape equipment, printer, etc.) and components specific to image processing that are standard in the small computer system (SKR) (1).

The image processing component of the BVS A6471 is a graphics unit with 768 x 512 x 8 bits, which features a video input and output, and thus is capable of a direct link to a television camera and to the system's color monitor. For interactive access—e.g., to position the cursor (reticle) provided by the hardware on a particular image point, to set non-numeric parameters for processing functions or to indicate features, the system also has a freely programmable track ball.

The BVS A6472 (Figure 1) has, in addition to a graphics unit, color monitor and track ball, four image memory units with 512 x 512 x 8 bits and a special processing phase (display processor). This makes it possible in the video phase to perform a number of arithmetic and logic operations between memory-resident images and temporary images provided via the video input. This means that image data pass the display processing at a data rate of 12.5 Mbytes/s and are subjected, almost simultaneously, to up to 30 different transformations, combinations and statistical evaluations in the pipelining, thus in sequential computing units. Each second, 25 result images are generated, which makes it possible on the one hand to perform on-line processing of moving images, given an adequate level of quality of the image data provided, and on the other hand to execute extensive algorithms for preparing and evaluating qualitatively inferior images, all in the course of a few seconds.

The BVS A6473 consists of up to four A6472 systems, a joint memory and a dispatcher computer. It is thus capable of processing large volumes of image data at high speeds and of performing the coordinated evaluation of data from various image recording stations.

Each of systems named can be coupled with the film input/output unit (FEAG) by VEB Carl Zeiss in Jena, which allows high-resolution scanning of films and the storage of image data on sheet film and microfiche.

Available Software

The software prepared for this image processing system is in keeping with its universal character. For use in the industrial testing process, there are the AMBA/R (BVS A6471) and DIXI (BVS A6472/73) software packages. Using these various software programs, which are adapted to the hardware, objects can be recognized and measured in the image, and can also be sorted by the user into established classes. These software packages permit on the one hand rapid automatic evaluation of the current image scene and on the other hand a high degree of interactivity. The latter means that it allows the user to watch the processing functions as they are taking place, as well as to interrupt with specific input, the effects of which are echoed back to the user. Because of this, this technology can be used to perform tasks that require more than the detection of clearly visible defects in the image with simple threshold operations and the classification of the image content based on their frequency (2).

We will now present a short summary of the basic progression of an image analysis, with an indication of the extent of potential applications based on several examples.

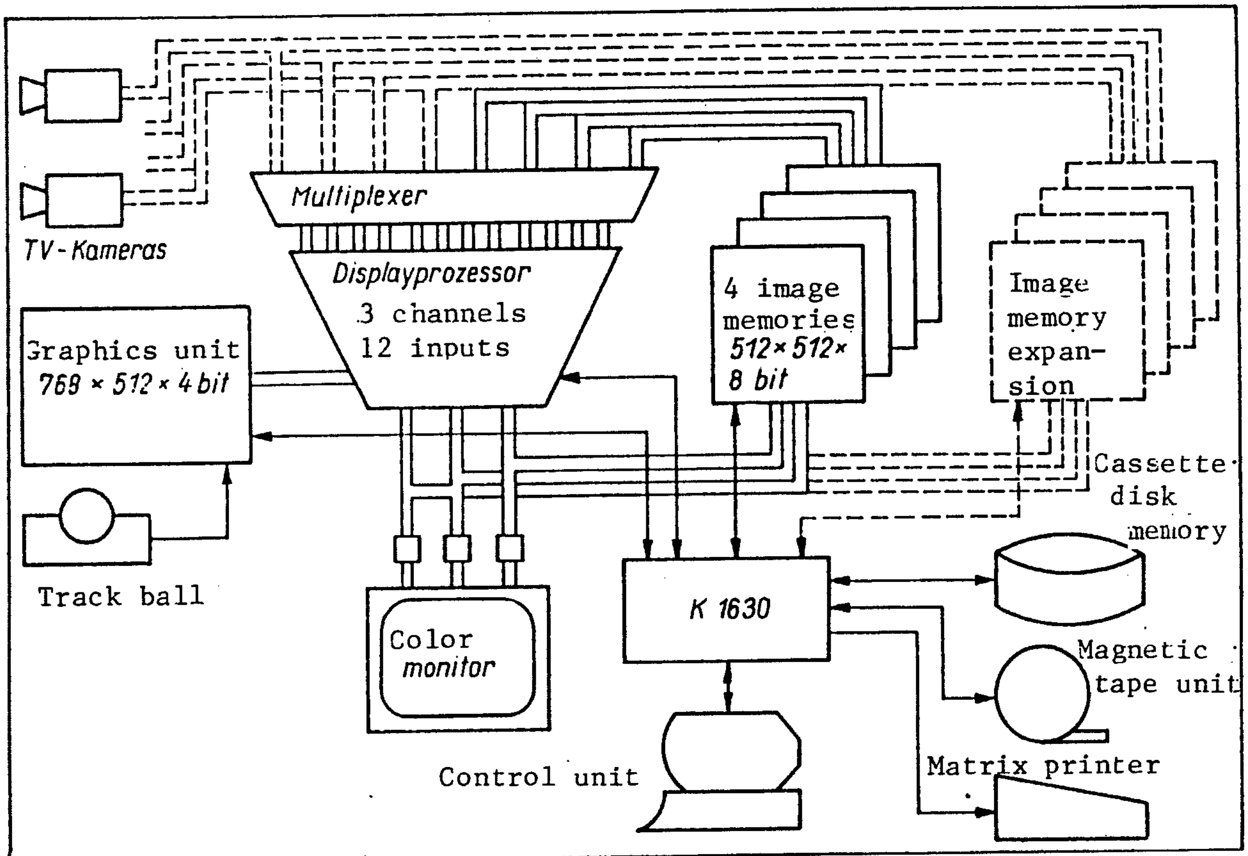

Figure 1. Structure of the Robotron A6472 Universal Image Processing System

3. Basic Potential Applications of Digital Image Processing in the Industrial Testing Process

As a result of the great variety in methods and goals of visual inspection during the testing process, there are a number of different performance requirements made of an image processing system. These demands can be roughly classified as follows:

- Preparation of images through contrast stretching, noise reduction, restoration, etc. in order to support visual interpretation
- Semiautomatic image evaluation, whereby the critical processing steps take place interactively or, after a preliminary classification by the computer, all final decisions are made by humans
- Fully automatic image evaluation

Although each of the related areas of application is apparently independent, this breakdown conceals a hierarchy in approaching a solution to problems in the area of image processing. Thus, the preparation of image data, which is accorded an independent role for visualization in X-ray television chains, is a necessary precondition for the semiautomatic or fully automatic evaluation of X-ray television images. Semiautomatic, interactive classification is in turn generally a necessary preliminary stage for developing an automatic system.

