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Science and Technology Perspectives

DEVELOPMENTS

Information Sharing

(Cuba) A Soviet EC-1035 computer has been installed in the Data Processing Center of the Documentation and Information Institute at the Cuban Academy of Sciences. The computer will process data in the fields of biotechnology, medicine, electronics, and computer science. The Cubans plan to link the computer with data bases in the USSR and other CEMA countries. (Opole TRYBUNA OPOLSKA 19 Aug 86) STAT

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FEATURE ARTICLES: **BIOCOMPUTER RESEARCH**

REPORTS

PERSPECTIVES selections are based solely on foreign press, books and journals, or radio and television broadcasts. Some of the materials used in this publication will appear as abstracts or translations in FBIS serial reports. Comments and queries regarding this publication may be directed to the Center Chief, to individuals at the numbers listed with items, or to the Science and Technology Center [redacted] STAT

DEVELOPMENTS

DEVELOPMENTS highlights worldwide S&T events reported in the foreign media. Items followed by an asterisk will be published by FBIS. The contributor's name and telephone number are provided.

Advanced Automobile

(EC) Eureka has initiated the DRIVE program, a multiyear effort to develop advanced-technology automobiles. Designers plan to equip vehicles with on-board radar, weather sensors, and navigation systems all coordinated by a central computer. Eureka's PROMETHEUS project, which involves 13 automobile manufacturers and 40 research laboratories, differs from DRIVE in its focus on the application of currently available technologies. (AFP from AGRA Data Base 23 Sep 86) STAT

Aircraft Engine

(UK) Rolls-Royce recently unveiled its new RB.211-524D4D engine at the Farnborough Air Show. The engine can deliver a maximum thrust of 58,000 lbs, which represents a 20 percent increase over earlier 524-series engines, and offers substantial fuel savings over previous models. Certification is planned for March 1988. Rolls-Royce has made advance sales to 56 firms, including Boeing and British Airways, and is now developing improved versions of the 524D4D that are slated for production by the year 2000. The accompanying photo is the first to be released of the new engine. (Paris AIR & COSMOS 4 Oct 86)* STAT

Artificial Intelligence

(France) A prototype of the Marcoussis Laboratory's Applications Machine (MAIA) is being manufactured by two French firms, Amaia and Copernique. MAIA, which incorporates Lisp and Prolog instructions, is a multitask real-time system for use in robotics, CAD/CAM, and weapons development. (Paris SCIENCES ET TECHNIQUES Oct 86)* STAT STAT

(UK) The British companies Logica Cambridge and Logica Energy will cooperate with Shell Research and FBC in a new ALVEY project for development of an intelligent knowledge-based system (IKBS) to demonstrate the applicability of expert systems in industrial production processes. The companies also plan to develop building-block components which can be reused in other expert systems. (Amsterdam COMPUTERWORLD 23 Sep 86) STAT

Computer Compatibility

(West Europe) Eight of Europe's major computer hardware manufacturers are initiating research to develop compatible interfaces among their systems. An agreement between Siemens, Nixdorf, Philips, Olivetti, Stet, Bull, Thomson, and ICL was reached within the framework of the Standards Promotion and Application Group (SPAG). Formal announcement was made in Brussels on 2 October. (AFP from AGRA Data Base 27 Sep 86; Groot-Bijgaarden DE STANDAARD 3 Oct 86) STAT

Factory Automation

(France) Renault's director of information systems has announced that the company is preparing a pilot project to learn how to operate the Manufacturing Automation Protocol (MAP). Renault and PSA are the two French participants on the Steering Committee of the European MAP Users Group (EMUG). (Paris ZERO UN INFORMATIQUE 23 Sep 86) STAT

Ion Trap Mineral Detector

(USSR) Soviet physicists have designed an experimental ion trap to locate deeply buried ore deposits. The trap, which is mounted on 4-meter rods, captures characteristic ions emitted by the ore from hundreds of meters below the surface. A description of the trap is not currently available. The device is being tested at ore sites in Uzbekistan. (Moscow SOTSIALISTICHESKAYA INDUSTRIYA 6 Sep 86)* STAT

