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Airbus Component Manufacturing in Dresden Described

93WS0042A Berlin ING DIGEST in German Oct 92 pp 34-35

[Article by Gunther Ludvik: Elbe Plant has Landed a "Beluga"]

[Text] Since 1991, the Elbe Flugzeugwerke GmbH in Dresden has been an integrated site for the German air and space travel industry. The joint enterprise of Deutsche Airbus and Flugzeugwerft Dresden continue to use their decades-old experiences in aircraft construction.

The body of the huge transport aircraft A300-600ST conjures up a white whale, the beluga. The first of four is supposed to be ready for use in the fall of 1995. Construction started in September of this year. As with the now obsolete Super Guppys, the new transport planes will, on order of the European Consortium Airbus Industry, transport the large components of several Airbus types to Toulouse and Hamburg for final assembly. The basis for the construction is the Airbus A300-600R.

Among the subcontractors who received orders from the German-French Joint Venture SATIC [Special Aircraft Transport International Company] is the Elbe Flugzeugwerke GmbH. "This is a nice success" said a pleased Director Erwin Hein, "because with the work parcels 60 to 120 which SATIC gave to us—they include the upper shell of the body for the rear conical part and for the complete rear body part—we have a chance to step into a new European project. This also helps our reputation." Shipment of the components for the first model from Dresden will take place in 1993.

The fact that aircraft are being built again in Dresden is not in small part thanks to Deutsche Airbus. The president of the board of the Hamburg giant, Hartmut Mehdorn, is just "a little bit proud" because of "the sensible planning" with which his company approaches the reception of the traditional air travel site Dresden. The Elbe Flugzeugwerke, of which 51 percent of the shares are held by Deutsche Airbus and 49 percent by the Flugzeugwerft Dresden which is under trusteeship, assumed three of the seven departments of the aircraft plant: Repair of aircraft and components and construction of production means. Personnel has been reduced from the former 2400 to 400. By the end of the year it is supposed to increase to 600.

"If we had looked at the whole from just a business management point of view, we would not even have entered," stresses Mehdorn. "Up to now we have invested DM40 million, and the plans are for DM60 million. Depending on market conditions, this could even be DM90 million." By 1994 the build-up in the Association of Deutsche Airbus is supposed to be completed. In order to push this, orders from all over Germany have been shifted to Dresden.

The Goal is Sales of DM45 million

Wolf-Dieter Siebert, second in command at the Elbe Flugzeugwerke, hopes that by 1994 some 800 to 1000 workers would be employed again. Right nearby the Aircraft Maintenance and Support Center (AMSC), a mainstay of the Elbe Flugzeugwerke, is going up. For the supply and service companies which are settling in on a parcel of land of about one million square meters right next to the airport Dresden-Klotzsche, Siebert calculates another 1300 work places.

Sales by the Elbe Flugzeugwerke for the last year were a modest DM3.5 million. For this year, sales of DM45 million are aimed for. However, if medium term profit is not the reason for the airbus engagement in Dresden, what is it?

Hartmut Mehdorn cites two aspects. "First of all it is the motivated work force, which stands for quality and reliability." As proof he cites the assembly of the rear part of the body for the Fokker 100, which was transferred from the Airbus plant in Einswarden to Dresden in the spring of 1991. In September, the Dresden aircraft plant delivered the first component, on time and in perfect quality. In the meantime, 20 large parts for the Dutch regional aircraft have gone to Amsterdam. By the end of the year this number should increase to 35 and for 1993, 53 rear body parts are on the order books.

It is no surprise that these capabilities are available at the Dresden aircraft plant. After all, a chapter of air travel history has been written there. In 1955 the aircraft construction in East Germany started in Dresden with the licensed production of the Soviet two-engine passenger plane Il-14P. However, the plant attracted international attention with the development and the construction of the, for its time pioneering, four-engine turbo passenger plane "152" during the years between 1955 and 1961. Bad planning of the costs for development and construction, as well as over estimating the export possibilities for this aircraft led not only to a suspension of the 152-project. The whole aircraft industry in the GDR was killed by this.

The aircraft plant, which was founded in 1961, was used, until 1990, primarily for the maintenance of military aircraft and helicopters, a total of 660 fighter planes of the types MiG-17, -21, and -23 as well as 250 helicopters Mi-4, -2, -24, and -8.

This also forms the second aspect for the decision to locate the "new enterprise in the old location," for which the term "strategy" is rightfully chosen. The idea is not that new that in the East, especially in the CIS a huge market could develop.

Realists can also see that it cannot be conquered overnight. A glance at the prospects makes this clear right

away. While the number of those employed in the airline industry in Europe is 700,000 and in the U.S. 1.2 million, the number for the CIS is 3.5 million. Although the transition to economic efficiency in this branch of industry will not be easy, the available capabilities, nevertheless, deserve the grade of "very good," and, according to Mehdorn, the products are very suitable to the special conditions in the East. "To get into this market can only be done jointly. Cooperation is a law of reason."