4. Generally Valid Image Processing Steps for Industrial Applications

Although the number of technologies with visual control is very large and the tasks faced are often very different, there are also many common features. For this reason, the individual processing steps in a processing sequence can be summarized, as follows:

- Image input
- Preprocessing (image enhancement and restoration)
- Segmentation and object measurement
- Classification
- Information output and documentation

For digital image processing, it is important to have a clear definition of the interfaces to the industrial process. On the input side is the TV camera or a film scanner (FEAG). With a certain expenditure on hardware, to be borne by the user, inputting can also be handled using special sensors. It is important here that the sensor be externally synchronized, since the clock rate is determined by the computer. There is a great deal of variety in potential output interfaces. Color or gray-shade images on the monitor, film output on the FEAG, printouts of the images with up to 17 gray levels or alphanumeric results on the printer are possibilities, as is the option of emitting signals via standardized computer interfaces, which can be utilized by the user for process control (e.g., by controlling engines). Software response to the input and output is guaranteed.

4.1. Image Input and Preprocessing

For all image processing tasks, the preprocessing step has proven to be a critical precondition for the quality of the further processing. The standard operations include noise reduction, contrast stretching and edge reinforcement.

All image-providing systems involve a loss of information with respect to the real object. This is caused by the geometric and radiometric resolution of the image (sharpness of image or contrast, number of gray shades), which is lower than that of the eye, and the geometric or radiometric distortion of the recording system (e.g., edge shading when using super wide-angle lenses or nonlinear gray-shade conversion). In addition, for all electronic processes there is a noise spectrum that is superimposed on the image and must be suppressed by special filtering operations. Using simple averaging filters, however, this results in a blurring of edges and structures, and thus an unclear image. Some special filters maintain the edges, but are computer time-intensive. If there is adequate time in the process to take several television images of the object, the information from these images can be used (accumulation) to achieve a discernible suppression of random noise.

Edge shading and nonhomogeneous lighting of the object represent another source of numerous misinterpretations. Although it is a basic rule of automatic evaluation that the expenditure on a good image should correspond as much as possible to the size of the information chain, and thus that uniform, favorable lighting and well-adjusted sensor technology should be ensured, it is a fact that computer-based adjustment of nonhomogenity generally cannot be avoided entirely. One good method is to produce a blurred mask of the image, which is generated by producing the output image in a large window (window dimensions greater than 15 x 15 pixels). The mask represents the average brightness of the image. The difference between the mask and the output image reinforces the object in the image and equalizes the background. By applying gradient filters or other operators (e.g., Laplace or Sobel operators) to the image, the edges of the object can be emphasized.

Pixel restoration is also one of the basic algorithms of preprocessing. In the event of failure of an element of the recording system, the accumulation of images results in reinforcement of the faulty pixel. A special filter compares each pixel with its environment and adjusts its gray shade to the average gray shade of the environment if there is a significant difference between it and all adjacent pixels.

4.2. Segmentation and Object Measurement

The goal of segmentation is to divide a complex scene into significant, simpler components in such a way that all objects can be further analyzed. The most important feature in image analysis is the gray shade. Locally homogenous distributions of gray shades indicate closed regions that are delimited from the environment by edges (gray-shade jumps). An additional feature is the gray shades of multispectral or multitemporal image sequences—thus, several pictures of an object in various spectral ranges (e.g., color) or at various points in time (e.g., movement). A major role is also played by the texture of surfaces; however, recording and evaluating them for image analysis is still a subject of intensive research.

For segmenting simple scenes, the object-background distinction can be made through binarization. In this case, the recorded gray shade range is divided by the threshold value into two ranges, which represent the background and the object. For example, all gray shades up to the threshold are coded as black, all above it as white. The threshold can be derived from the histogram interactively or automatically. If, for example, there are relatively dark objects against a bright background, the threshold can clearly be placed in the valley between the histogram maximums, thus making the object stand out so that it can be measured and divided into classes on the basis of the determined densitometric (optical density) and morphological (shape) parameters.

4.3. Classification

Separated objects are classified by comparing given features (e.g., gray shade or color, surface area, contour length, shape). Selection of the most suitable features is essential. To this end, the reliability (quality) of the features must be assessed.

The problem with classification is establishing separating functions in the feature range that make it possible to distinguish between all objects. As elucidation, Figure 3 [not reproduced] shows the features "surface area" and "gray shade" for classifying objects. The z-axis represents the frequency (e.g., quantity). The parameters of the classifier that determine separating functions can be determined either automatically using a search for cluster points in the feature range (cluster analysis) or through random samples for each class (monitored classification, trained classifier).

4.4. Information Output and Documentation

The result of classification is information on the frequency of the appearance of the object class in the image, e.g., as a quantity or amount of area. The classified image can be output at the printer for documentation purposes. Texts and numbers describing the defect (size, position, frequency, test score) and the prior history of the test object (e.g., test segment number, test process, tester number) can be inserted into the printout. Filing is done sensibly in a compressed form on external mass memory, such as on magnetic tape.

Because of the general nature of the tasks, modular components can be created that can be combined for the individual processing steps and that are used for various applications. This type of algorithm preparation (subprogram library) should enable the user to formulate and test his own technologies in order to arrive at permanent, optimized processes.

5. Examples of Applications

5.1. Crack Detection and Measurement

The task is to detect a crack and measure its width. The basic material has notches and scratches that also run in a straight line and in the most disadvantageous case have the same contrast to the background as the "actual" crack. By mounting the work piece, it is possible to ensure that the crack is vertical, about in the middle of the image. The crack width fluctuates around the nominal value by no more than 20 percent, and measurement uncertainty should be smaller than five percent. Evaluation time should not exceed 5 s. The work pieces are divided into quality groups based on deviations, and the measured values for the entire lot are stored and then statistically evaluated.

The basic solution that was implemented in AMBA/R uses the accumulation of more than 50 line segments. In this way, only the vertical cracks are reinforced, while all others are "averaged away." Because of the given standard width and the permissible deviations, only the measured crack remains in the result. The crack width is now determined automatically and the result is compared to the nominal value.

Other areas of application can be drawn up directly with the AMBA/R-TECH software package. The user is given complete programs with which it is immediately possible to solve a large class of tasks of structural and textural analysis. One example is analyzing globular graphite in stably solidified cast iron. Quality control, which is determined by surface area and by the shape of the inclusions, is of paramount importance here. Besides diameter distribution, the distribution function of spatial parameters is also calculated in order to increase reliability.

5.2. Automatic Evaluation of X-Ray and Isotopic Images

There is a need in mechanical and plant engineering, depending on the planned conditions for use, to subject all weldings or individual samples to a nondestructive test, e.g., using ultrasound or radiation methods. The latter in particular has been regarded in the past as a technique that cannot be automated. The only outstanding technical innovation in recent decades in the area of industrial X-ray testing is the development of X-ray television chains. Although various manufacturers offer analog and digital components for noise reduction and contrast stretching in television chains—some of them even featuring visualization stations that permit zooming and other interactive manipulations on the television screen—only weak efforts have been made to create automated evaluation systems, even on an international level. The reason for this is not the lack of economic feasibility of such a system—on the contrary, it promises to be of great economic benefit—but rather the specifications of the X-ray images.