Microelectronics

(Hungary/GDR) Within the framework of a technical cooperation agreement to cover the period 1986-90, Hungary and the GDR will jointly develop equipment for the computer-aided design of ICs and the production of optoelectronic devices. The agreement also provides for possible GDR cooperation in reequipping the Microelectronics Enterprise (MEV) chip factory partially destroyed by fire last May. Some of the equipment used in MEV's bipolar production line was manufactured in the GDR. (Budapest HETIVILAGGAZDASAG No 36, 6 Sep 86) STAT

Nuclear Plant Safety

(Czechoslovakia) A psychological assessment section has been established at the Mochovce Nuclear Power Plant to help improve the selection of technical and management personnel. The section will screen prospective employees for all nuclear power plants. Applicants must pass a stringent battery of tests as a precondition to attend the special training course. Some 65 percent of applicants fail to meet the requirements. Many of those rejected are reportedly honor graduates of university technical institutes who have already built successful professional careers. (Prague RUDE PRAVO 28 Aug 86) STAT

Plasma Diagnostic Equipment

(Hungary) The Central Physics Research Institute (KFKI) has developed plasma diagnostic instruments which are being sent to Moscow for installation at the Korchatov Institute's thermonuclear facility, which is under construction. The instrument measures plasma radiation in the X-ray range and determines plasma composition and temperature on the basis of wavelength and radiation intensity. A dual-remote infrared laser source for measuring plasma density is currently under development. The design of both instruments is the result of KFKI research on plasma vibration and the behavior of impurities. (Budapest IMPULZUS No 18, 6 Sep 86) STAT STAT

Robotics

(Hungary) The HODGEP Machine Factory has purchased a ZIM-10 and ZIM-60 robot from the GDR at a cost of 1 to 2 million forints each. Installation of the ZIM-10, which removes corrosion by ejecting a granular spray, was completed in 1985 and is expected to begin operation soon. The ZIM-60 is being installed in a machining plant where it will move work pieces between lathes. HODGEP's director of production says his company and the Tungsram Works will coordinate domestic robot production under the government's new factory automation program. (Budapest MAGYAR HIRLAP 4 Sep 86) STAT

JAPAN: BIOCHIP R&D

Key Points: A project to promote biochip technology is slated to begin this year with research to be conducted over a 10-year period. The Japanese Government regards this technology as crucial to the development of a biocomputer with pattern recognition and learning capabilities.

The Ministry of International Trade and Industry's Agency of Industrial Science and Technology (MITI/AIST) will launch a biochip research project to be conducted as part of the agency's Basic Technology R&D System for Next-Generation Industries program, according to Tokyo press reports in August and September. Because of the project's length and expense (110 million yen for the first two years alone), MITI has decided that it will be undertaken by private firms commissioned by AIST and coordinated by the New Function Chip R&D Association (headed by Sadakazu Shindo, honorary chairman of Mitsubishi Electric) and AIST's Electrotechnical Laboratory. MITI reportedly began in late September to designate those electronics and biotechnology firms that will participate in the project. The Ministry will assign research duties to each firm by the end of this year. The names of the firms and their possible research functions have not been made public.

In the Japanese view, the biochip will circumvent the limitations inherent in chip miniaturization and large-scale integration using electron beam or X-ray processing technology. Moreover, Japanese researchers believe that Neumann-type processing is inadequate to handle the data and numeric computation needed in developing an artificial intelligence capability. The aim of the MITI project is to design a biochip by mimicking the information processing functions (bioarchitecture) of organisms having relatively simple nervous systems.

The MITI bulletin TSUSANSHO KOHO of 9 September presents an overview of the project but offers little information on specific organisms and biomolecules under study, laboratory procedures to be used, or modeling techniques being developed.

The project schedule has divided biochip R&D into three broad stages. As a first step, scientists will analyze the nervous systems of lower animals to determine the ways in which learning and memory are built. To accomplish this, the Japanese will develop noninvasive methods for observing the nervous activities of organisms. The resulting data will be used to design models that mimic these processes. In the second stage a study will be made of biomolecule plasticity and of the self-assembly and recognition capabilities that molecules utilize in building organic complexes. Based on this data, scientists reportedly will develop models that duplicate molecular organization processes. Although AIST envisions a third step involving prototype production of biochips, TSUSANSHO KOHO does not explain how data gathered from biomimetic modeling would be converted into a biochip blueprint. Moreover, the bulletin gives no indication as to the fabrication technologies that might be employed.