The Elbe Flugzeugwerke Dresden are just about at the juncture to the East in the Airbus empire. "We want to become the turntable between East and West," stated Erwin Hein as the goal of the company. "Our specialty is the integration of western avionics into the eastern aircraft types." For this purpose the structural preconditions also have to be established. Three maintenance docks are currently under construction.

The first order, the life extension of a transport plane of the type Antonow-26 and its retrofitting to Western standards was already ready for the turntable. Dresden had contracts with companies, such as Antonow, Iljuschin, Tupolew, Mil and Mikojan to retrofit their aircraft according to Western criteria and conditions.

Companies from East and West have already discussed the retrofitting in the area of engines, avionics and interiors for the concrete case of the Tu-154. This would be profitable: Currently, some 550 Tu-154B and some 200 Tu-154M are in service with 24 airlines. Tupolew plans to construct annually another 40 to 50 TU-154M until 1998.

However, the "turntable" also moves in the East-West direction. Dresden is preparing the retrofitting and painting of Boeing aircraft of the types B727 and B737. In this connection, C and D checks are also supposed to be done. The preconditions of product support by Boeing have been fulfilled.

French Firm Develops Noise Control System in Aircraft Cabins

93BR0054 Paris ELECTRONIQUE INTERNATIONAL HEBDO in French 1 Oct 92 p 16

[Article by Loic Josselin: "Electronic Counter-Noise Distributes Silence"]

[Text] MS2I, a subsidiary of the Matra group, is studying active noise control in aircraft cabins as part of a European project. The first in-flight experiments took place in June with definite success.

Although active noise control systems (electronically generating a noise in phase opposition with an unwanted one to cancel it out) are yet to find a real market, one should not believe that the technology behind the name is being ignored by French manufacturers—quite the opposite. If the Mors Group chose to draw on the American ANVT's know-how, a number of French firms already know how to hunt down unwanted noises. A case in point is MS2I (Matra-SEP Imaging and Information Science). In the European context of the BRITE [Basic Research in Industrial Technologies for Europe] program, the company is putting the finishing touches on a complex system meant to control noise in aircraft cabins.

An Eager Customer: The Armed Forces

Military contracts were a determinant in the development of active noise control techniques by MS2I. The company, which is to merge with Cap Sesa [Automation Systems Research Company] Defense, is specializing in military information and control systems, satellite-image acquisition stations (including for SPOT [Probational Earth Observation Satellite] and Helios), as well as image- and signal-processing systems. Among other things, MS2I is developing underwater acoustic detection and stealth systems for the French Navy. Thus, activities related to active noise control developed as a result of the navy's special interest in the problem of vibrating parts (such as alternators) being a source of sound "pollution." Civilian applications, however, are now on the agenda. Within a BRITE-EURAM [European Advanced Materials] project named ASANCA [Advanced Study for Active Noise Control in Aircraft], MS2I is busy developing a noise reduction system for regional transit aircraft in which noise is mostly produced by the engines and propellers. Aboard such planes, noise levels are a real nuisance for passengers.

Last June, the first full-scale experiments were carried out aboard a 20-seat aircraft built by the German manufacturer Dornier, which is also the project leader. Despite the problem's complexity, the first in-flight tests were a success. "In the aircraft's most affected area, near the wings, we measured as much as 20 dB's reduction on the noise's fundamental frequency (104 Hz)," declares Guy Billoud, senior project engineer in Matra MS2I's Active Control Applications Department. On the surface, active noise control may look like a simple technique; it calls for superimposing two waves in phase opposition: one being the unwanted one, measured via a microphone; the other being the latter's exact opposite, broadcast by loudspeaker. The problem, however, is magnified when the operation must be carried out in an enclosed space as large as a plane's cabin. Here, the accuracy requirement extends from temporal to spatial aspects. In fact, MS2I's engineers had to use 48 acoustic sensors, which roughly represent passengers' ears, and 32 loudspeakers, where secondary noise originates (the primary noise sources being the propellers). Matra MS2I's multiple-variable active noise control system is based on the following principle: From a noise-related synchronizing signal, the waveforms that correspond to the harmonics to be controlled are synthesized, then filtered by a battery of FIR [finite impulse response] filters to generate signals sent to the secondary sources. The filters' coefficients are continuously recycled through a complex algorithm to minimize the energy of the signals picked-up; this is called adaptive control. In the case of the aforementioned Dornier aircraft, the synchronizing

signals' frequency is that of the propellers gyration. MS2I built the control system around a VME [virtual machine environment]-bus-based computer with proprietary architecture. While it was decided to use a lot of standard hardware, some cards were developed internally (synthesis card, cards based on eight DSPs [digital signal processors] for FIR filtering, and calculation of the control algorithm). Moreover, in last June's test configuration, the controller's passband was 500 Hz, the sampling frequency of the pickup signals being more than 2 kHz. "Here, we reach the VME bus's limitations. So we used an internally-developed, real-time operation system," says Guy Billoud. Last, sampling is done non-synchronously, a feature which reportedly improves reliability as well as the control algorithm's convergence rate.