On the one hand, the images provided by X-ray television chains feature strong noise, low contrast and generally nonhomogeneous illumination of the image field. On the other hand, the variety of welding shapes and potential types of defect demand an image analysis that is too complex to be realized by current sequential computers in an appropriate period of time. Special hardware for these tasks is not anticipated at present, due to the inadequate level of know-how.

Since, as noted earlier, the BVS A6472/73 with its rapid video phase is able to involve camera images on-line in the processing and to work on parallelizable algorithms in few "image runs," work is currently under way on using it to evaluate radiation images. Since this is new terrain, involving a very complex problem, it should not be expected that a turnkey, production-efficient total system can be prepared over night.

At present, the DIXI (Digital Inspection of X-Ray Images) program package and a subprogram library contain algorithms that are proving useful in preparing and evaluating industrial X-ray images. For potential users this is an initial "hand tool" for application-oriented research (3). The series of images seen here [not reproduced] shows various interim results of defect detection using DIXI programs with an isotopic picture scanned from the film with the camera. The processing phase took place within the course of several minutes, partially in parallel in the display processor (accumulation, restoration, background modelling, subtraction and edge detection) and in part sequentially in the control computer (object measurement and classification).

By perfecting the algorithms, optimizing their running time and chaining subprograms to a program adapted to the special application, it is expected that processing time, including image input and error logging, can be reduced to around 2 min for each 10 cm of welding. In this way, the evaluation time would be in the same order of magnitude as the propulsion speed of welder robots and, in view of the proportionate time devoted to exposure and developing, roughly equivalent to a visual inspection of the film.

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METALLURGICAL INDUSTRIES

Advances in GDR Welding, Metal Processing on Display at Leipzig Fair

Metal-Cutting Machinery

23020051 East Berlin FERTIGUNGSTECHNIK UND BETRIEB in German No 3, 1989, pp 140-142

[Article by chief engr H.-J. Barth, Chamber of Technology, 7 October Machine Tool Combine VEB, Berlin: "Metal-Cutting Machine Tools of the 7 October Machine Tool Combine VEB, Berlin, at the 1989 Leipzig Spring Fair"]

[Text]

0. Introduction

The leading theme of the 1989 Leipzig Spring Fair "Flexible Automation" is made clear in many ways by the 7 October Machine Tool Combine VEB, Berlin. Shown are user-related problem solutions as production lines, production elements and individual machinery for processing rotation-symmetric workpieces.

One focal point is flexible automation in large-scale production, represented by sections of production lines for the roller bearing industry, the automobile and transmission-building industries. In general, export of complete installations represents an important part of the output offered by the 7 October Machine Tool Combine. In planning and delivering complex technologies, the combine can look back on many years of experience.

Automated solutions for small and medium-series manufacturing can be worked out through flexible automation modules. The production program of the 7 October Machine Tool Combine VEB, Berlin, includes a wide range of lathes, circular grinding machines and gear-cutting machines, which, executed as machining centers and production elements and supplemented by linkage, diagnostic, and measurement technology, in practice represent automation modules. Various examples of this are shown.

However, in addition to machine tools, assembly lines and systems, a varied program of abrasive wheels, pneumatic tools and machine tool-specific feed motors is included in the combine's production and exhibition program.

A few exhibits are presented.

Flexible Assembly Line for Processing Chuck Parts for FS DFF 2/124

A section of an assembly line for lathe processing of chuck parts is being shown by the Hermann Matern Machine Tool Factory VEB, Magdeburg. This assembly line is designed for use in large-scale production, particularly in the vehicle industry, transmission building and in the roller bearing industry. The achievement of a minimal production surface was a major concern in the development.

The principal component of this section is the newly developed two-spindle DFF 2/124 CNC front-operated lathe. It is part of a modular construction kit of front-operated lathes for highly productive processing of chuck parts. This section is supplemented by

- a portal loader for simultaneous workpiece exchange at both machine spindles
- a conveyor belt installation for transportation and storage of workpieces
- an external measurement station
- automatic shavings removal and
- a CNC [computer numerical control] 700 control system with PC components for the entire section.

Studies and practical experience have shown that, depending on the processing task, linkage of up to five sections is effective.

Maximum workpiece diameter is 250 mm, maximum workpiece length 125 mm and the operating weight for the version shown is 2 x 10 kg.

2. Assembly Line for Processing FS W 63 Sliding Selector Shafts

Mikrosa VEB, Leipzig, has for years been delivering assembly lines for the complete processing of wavy and ring-shaped workpieces by means of centerless grinding. According to the nature of the production, these assembly lines find application in large-scale and mass production.

This year a section of a partially flexible assembly line for mechanical and thermal processing of sliding selector shafts was presented. This section consists of

- input storage
- washing machine
- various transportation facilities
- pass rolling machine UPWS 31,4,2

- centerless cylindrical surface grinder SASL5/AD
- distribution installations
- control installations
- several storage devices
- central control based on a PC 603.

Sliding selector shafts with a diameter of 19.6 mm in various lengths between 213 and 293 mm are processed. The capacity of the section amounts to 189 pieces/hour.

From the section's input bin the workpieces are automatically brought to the washing machine. After washing, they are brought to the pass rolling machine. Having been milled straight, they are automatically checked for straightness and length. Workpieces which do not come up to requested dimensions are segregated out. Through a storage bin the workpieces are fed to the centerless cylindrical surface grinder. The grinding process is size-controlled and operates with the pass-through method. The ground workpieces are then brought to another storage bin.

ZSTZ 10 EG-CNC Gear-Cutting Roller Grinding Machine for Cylindrical Gear Cutting With Electronic Transmissions

The ZSTZ 10 EG-CNC is a gear-cutting roller grinding machine operating in partial processing; it is being shown for the first time by the parent enterprise 7 October Machine Tool Combine VEB, Berlin, with electronic transmissions and a CNC control system. In the area of individual, small- and medium-scale series production in the transmission and machine-building industry, this machine permits the grinding of high-precision involute-shaped tooth profiles. Tooth profile modifications such as height and/or width crowning, can be achieved during the normal grinding rotation without additional time expenditure.

With two direct-current actuating drives the CNC control system executes all motion routines which are required for grinding, for producing tooth profile modifications and for executing auxiliary routines, such as adjustment and measurement.

Since the ZSTZ machines are constructed without change gears, they provide great operational convenience. Short piece and auxiliary times through motorized adjustment of the components, paired with hydrostatic guiding arrangements and bearing applications characterize their high user value and assure high teeth qualities. A complete cover prevents oil spray from escaping.