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USSR: TOP BIOPHYSICIST DETAILS BIOCOMPUTER RESEARCH

Key Points: A leading Soviet physicist is optimistic that biochemical research will result in the identification of organic substances useful in the development of a biocomputer. To this end, Soviet scientists are focusing attention on energy conversion techniques, photopigment technology, and biochemical films.

Soviet efforts to develop a biocomputer are being driven by a belief that organically derived energy systems, microsensors, and switches will be technological realities in "the near future" and that microtechnology based on organic substances will become a major force in computer R&D over the next 10 to 15 years, according to an interview with G. Ivanitskiy, director of the Institute of Biophysics of the USSR Academy of Sciences, in NTR: PROBLEMY I RESHENIY No 10 (June 1986). Ivanitskiy notes that "living systems employ the most efficient means of converting chemical energy into mechanical energy." The conversion does not require special conditions because it occurs at room temperature and under low pressure. The energy produced is 10 to 100 times greater than that generated by a magnetic field.

Ivanitskiy observes that current advances in molecular biology have made it possible to design biosensors with predetermined properties, selective reaction, and high sensitivity. He notes that the Institute of Biophysics has experimented with protein crystal-based sensors in which a sensor was used to detect minute changes in lysozyme protein. A second approach would be the design of microsensors that utilize bioluminescence. For example, the bacterium *Halobacterium halobium* uses the pigment rhodopsin to convert light into electrochemical energy. Rhodopsin present in bacteria is called bacteriorhodopsin. Of the photopigments tested, bacteriorhodopsin offers the greatest promise for application in sensors.

Biocomputer memory devices could be based on bacteriorhodopsin. The Institute of Biophysics discovered that dehydrated bacteriorhodopsin can be stopped at a specific stage of its photochemical cycle without loss of an image imprinted on it. As a result, the Institute developed a bacteriorhodopsin-based photofilm which after several years of development was improved to such an extent that it "surpassed all known photochromes," according to Ivanitskiy. Biochrome materials acted upon by a laser, which would enable the rapid recording or erasing of optical information, provide a basis for development of memory devices. Ivanitskiy asserts that the information contained in a "large library" could be stored on a biochrome disk the size of a long-playing record.

Ivanitskiy predicts a transition from discrete calculation procedures to wave procedures by using computer devices on biological films or through autowave chemical reactions. He asserts that under certain conditions crystalline-protein and enzyme films could act as the media through which autowaves are propagated. A wave moving through a biochemical medium at a speed of only 0.1 mm per second can produce 1 million operations per second. A plane wave moving through a film measuring 1 square centimeter could produce 10 trillion switching procedures per second. Ivanitskiy states that some autowave reactions have color or are fluorescent, making them potentially useful as analog computing devices.

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REPORTS

REPORTS surveys science and technology trends as detailed in articles, books, and journals. It also includes summaries and listings of articles and books which may serve as potential sources for future research. Conference proceedings will occasionally be presented in this section.

USSR: NEW PUBLICATIONS

BOOK ON FERMENTATION TECHNOLOGY

A systematic survey is made of current fermentor design and equipment in the 1986 book "Fermentation Systems" ("Sistemy fermentatsii") by U. E. Viyestur, A. M. Kuznetsov, and V. V. Savenkov, of the Institute of Microbiology imeni A. Kirkenshteyn, Latvian SSR Academy of Sciences. Scale-up of fermentors, principles of growth and biosynthesis modeling, and the use of computers to monitor and control fermentation processes are discussed. Data are presented on the assembly fermentation systems FU-8 and FU-30, which were developed by the authors. This book represents the first Soviet attempt to systematize various biotechnical processes and relate them to fermentor capabilities.

(A translation of the table of contents and annotation will appear in USSR REPORT: LIFE SCIENCES.)

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BOOK ON POWER PLANT EQUIPMENT

The 1986 book "Electrical Equipment for Thermal and Nuclear Power Plants" ("Elektrooborudovaniye teplovykh i atomnykh elektrostantsiy") by L.D. Rozhkova and Ye. Dobrodeyev discusses generators, transformers, and distributing devices. It details construction principles for thermal and nuclear power plants, characteristics of machine and power feed systems, and simple methods for calculating short circuit currents. The book also provides information on relays as well as automation and signal systems at power plants. This textbook is intended for secondary electronics schools.