The following technical parameters characterize the application area of the machine:

Tip diameter, max.	1,000 mm
Root diameter, min.	50 mm
Number of teeth	5 to 500
Module	2 to 14 mm
Tooth width (>b0 = 0°), max.	265 mm
Helix angle, max.	45 degrees
Table load, max.	1,500 kg

4. SAW 6 Roller Bearing-Automatic Cylindrical Surface Grinder

The Karl-Marx-Stadt Grinding Machine Works VEB shows a special equipment variant of this large automatic grinder. It is designed for edge processing of the inner raceway of the 7536/02 tapered roller bearing. The largest grindable diameter with conical side construction is 355 mm, the maximum workpiece width 150 mm.

The following advantages are featured by the roller bearing-automatic grinder:

- Fully automatic grinding of the roller tracks of roller bearing rings and other ring-shaped workpieces in the area of large-scale and mass production
- Simultaneous processing of several operating spaces by means of combined operating and trueing methods
- Frontal construction with unobstructed input and output of workpieces
- For incorporation into production lines, linkage or robot connection is possible
- Microelectronic control enables for example process optimization, control of the feed axes and the abrasion process as well as the monitoring of lubrication, etc.

The following technical parameters apply to the standard version:

Grindable diameter, max.	315 mm
(in special versions up to	400 mm)
Workpiece width, max.	155 mm
Workpiece weight, max.	40 kg
Peripheral velocity of the abrasive wheel	35/50/60/m/s

5. 6230 Pneumatic Abrasive Planer

The Niles Compressed Air Tools VEB, Berlin, shows a varied program of turning and hammering hand-controlled compressed air machine tools. Low weight, high efficiency and good ergonomic design are characteristic of these products.

The 6230 abrasive planer is new. Combined with a diamond-coated cup grinding wheel, this installation is used for contra-rotating of CBN [not further identified] grinding wheels.

As we know, the application of ceramic bonded CBN grinding wheels is constantly increasing. A precondition for this is, however, that the grinding process can be mastered. Good experience was obtained internationally by using a pneumatically driven grinding spindle and metallic-bond diamond cup grinding wheel. A preferred application area for CBN use and thus for the abrasive planing unit is, for example, bore grinding in the roller bearing industry. Some technical data for the grinding unit:

External diameter	27f7
Length without grinding wheel	205 mm
Weight	0.45 kg
Direction of rotation	right
Idle-running speed	27,500 RPM
Air pressure for full load	0.68 MPa
Air consumption	0.4 m3/min
Output	175 W

The input takes place in a suitable manner in a slotted spring collet, diameter 27, H 7, maximum length 45 mm.

Metal-Forming Systems

23020051 East Berlin FERTIGUNGSTECHNIK UND BETRIEB in German No 3, 1989, pp 143-146

[Article by diplomate engineer B. Sickel, Chamber of Technology, Herbert Warnke Metal-Forming Technology Combine VEB, Erfurt: "Flexible Metal-Forming Systems at the 1989 Leipzig Spring Fair"]

[Text]

0. Introduction

The new and continued developments of automated metal-forming systems by the Herbert Warnke Metal-Forming Combine VEB in Erfurt stress the production profile of the combine. It is aimed at commercial production with increasing conversion frequency in the user industry.

The combine offers metal-forming systems constructed from modules with high reliability and capacity for specific need-oriented automation of production in small and medium-series production.

The exhibits of the 1989 Leipzig Spring Fair meet the efforts for higher efficiency. With increasing complexity in production and expanded program combinations, modern installations for metal-forming technology enable short throughput time, optimum machine utilization, good form and size accuracy, reduced material and energy consumption and significantly higher work productivity.

The exhibit program reflects the technological level reached and the advantages resulting from it for the user industry.

FC PE4-HHTr-500.1/3,500 x 1,800/630 FS E Production Element

Manufacturer: Herbert Warnke Metal-Forming Technology Combine VEB, Erfurt—parent enterprise.

The production element with the additionally developed PE 4 HHTr-500/3,500 x 1,800/630 FS basic transfer molding press represents the international trend of using automatic technological solutions with transfer technology, sheet bar feed, automatic stacking of parts and automatic tool changing for rational production.

With the exhibited products, medium-sized preformed sheets of the most varied geometric shapes can be competitively processed into a wide-ranging product line, such as exist in automobile manufacturing or the major household appliance industry.

The flexible production unit consists of the components:

- Sheet bar feed installation MZP (M) 1,800 x 600
- Transfer press PE 4-HHTr-500.1 FS E
- 3-D transfer
- Tools
- Removal facility MEF (E) 2100.

The individual modules and the facility are controlled by means of stored-programmable controls. The press, the sheet bar loader and the production unit are controlled by an SPS 7000.

An SPS EFE 720 controls the removal facility. For functions requiring a very brief reaction time in the sense of safety technology, the ESACONT press safety control system is employed.

The SPS [series-parallel-series memory] controls the automatic process routine, operating and job setting control as well as the diagnostic system.

Tool-dependent parameters for 16 workpieces as well as related processing data for the press and other components can be stored in the SPS and serve to control and monitor the automatic production routine including the tool change and the conversion to new processing data.

The control is used to switch types of routines and circuits for setting, automation, emergency shutdown, immediate stop and normal stop.

For the sheet bar feeding mechanism the pallet stack is driven in two carts behind each other to the unloader station. The sheet bars are individually lifted by suction devices, examined for double sheets and deposited in the deposit station. Sheet bar changing after one stack has been removed is done without interrupting the operation of the press.

At the working pace of the press, the deposited sheet bars are transferred from the tool-connected receiving station and transported to the individual work stations. Finally, the workpiece is deposited at a transfer station to be taken over by the removal installation.

Flexible production units of this type have special production and space advantages compared to the presses in the production line.

Work productivity in comparison with mechanized production lines grows to 160 percent, and the space requirement drops by 50 percent. The example of production of trim rings and spreader rings shows the automatic tool change and the production routine, demonstrates the reduction in auxiliary and nonproductive time and a productivity of 850 pieces/hour.

Technical Data

PE 4-HHTr-500.1 transfer press

Ram force	5,000 kN
Ram stroke	650 mm
Adjustability of the ram	50 mm
Operating steps	6
Ram surface	3,500 mm x 1,800 mm
Number of strokes, infinitely variable	10...25 strokes/min

MZP (M) Sheet bar feeder 1,800 x 600

Sheet bar dimensions	
Length	500...900 mm
Width	200...500 mm
Thickness	0.5...3 mm
Max. number of strokes in through-feed	20 strokes/min

MEF (E) 2100 Part Removal Installation

Max. number of strokes	20 strokes/min
Number of transportation steps	2
Longitudinal feed	990 mm/1,590 mm
Lifting strokes	90 mm
Distancing height	24 mm
Number of stacking hoppers	4
Output height	1,020 mm

2. Transfer Tool Kit for Production of "Trim Ring" and "Spreader Ring" Parts

Manufacturer: Schwarzenberg Mold Construction VEB

The transfer tools exhibited are mounted in the PE 4-HHTr-500.1 production unit. These tool kits have the same construction and are used to make the "trim ring" workpiece in six labor steps or after automatic change to fabricate the "spreader ring" in five labor steps. The individual tools are mounted on a base plate, on which the swivelling takeover and delivery stations for automatic tool change are also arranged. The position accuracy of the workpieces at the receiving and transfer stations as well as at the gripper elements are monitored by approach switches. Three depositing stations for the workpieces have been screwed in place between the lateral supports of the press on the lock box of the transfer. In changing tools the part rests and gripper rails between the supports are not exchanged.