(A translation of the tables of contents and annotation will appear in USSR REPORT: ENGINEERING AND EQUIPMENT.)

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REPORT ON LASER-PLASMA METALLURGY

The May 1986 issue of "Surface Science: Physics, Chemistry, and Mechanics" ("Poverkhnost: Fizika, Khimiya i Mekhanika, No 5") carries a one-page report on the 1984 1st All-Union Conference on Laser Metallurgy and Laser-Plasma Processing. This is the first mention of the conference in Soviet scientific literature. Papers presented at the conference covered such topics as combined laser-arc discharge effects on surfaces, laser effects combined with ultrasound, and the physical parameters of laser plasma effects. Much attention was given to laser-plasma synthesis on surfaces of refractory metals such as nitride, carbide, oxycarbide, and carbohydride. The subject of iron-based alloy laser alloying was also addressed. Many of the papers were devoted to laser-induced changes in the properties of materials. In the area of electronics applications, the report noted that laser-aided manufacture of semiconductors was examined.

(A translation of this report will appear in USSR REPORT: ENGINEERING AND EQUIPMENT.)

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JAPAN: NEW CVD METHOD PRODUCES HIGHER QUALITY METALLIC THIN FILM

A new CVD (chemical vapor deposition) method has produced a higher-quality metallic thin film for use in semiconductor devices. The process reportedly has eliminated the drawbacks of the hot CVD approach.

Fujitsu has developed a method of producing high-quality metallic thin film by bringing a magnetic field close to the substrate surface of LSIs (large scale integrated circuits) and increasing the density of the organometallic plasma. NIKKEI SANGYO SHIMBUN of 6 September reported that this magnetron CVD produces film with a finer crystal grain structure and a smoother surface than was previously possible. The film quality is such that it does not deteriorate even after heat treatment, making it useful in the production of semiconductor devices. High quality film can be formed with sputtering techniques, but it is difficult to form uniform-quality film on the lateral surface of the layered portions of multi-layered wiring patterns. Although burnout does not occur with the hot CVD or plasma CVD approach, researchers have encountered oxidation, heat-induced crystal grain disarray, and increased impurity levels.

Fujitsu developed this new thin-film method by turning its attention to the plasma-sealing effect of a magnetic field. Using the magnetron phenomenon, the plasma can be generated locally at the required high densities. Moreover, as there is no need to maintain high temperatures, oxidation is prevented and high-quality thin film is produced in an efficient manner. Aluminum film, which is used most often in semiconductor devices, has been produced in experiments using this technique. The electrical resistivity obtained was comparable to that produced by traditional methods, but microprocessing precision is enhanced because the film is finer and smoother.

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CHINA: WHITE PAPER ON SCIENCE AND TECHNOLOGY

The State Science and Technology Commission has issued its first white paper entitled GUIDE TO CHINA'S SCIENCE AND TECHNOLOGY POLICIES (No 1, August 1986). The authoritative 322-page paper details China's S&T development policies and indicates trends and key issues. The following sections are currently being translated:

—A general survey of Beijing's fundamental S&T principles and strategies and the structural reforms they entail.

—An examination of research and development programs, including development planning and the "spark plan" designed to stimulate local S&T research.

—Commercialization of technological achievements, including a chapter on the transfer of technology from the military to the civilian sector as well as a discussion of the patent system and relevant legislation.

—Chapters on the organization of learned societies, international cooperation agreements, and data base information systems.

—A statistical survey of scientific institutions, their personnel, and their research activities.

Advance copies of the above sections will be available in late October. The complete white paper will be published in a special January issue of CHINA REPORT: SCIENCE AND TECHNOLOGY.

For advance copies, contact [redacted] STAT

BRAZIL: GOVERNMENT REPORT SURVEYS COMPUTER INDUSTRY

The Brazilian Government has issued its sixth annual study of that country's computer industry with brief sections on automation and instrumentation. The report appeared in the Brasilia monthly PANORAMA DA INDUSTRIA NACIONAL (April 1986).

The report is prefaced with an overview of computer industry sales and imports and examines domestic and multinational firms active in Brazil. The bulk of the report deals with specific aspects of the industry.