When the exchanged tool kit is put down, the necessary spring release is achieved by pulling the rubber springs. The pneumatic control of the spring tension and the tiltable receiving and transfer stations are coupled and are controlled by the docking system.

The tools are equipped with quick-gripping plate chucks for automatic gripping.

These transfer tools assure short conversion times and high productive capacity. For example, automatic production of trim rings is 850 pieces/hour.

Technical Data

Number of strokes	1...25 strokes/min
Length	3,480 mm
Width	1,620 mm
Headroom	900 mm
Weight	12,500 kg

PEZZ 250-PC Flexible Forming Element for Production of Small and Medium-Sized Sheet-Metal Parts

Manufacturer: Gotha Sheet-Metal Processing Machine Works VEB

This production unit is adapted to the higher level of requirements in the principal user areas, such as the appliance, standard parts and consumer goods industries. Constructed with a high-performance modular unit with proven reliability, these metal-forming systems are easily adapted to a wide range of the most varied production duties and are delivered with the desired level of steps. Modern metal-forming systems meet the demand for automated, economical production in the field of medium and small series production.

To the production unit belongs the following principal equipment, among others:

- Sheet bar feeder with programmable lubricant dosage
- Modified PEZZ 250 two-column-two-position eccentric press
- Transfer facility with programmable feed step
- Tool change and tool storage system
- Automatic pallet timing facility
- Programmable control

With this unit small and medium-sized sheet-metal parts can be manufactured in three to five labor steps. Tool- as well as process-dependent parameters can be preprogrammed for 30 different workpieces. When the processing application of the tool is converted, all processing data are automatically changed to the preprogrammed tool-dependent ones. In changing tools, which takes place automatically, the gripper rails remain in the work space and the tool-specific gripper elements remain with the transfer tool kit.

The "conversion" of the facility is carried out in the framework of an autonomous operational mode and includes the principal steps:

- automatic gripping of the tools
- automatic coupling of the grippers with the transfer rail
- run-in and retraction of the tools
- automatic setting of the new production data for the individual modules.

Each module is individually controlled. It is connected through the overall control. Operator control, diagnostics, error tracing and monitoring of the process take place by means of video screen technology.

Production capacity is up to 2,700 pieces/hour, and productivity increases to 300 percent. Compared to manufacture with individual presses, a saving in equipment and space is achieved.

Technical data

Dimensions of the molding sheet bars,	
max.	400 mm x 400 mm
min.	diameter 130 mm
Sheet-metal thickness	0.5...4 mm
Sheet bar lubrication on both sides	programmable
Metal-forming steps, alternatively	3;4;5
Transfer step	programmable
Number of strokes, adjustable	15...45 strokes/min
Compression force	2,500 kN
Part output, alternatively	
- stacked in hoppers	
- optimized, dumped in hoppers	
Conversion process, automatic	5'

4. PYE 250.S.3 Automated Molding System

Manufacturer: Zeulenroda Machine Tool Factory VEB

The width of the technological application possibilities for the hydraulic open-front forging presses of the PYE product line from manual operation all the way to the linked automatic molding line are indicated with the molding system. The automated molding system represents a component in a flexible automated line for the production of small and medium-sized sheet-metal formed parts, such as are manufactured in the metal-processing industry. The various advantages of hydraulic presses are increasingly demonstrated by automation technology, in the interest of economic production. The automated molding system with conveyor belt processing line includes the further developed basic PYE S.3 machine and peripheral equipment technologies:

- MHH 500/2 winder
- MHR 500/2 aiming device
- MVWE 400/2 NC roller feed device
- STR 2 x 2000 rail transport robot

The molding machine has a new hydraulic control in modular construction based on the PN 32 valve kit. An electronic position sensor records the ram path. The facility is controlled by an EFE 700 microelectronic stored-memory routine control. An automatic tool change and tool clamping system in combination with the STR 2 x 2000 robot guarantees good flexibility.

By using the BSM 720 with software for the operating modes of error diagnostics, turn-on condition statement, status diagnosis, final position control and post-processing time indication, the demand for diagnostic functions and operator communication have been met.

The automatic process is carried out by means of microelectronic control of the machine in combination with microelectronic control of the feed and the tool change.

Rapid ram speeds, shortened auxiliary and nonproductive times, maximum operational safety and high productivity are user advantages, which result from the modular construction of this metal-forming system.

The flexibility and capability of the automatic molding system is shown by a working example for production of two different casserole parts. The quantitative output is 360 pieces/hour. Work productivity increases to 130 percent. Energy consumption is reduced by 3.5 kW.

Technical Data

PYE250.S3	
Rated compression force	2,500 kN
Pull-back force	470 kN
Ram speeds	
Rapid stroke, downward	280 mm/s
Operating speed	4.8 mm/s
Return stroke	180 mm/s
Ram stroke, max.	500 mm
Mounting height	800 mm
Band processing, width up to	400 mm

5. Production Lines for Welded Cans up to 100 mm Diameter

Manufacturer: Aue Sheet-Metal Processing Machine Works and Tool Manufacture VEB

The exhibit meets the requirements of the manufacturers of thin sheet-metal packages for greater output with reduced need for material, energy and space.

The efficiency of the further developed production line is based on high-performance, newly developed modules:

- KEAZHS 100/63 automated can manufacturing and welding machine
- KEAZL 100/63 automatic can laquering machine
- KEAZLT 100 automatic can drying machine
- KEXVBST 100 linkage facility
- KEADH 100 modular system

The components are constructed so that the required control precision and dynamic rigidity which the greater output of this line demands are reliably assured.

Combination of the three construction components of separation, flanging and seaming into a modular system makes it possible to achieve greater operational safety, an improvement in quality and reduced need for space. Higher welding speeds are achieved with the higher-output automated welders, and a considerable amount of tin plate is saved.

Arranged after the automatic welder is an automatic can lacquering and drying machine. By applying the laquer film, the welded longitudinal seam is protected against corrosion. Drying of the lacquer film takes place in a gas-heated can drying machine. The linkage installation takes over the can and leads it into the modular system.