The assets and sales of 79 companies are surveyed for the period 1979-85 and trends are analyzed in terms of marketing methods, type of customer, and geographic region. Moreover, a chapter is devoted to labor force with respect to size, education, type of work, training costs, wages, and benefits. The report also reviews software development expenditures and sources for software as well as the volume and dollar value of hardware component sales. The closing chapter describes the main obstacles the industry has faced over the last six years and solicits from company officers 79 problem areas that are grouped under general categories such as production, financing, and marketing.

A translation of the report is available as JPRS-LAM-86-089.

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DATA BASE SURVEYS

DATA BASE SURVEYS presents an annotated list of documents compiled by the FBIS [redacted] *from searches of European commercial data bases on specific technical topics. Additional searches and full-text translations of the documents cited below can be provided on request.* STAT STAT

The following list is the result of a [redacted] search of INSPEC (International Information Services for the Physics and Engineering Communities)—a UK data base providing information on international scientific and technical research—for documents issued by major French companies and institutes. STAT

TECHNOLOGY AND COMPANY	RESEARCH TOPIC
ARTIFICIAL INTELLIGENCE	
CGE (General Electric Company)	MAIA (Machine for Artificial Intelligence Applications), a workstation for software development applications needing powerful symbolic computation, is discussed in a research paper entitled "The Multi-Task Model MAIA" dated March 1985.
THIN FILMS	
CNET (National Center for Telecommunications Studies)	An original technique for preparing thin organic films by scanning a compact powder with a continuous wave argon ion laser is described in a paper prepared early this year entitled "Laser-Induced Deposition and Crystallization of Organic Thin Films."
TELECOMMUNICATIONS	
CNET	SARDE, the data base in which technical documentation on the French PTT's telecommunications network equipment is stored, is detailed in the CNET's 1985 report entitled "The SARDE System for Electronic Document Storage and Retrieval."
Thomson	Online encryption equipment and key management systems are examined in a 1984 document entitled "How To Protect and Authenticate Transactions Through a Communications Network."
RESEARCH NETWORKS	
INRIA (National Institute for Research in Information Technology and Automation)	A March 1986 report entitled "Research Networks" reviews UK and European networks that distribute research information and the networks' data security.

RADAR

ONERA (National Office for Aerospace Research and Studies)

ONERA has built a network of radar stations, code-named Brahms, for recording electromagnetic signals involved in target signature studies. New programs created to process the data and methods of generating one-dimensional images of the target are discussed in "Characterization of Moving Targets by Radar Signature" from May-June 1985.

INTEGRATED CIRCUITS

Thomson

An ion beam system composed of a liquid gallium ion source coupled with a single accelerating lens to produce a highly focused ion beam for making microstructures with a very narrow line width is explained in "Study and Realization of a Submicron-Focused Ion Beam System" dated September 1985.

The activities of Thomson's GaAs Department are outlined, highlighting the ion implanter used in manufacturing GaAs circuits, in the research paper "The Ion Implanter 400 MPH" from June 1985.

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PREVIEWS

PREVIEWS is an annotated list of selected science and technology items being translated by FBIS. The list may also contain previously published items of wide consumer interest.

EUROPE REPORT: SCIENCE AND TECHNOLOGY

FRG MINISTER COMMENTS ON FUTURE MANNED SPACE FLIGHTS

FRG Research Minister Riesenhuber challenges the opinion that manned space flight is too expensive and risky. He points to the FRG "Telescience" orbital telescope as a project worthy of continued support and says that future space expeditions should focus on the biosciences. (Bonn TECHNOLOGIE NACHRICHTEN No 439, 15 Sep 86 pp 4-5)

ESA EXAMINES PROSPECTS FOR HERMES PROJECT

The Council of the European Space Agency has decided on the "Europeanization" of the Hermes project. This will involve the definition of a preparatory program (to be carried out by June 1987) to include technical data on the project as well as cost estimates, schedule, and organization. (Bonn TECHNOLOGIE NACHRICHTEN No 437, 10 Aug 86 pp 10-11)