The production line consists of five modules with their own controls. Three machines (KEAZHS, KEAZLT, KEADH) are equipped with EFE 700 stored-programmable controls. In conjunction with the process-dependent output parameters, the output of the line is automatically adjusted to the changing needs of the subsequent installations.

The user advantages of the production line consist, for example, in the productive capacity of 52,180 cans per hour, the saving of 2 t of tin plate, 5 kW electrical energy and two workmen. Compared to the previous technology, work productivity increases to 140 percent.

Technical Data

Welding speed	63 m/min
Capacity of pieces per hour, max.	
with single-height method	500 pieces/hour
with two-height method	900 pieces/hour
Can dimensions	
diameter	56...105 mm
height, with single-height method	80...140 mm
height, with two-height method	40... 70 mm

Developments in Welding Technology

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[Article by H. Domrau, engineer, Chamber of Technology, Central Institute for Welding Technology of the GDR, Halle (Saale): "GDR Welding Technology at the 1989 Leipzig Spring Fair"]

[Text]

0. Introduction

In 1989 the Central Institute for Welding Technology [ZIS] Halle and the enterprises of the Arc-Welding and Cutting, Resistance Welding, Plastic Welding and Gas Welding Technology production group are again represented by modern welding and cutting technologies as well as newly and further developed welding and cutting equipment at the Leipzig Spring Fair in Hall 11.

As partners of the user industry for all problems in automating the processes of welding technology, they also offer experience, performance readiness and licensing offers for new technical solutions.

Interesting new and further developments from the extensive output and production program of the GDR welding technology are presented.

1. Central Institute for Welding Technology of the GDR (ZIS Halle)

1.1. ZIS 15-23 Welding Robot Workstation With New Modules for Equipment in Welding Engineering

On the basis of the ZIS 995 construction kit system which has been proven over many years, an expanded, field-tested application example for MAG [not further identified] welding of test chamber walls is shown in 1989. This exhibition object differs from its predecessors by the use of newly developed components and modules. This creates preconditions for a further increase in effectiveness and reliability, and the international standard of such components is approximately taken into account.(1)

1.1.1. ZIS 14-67 Robot Welding Torch

The new ZIS 14-67 robot welding torch represents a complete component system, from which a suitable variant for all applications can be put together (Table 1). The supply of fuels to the burner is new. It is carried out decentrally through separate lines for inert gas, welding current, welding rod and cooling water, as well as separate signals. A quick-release plug-in connection makes it easy to exchange torches. 1.1.2. ZIS 15-02 Collision Protection

It is the task of the collision protection located in the burner area to reduce operational disturbances and to delimit service areas. The modified ZIS 15-02 collision protection is based on the function of two inductive initiators, which in a collision issue a signal for the robot facility to come to an emergency stop. The release force is continuously adjustable in the range of 20 to 50 N, the accuracy of the return to the initial position of the welding torch is given as +/- 0.2.

Table 1. Technical Data for the Robot Welding Torch

	RSB 250	RSB 400
Welding current in A	250	400
Operating time in percent	100	100
Diameter of rod in mm	0.8...1.2	1.0...2.0
water-cooled	no	yes
Sensor connection	yes	yes

Torch length in mm	250;320	250;320
Torch neck design	straight or curved 22° and 45°, resp.	

1.1.3. ZIS 14-70 Rod Feed System

The newly developed ZIS 14-70 rod feed system (Table 2) demonstrates the following advantages, among others, in comparison with previous technology:

- Constant rod feed provides constant welding parameters.
- A guide mechanism acting on two levels guarantees perfect rod feed
- Space-saving arrangement through integration of mechanical and electronic components in one housing

Additional accessory components increase the efficiency and reliability of this new system. Among them are:

- ZIS 14-90 rod supply with electronic rotary reserve and end of rod indicator.
- The ZIS 14-71 tension module to prevent the rod from buckling during welding with thin rods and/or long hollow cables.

1.1.4. ZIS 14-92 Gas Metering

The ZIS 14-92 device, also newly developed, for metering out and thus optimizing the amounts of inert gas offers new possibilities for rational use of the required operating materials (inert gases). In addition to metering the required quantities, it is further possible to detect the conditions "gas error" and "gas reserve" and pass them on to the processing control unit.

1.1.5. ZIS 14-69 Circulation Cooling Device

The newly developed ZIS 14-69 circulation cooling device is needed for use with water-cooled welding torches or sensors when no centrally operated cooling cycle is available.

1.1.6. IRS 711/ZIS 995 Robot Control

The IRS 711 robot control by the Karl-Marx-Stadt Numerical VEB, with an operational system integrated with the ZIS 995 tool kit, replaces the presently used IRS 650.

1.1.7. ZIS 13-06 Adapter Control

The coupling between the IRS 711 robot control and the overall unit for welding engineering equipment takes place with the newly developed ZIS 13-06 E adapter control. It permits program corrections during welding. A supplementary component group ZIS 13-06 SENS allows the connection of a maximum of three distance sensors.

ZIS 14-66 Spray Turning Mechanism

Powder-flame spraying has been used for some time in maintenance of agricultural equipment as a new rapid repair method. In addition to the ZIS 13-01 powder-flame spray burner, the development of suitable peripheral equipment became necessary.

The ZIS 14-66 spray turning mechanism with the ZIS 14085 control belonging to it was developed to take pivoting parts and a spraying device for thermal spraying with powder or rod. An actuating gear motor is used to turn the workpieces during spraying approximately equal to 20 m/min. The spraying device is moved between two adjustable limit switches with the moving cart from the ZIS 10-10 production line. The ZIS 14085 control is attached to the mechanism and permits control of the entire process (Table 3).

Table 3. Technical Data for the Spray Turning Mechanism

Diam. of pivoting part	20 to 150 mm
Pitch	400 mm
Part length	up to 1,200 mm
Part weight	up to 20 kg
Connected loads	1 kW; 380 V; 50 Hz; 2x6 A
Speed range	n = 44...254 RPM
Feed range	0.2...1.3 m/min

Special advantages to be mentioned are:

- Use of commercially available actuating gear motors
- Use of the ZIS 10-10 non-dust-sensitive roller chain motor for maintaining 4 mm/rev
- The spray turning device can also be used with another actuating gear for MAG welding (such as ZG 6/1-BKG1-KMR 7 1G6 1,15 to 4.6 RPM)
- Great operational safety since the suction funnel is carried along and is integrated into the spraying process
- The working height assures good operability
- Adjustments for turning, feed and working gas are possible both separately and combined.

1.3. K 85/ZIS 13-23 CNC Cutting Machine

Thermal cutting is increasingly becoming an integrated component of technological processing methods. This requirement is satisfied with the K 85/ZIS 13-23 CNC cutting machine (Table 4) developed by ZIS Halle. The basic construction is a cross-track machine with two to four slide rests and a working width of 2,500 mm. All the control electronics are mounted on the running gear of the machine. The drive unit for the running gear and the drive slide rest, which can trail up to three movable slide rests synchronously or mirror-inverted, is carried out by RSM 10 direct-current servomotors and WE 80 x 160 S spindle drives. A modified ursalog 5023 K control is employed. A punched tape is used to store data. In order to assure an optimal flame cut, the machine possesses the following additional functions:

- Burner height adjustment,
- automatic ignition,
- automatic punch (hole punching)

In comparison with conventional optoelectronically controlled machines, the following performance effects should be anticipated with use of the K 85/ZIS 13-23 CNC cutting machine:

- Reduction of the user's production surface by 35 to 40 percent, due to an average track length of 12 m
- Increase in material economy by 15 to 20 percent through component overlapping and cutting plane optimization
- Increase in cutting efficiency; the goal is an 80 to 85 percent operating factor
- A 15 percent improvement in the weight-output ratio, referring to machine weight and cutting volume.
- A 5 to 10 percent reduction in the cost per meter of cutting.

Table 4. Technical Data for the K 85/ZIS 13-23

Working width	2,500 mm
Cutting speed	up to 6,000 mm/min
Cutting thickness	5...200 mm
Number of burners	2 (4)
Method of operation	gas burner cutting or plasma cutting
Number of steerable axes	2 (X,Y)
Interpolation	2D, linear and circular
programmable	0.1 mm or
length of path, min.	1.0 mm, alternatively
Radius, max.	209.80 m
X path	17,32 m
Y path	6.62 m
Workpiece programming	ESSI format
	CODE EIA RS 244 or
	KOI 7
	(TGL 200-0862)
	Code recognition is automatic

2. Finsterwalde Welding Technology VEB at the Wilhelm Pieck Mansfeld-Combine VEB, Eisleben

The enterprises of the Arc-Welding Technology production group of the GDR show a multitude of new and further developed products in their exhibit program at the 1989 Leipzig Spring Fair. The exhibits express the effort of the enterprises to meet the demands for modern high-quality welding manufacture with products of high application efficiency and versatile operational value.

The exhibits are a representative cross-section of the delivery and output capability of the arc-welding technology of the GDR.

2.1. Complex Plasma Cutting Installations

Shown is the complete range of systems, consisting of types PA 3, PA 12 and PA 50 (2), as well as the newly developed air-cooled plasma-cutting unit PA 3 L, all of which were produced in joint development with the Manfred von Ardenne Research Institute.

The PA 3 L plasma-cutting unit is easily movable and can also be shifted by crane. It is preferable for cutting work in craftsmen's establishments, small and medium-sized enterprises and as workshop equipment, but it is also suitable for assembly work at construction sites. The cutting gas can be pressurized air (oil-free, dry) or nitrogen (technical data, see Table 5).

Table 5. Technical Data for Plasma-Cutting Installation PA 3 L

AC voltage	220,380,420,500 V (50 Hz, rotary current)	
Connecting output	14.5 kV . A	
Cutting voltage	25 A at 75% operating factor	
	40 A at 35% operating factor	
Nominal output	5.5 kV . A	
Cutting range	High-grade cutting	Separation cutting
- Construction steel	10 mm	16 mm
- CrNi	8 mm	12 mm
- Al	10 mm	16 mm
Dimensions (l x w x h)	710 mm x 344 mm x 640 mm	
Weight	85 kg	

The plasma torch hose package is 7.50 m long. The PB 3 HL can therefore cut even large workpiece dimensions or bulky construction parts. The facility is reliably protected against overloading by a thermal safety switch.

3. Wilhelm Pieck Mansfeld Combine VEB, Systems and Equipment Building Works

Among the proven exhibits for 1989 as well are:

- the MSG 60 S/3-D MIG/MAG welding equipment system
- the ZIS 726.1 WIG stabilized power source
- the MSS 2000 Mansfeld sensor welding control in combination with a longitudinal welding facility of ZIS 650 components for making fillet welds.

The MSS 2000 control can be used in combination with components from the ZIS 650 and ZIS 995 systems for MAG welding of continuous or interrupted weld seams, as desired. It is a component of the ZIS 650 tool kit system and with a mechanical path program memory takes over the control and adjustment functions of partially automated welding processes. In view of the process-related features of the arc-welding process and the variety of parts to be welded, the MSS 200 is offered in the three variants

- MSS 2030: Maximum control accumulation,
- MSS 2020: stripped-down variant with two travelling axes,

- MSS 2010: stripped-down variant with two sensor axes.

each with four variants (Table 6).

Table 6. Technical Data for MSS 200 Sensor Welding Control

Input voltage	6 x 48 V . Ws
Connection output	6 x 0.4 kV . A
Drive motors (drive axes)	3 x SSB 87/55
Armature voltage	0 to 40 V . Gs
Nominal armature voltage	6 A
Excitation voltage	38 to 40 V . Gs
Excitation current	0.25 A
relative working time	60%
Degree of protection according to TGL RGW 778	IP 21
Dimensions (l x w x h)	560 mm x 320 mm x 320 mm
Weight	25 kg
Temperature range	+5°up to +35°C
Program variants	
-X axis (welding motion)	8 programs
-Y, Z axes (feed motion)	6 programs
Connection possibilities	
- main axes (X, Y, Z axes)	3 (ZIS 650)
- auxiliary axes	4 (ZIS 995-T 100, T 250)
- rod feeds	2 (2 x SSB 87/55)
- solenoid valves	2 (40 EMV 1-2, 40 V . Gs)
Sensor heads	4 (U = 27 V . Gs, ; = 35 mA)
Sensor motors	4 (GSM 1223.3; max, 50 W)

4. Woltersdorfer Electrical Machines and Systems Construction VEB

4.1. MIG/MAG Compact Inert Gas-Welding Equipment System

The exhibited products of the Woltersdorfer Electrical Machines and Systems Construction VEB include a complete, in part further developed assortment of compact inert gas-welding equipment (Table 7). This configuration of equipment is suitable for construction sites as well as for the workshop area. The stepped performance areas permit optimal adjustment to the welding task.