ITALIAN INDUSTRIAL PARTICIPATION IN SDI OUTLINED

Article explores the implications of the US-Italian memorandum of understanding on SDI and examines the involvement of the following companies: Ansaldo (cooling systems); Aeritalia (tethered satellite); Snia Bpd (advanced propulsion systems); Selenia (radar, space communications); Nardi (command systems for space vehicles); Contraves Italiana (radar, sensor, and electronic systems); Elettronica (electronic defense systems); SMA (microwave sensors); Fiat Research Center (satellite sensors). (Milan CORRIERE DELLA SERA 30 Sep 86 p 7)

ITALIAN PARTICIPATION IN EUREKA PROJECTS OUTLINED

The Italian Industrial Confederation (Confindustria) has scheduled a conference in Milan in the near future to inform Italian companies of opportunities for Eureka participation. This report gives a list of Italian firms participating in the Eureka program and provides funding figures. (Milan IL SOLE 24 ORE 3 Oct 86 p 7)

EUREKA SECRETARY GENERAL COMMENTS ON ACCOMPLISHMENTS

Interview with Xavier Fels, secretary general of the Eureka program. Fels comments on the accomplishments and goals of the Eureka program, its impact on European technological competitiveness, and its relationship to Esprit projects. Article contains full listing of Eureka programs with French participation. (Paris ENJEUX No 72, Sep 86 pp 32-37)

DFVLR FUNDS MICROGRAVITY SUPPORT CENTER

The DFVLR (FRG Research and Test Institute for Air and Space Flight) has allocated DM200 million over the next 10 years for the development of a Microgravity User Support Center (MUSC) to be used in materials and biotechnology experiments in earth orbit. The impetus for this project is the FRG's desire to maintain its competitiveness with the US and its plans to become fully independent of NASA. (Duesseldorf VDI NACHRICHTEN No 39, 26 Sep 86 p 45)

FRG RESEARCH MINISTER PRESENTS 1985 ANNUAL REPORT

FRG Research Minister Riesenhuber recently presented the 1985 annual report on research and technology. Milan Unit is translating the following sections: "Objectives and Outstanding Points of Research and Technology Policy," "Scientific Fundamentals," "Max Planck Society," "Special Fields of Basic Research," "Government Long-Term Programs," "Space Research and Technology," "Information Technology," "Biotechnology," "Materials Research," "Manufacturing Technology," "The Fraunhofer Association for the Promotion of Applied Research," "Indirect Promotion of R&D Employment in the Economy," and "Technology-Oriented Company Establishment." (Bonn TECHNOLOGIE NACHRICHTEN No 382, 15 Aug 86 pp 2-16)

EUREKA MINISTERIAL CONFERENCE STRUCTURE DESCRIBED

Report provides an overview of the Eureka charter, goals, and priorities as determined during a November 1985 meeting of research ministers in Hannover. Also details the functions and operation of the Eureka Ministerial Conference, the main management committee for Eureka projects, and the mechanisms for project coordination. (Paris RECHERCHE TECHNOLOGIE No 1, Jan-Mar 86 pp 52-55)

BMFT EXTENDS SUBSIDY PERIOD FOR INTELLIGENT SENSORS

Article expands on BMFT (Federal Ministry for Research and Technology) decision to extend the subsidy period for the development of microelectronics-compatible "intelligent sensors." Background on the program, now extended to 30 June 1987, is provided. (Bonn TECHNOLOGIE NACHRICHTEN No 440, 26 Sep 86 p 6)

HANNOVER UNIVERSITY PLANS EUREKA LASER RESEARCH

The University of Hannover, with subsidies from private companies and research institutes, will soon begin work within the Eureka laser project. Funding for the university's role in the laser project will total DM51.4 million over five years. (Bonn TECHNOLOGIE NACHRICHTEN No 440, 26 Sep 86 p 11)

FRG FIRMS, INSTITUTES PLAN ULTRA-THIN FILM RESEARCH

Bayer, BASF, Hoechst, the Max Planck Institute, and the University of Mainz have agreed on a joint research program for the development of ultra-thin polymer films. Details on the five-year, DM37 million BMFT program are provided. (Bonn TECHNOLOGIE NACHRICHTEN No 440, 26 Sep 86 p 8)

DEGUSSA CONDUCTS THIN-FILM RESISTOR RESEARCH

Degussa AG's DM4 million effort to develop platinum and iridium-based thin-film resistors for use in sensor system components is reviewed. (Bonn TECHNOLOGIE NACHRICHTEN No 440, 26 Sep 86 p 14)