Table 7. Technical Data for MIG/MAG Compact Protective Gear Product Line

	MIG/MAG 100	MIG/MAG 100.5	MIG/MAG 120.5	MIG/MAG 150	MIG/MAG 1600	MIG/MAG 200
Nominal voltage in V	220	220	220	220	220	3 x 380.5
No-load voltage	23...27	18.5...26	19...20	19...34	19...34	16 ..30***)
Welding current range in A	30...80	30...80*)	35...100**)	30...150	30...150	30 ..200
Manual welding operation in A		80 to 10 % operating time	100 with 10% operating time			
MAG				30...125		
MIG				30...150		
Range of weldable sheet-metal thickness in mm	0.6...2.5	0.6...2.5		0.6...4.0	0.6...4.0	
Rod diameter in mm	0.6...0.8	0.6...0.8	0.6...0.8	0.6...0.8	0.6.. 0.8	0.6...1.0
Rod spool	D 100	D 100, D 200	D 100, D 200	D 200, D 300	D 200, D 300	D 200, D 300
Diameter in mm	570 x 220 x 400	450 x 270 x 630	450 x 270 x 660	860 x 360 x 549	860 x 360 x 540	900 x 500 x 1,080
Weight in kg	20	26	27	47	47	85
Time program in s						Welding 0.2 to 3.5; pause 0.2...1.0

*) with 3 switching steps
**) with 4 switching steps
***) with 11 switching steps

5. Aue Electrical Welding Machine Works VEB

5.1. Band Butt-Welding Machine Type SP 0.8 with Electronic Annealing Program Control (New Development)

The welding machine exhibited represents the highest technical level in the field of band butt-welding machine technology. It is suitable for the production of high-grade butt-welding connections of band-shaped workpieces, in particular band-saw blades and rotation hoop knives for wood, metal, leather and textile processing.

Butt-seam welding and separation butt welding can be carried out. The electronic annealing program control permits thermal treatment for the material in question. This achieves optimal solidity for the welded connections.

Economic operation is guaranteed in both series and individual production (Table 8).

The principal features are:

- Microelectronic welding, drive and annealing control
- Direct evaluation of the temperature of the annealing spot
- Large setting range and exact reproducibility of all parameters
- Electromagnetic feed drive assures precise feed unit motion and high upsetting forces.
- Resettable feed drive control
- Height adjustment possible in restrained state
- Rapid setting of the jaw space from welding to annealing.

Table 8.

Nominal voltage	380 V, 50 Hz (standard version)
Nominal output	3.5 kV . A with 50% operating time
Connecting output	9.5 kV . A
Secondary short circuit current	14,000 A
Upsetting force, max.	850 N
Weldable bandwidths	16...45 mm
Weldable materials	unalloyed and alloyed steels, tool steels, C-steels, Ne metals and metal-coated materials, according to weldability
Type of cooling	natural air cooling
Dimensions: Width	540 mm
Height	420 mm
Depth	500 mm
Weight	about 90 kg

5.2. P2-500-6.3 f Foot-Operated Spot-Welding Machine (New Development)

This newly developed spot-welding machine (Table 9) is characterized by the following features:

- Economic use in individual and small-series production
- Production of high electrode forces with normally allowed foot pressure
- Electronic welding time limitation, as well as individual time control possible
- Expansion of the application area through the use of elbowed electrodes.

Table 9. Technical Data for P2-500-6.3 f Spot Welding Machine

Nominal primary voltage	380 V (standard version)
Frequency	50 Hz (standard version)
Connection output	19 kV . A
Nominal output	17 kV . A at 50% operating time 24 kV . A at 25% operating time
Secondary short circuit current	14,500 A
Electrode force	500...2,000 N
Electrode stroke	0...30 mm
Arm unloading	500 mm
Cooling water requirement	up to 100 l/h (according to load)
Working range for unalloyed steel with clean surface	
- sheet-metals	0.2...3.0 mm individual thickness
- rods	3.0...about 12 mm diameter
NE metals	according to weldability

6. Halle Construction Machine VEB

In order to automate the arc welding and resistance welding techniques, various types of welding robots continue to be required. The 1989 fair exhibit, consisting of the ZIS 995 component group and IRS 711 industrial robot control, is a combination of production process (joint and overlay welding) and automated charging.

7. Dresden Plastic Processing and Welding Technology VEB

7.1. MIG/MAG Robot Welding Torch

The RoB-S 250 and RoB-F 500 robot torches are MIG/MAG precision welding torches specially adapted to the welding robot technique. They are intended for inert gas-arc-welding with a fusible electrode in the fields of short shielded arc welding and spray arc welding. The burners have a highly reproducible positioning accuracy and can also be set for sensor-controlled welding tasks. Being a precision product, they meet process-specific demands for welding with robot technology by means of new types of patented function and construction solutions. The consistently high positioning accuracy remains even after exhanging the working parts or the torch (Table 10).

Table 10. Technical Data for Robot Welding Torch Product Line

	RoB 250	RoB-F 500
Welding current load carrying ability	200A at 80% oper. time for mixed gas/Ar 250 A at 80% oper. time for CO2 250 A at 60% oper. time for mixed gas/Ar 315 A at 60% oper. time for CO2	500 A at 100% oper. time for CO2, mixed gas/Ar

Welding rod diameter	0.8 to 1.6 mm	0.8 to 2.5 mm
Concentricity deviation (burner saving for contact nozzle acceptance)	max. 0.15 mm	
Cooling type	self-cooled	water-cooled (cooling water quantity 1.5 to 2 l/min)
Acceptance possibility for sensor technology	Control/distance sensors	
Dimensions Clamping	Diameter 31, H 8, L 32 mm	
Burner length (middle of clamping to front edge of nozzle)	174 mm	
Torch pipe	Diameter 22 mm	
Gas cap	Diameter 20 mm	
Cable length1.5; 2.0; 2.5 or 3 m		

7.2. AuB 315 S and AuB 630 F MIG/MAG Automatic Welding Torch

The AuB 315 S and AuB 630 F automatic torches are precision welding torches and can be attached, by means of various connecting parts, to welding machine components (BAL, BAM, BAS, Zis 650), automatic welders, rod feed mechanisms and specially built installations. They are intended for inert gas-arc-welding with fusible electrode in the short shielded arc welding and spray arc welding area and have optimal heat dissipation due to proven performance and construction solutions. The high positioning accuracy remains even after exchanging working parts or the burner.

High reliability and effective operating times are achieved through

- low-maintenance, easily serviced and solid burner construction
- good accessibility and rapid exchange of the principal wearing parts
- increased lifetime of the power contact nozzles
- simple splash elimination with a quick-exchange plug-in gas cap,
- possibility of cleaning out the inside of the burner with a thrust of compressed-air.

The small burner tube and gas cap diameter as well as the flexuous design permits good accessibility by the burner even to unfavorable seam locations. The externally cooled design of AuB 630 F has an internal cooling as well as a sliding external cooling on the burner pipe. The auxiliary component possibilities correspond with those of the ZIS 714/793 machine welding torch components.

Hans Beimler Combine VEB LEW

8.1. SK 63 Chain Butt-Welding Machine With Microelectronic Control

The SK 63 chain butt-welding machine is exhibited by the Hennigsdorf Combine VEB LEW as a flash-butt welding machine for chain welding with microelectronic control. The automatic machine is suitable for welding and burring cold-coiled and attached strings of chain with diameters between 14 and 26 mm and a maximum spacing of 100 mm according to the flaw butt welding method. It is designed for welding bar steel chains with guaranteed strengths of normal quality (TGL 12 969) and bar steel chains of high strength for the mining industry (TGL 16 473).

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