Controller in the 1/2-ATR Format

Average attenuation was 11 dB on the fundamental frequency, 10 dB on harmonic 2, and 6 dB on harmonic 6. Algorithm convergence takes about 30 seconds, which is especially interesting when the noise's fundamental frequency varies during a flight due to various atmospheric parameters.

After two years of work, MS2I has no intention to rest on its laurels. The size of the demonstration noise controller (that of a refrigerator) should be reduced to make it 1/2-ATR-compatible—standard dimensions in the aeronautical industry—through the use of hybrids, ASICs [application-specific integrated circuits], etc. "The system will also have an impact on a plane's wiring. We need to think this through. In any case, the price will be negligible compared to that of the aircraft..." Guy Billoud concludes.

Germany: Test Facility For Hypersonic Technology Set Up in Cologne

93MI0105 Cologne DLR NACHRICHTEN in German Oct 92 pp 42-43

[Text] After three years in the building, the Institute of Propulsion Engineering at the German Aerospace Research Establishment (DLR) has commissioned a test stand that is unique in its kind in Europe into service at the Cologne-Porz research center. This test stand is being used primarily for the experimental testing of thrust nozzles for air-breathing propulsion units for reusable spacecraft.

The test stand has been set up under the hypersonic technology funding scheme, a concerted research and development initiative by the federal government, industry, universities, and the DLR designed to increase know-how in a strategically important and promising sector of space flight. The inspiration for the technological development is provided by a two-stage space transporter that goes by the name of Saenger.

For greater safety and economy, it is crucial that the engine for the lower stage should be air-breathing so that the oxygen required for combustion need not be carried but is drawn from the surrounding atmosphere.

The test piece is an essential component of the air-breathing engine, the thrust nozzle, whose task it is to exploit its variable geometry to provide the required thrust during the entire flight of the lower stage, from take-off to staging and back to earth.

In the higher speed range the air-breathing engine acts as a ramjet engine. In this type of engine, the requisite combustion pressure is generated by banking up the air flowing through the engine. The fuel—interestingly enough, hydrogen—is injected into the compressed and already very hot air and directly burned, giving rise to temperatures up to 2,700° C. Most of the thermal energy is then converted into thrust in the nozzle cone.

The thrust nozzle test stand will simulate flight conditions, that is, it will duplicate the combustion chamber pressure, the final combustion temperature, and the nozzle reaction according to flight altitude as realistically as possible in a model experiment. For this purpose, a hydrogen combustion chamber is connected upstream of the thrust nozzles and a diffusor downstream to reduce the reaction. The thrust is measured with a high-precision balance and the flow field inside the nozzle is analyzed by optical measurement methods so that the numerical design procedures can be reviewed or improved.

Because the fuel concerned is hydrogen, the test stand can also be used for hydrogen technology research and may therefore also assume an important role in environment-relevant development work on the reduction of carbon dioxide production. Questions of combustion chamber design, flow and reaction control, nitrogen oxide formation, choice of materials, and cooling methods can be resolved by performing experiments on this test station. In addition, new optical measurements methods for high-temperature process analysis are being adapted, considerably extending their range of applications; static testing in general will benefit from this. Finally, the testing of materials and construction methods for components subject to high thermal stresses are also among the uses to which this new test facility can be put.

The design of this test stand is unique in Europe, because there had previously been no plans to develop ramjet engines for the high flight speeds in question. It was the demand for greater economy and safety for space transportation systems that triggered these developments. Germany is trying to build up know-how in this branch of technology so that it can take a leading position in international joint ventures that aim to achieve hypersonic flight with air-breathing engines.

The nozzle test stand has cost around 10 million German marks to build; two-thirds were paid by the Federal Government BMFT [Federal Ministry of Research and Technology] and one-third by DLR. A "scramjet" option extension (supersonic combustion) is in preparation.

Belgian Science Minister on ESA Conference Results

93BR0181 Antwerp DE FINANCIEEL-EKONOMISCHE TIJD in Dutch 12 Nov 92 p 10

[Article: "EC Ministers of Science To Start New Program: ESA Wants 'Columbus' To Continue; 'Hermes' To Be Reoriented"]

[Text] Granada (BELGA)—At the close of their two-day conference in Granada, Spain, the European science ministers agreed to establish an ambitious program for the observation of the earth and the environment. The program involving the development of the European "Columbus" space laboratory will be continued. As of 1 January 1993, the "Hermes" space shuttle project will enter into a reorientation phase. The DRS-1 [Data Relay Satellite] system will be launched in 1993. The ministers will meet again in 1995, however, for an evaluation of Columbus, Hermes, and DRS.

The ministers will allow the European Space Agency (ESA) to start two new programs with an estimated value of almost 50 billion Belgian francs [BFr]: Envisat-1 for observation of the environment, and Metop-1 for meteorological observation. According to Minister of Science Jean-Maurice Dehousse, Belgium attaches a great deal of importance to this. It will take a 4-percent share in both programs, which are as a matter of fact already supported by over 100 percent in the member states. The ministers also announced the need for the start of the Meteosat-2 system in 1993, with the aim of achieving a first launch in 1999.

The French conference chairman, Hubert Curien [minister of research and technology], said that the Ariane 5 program will remain on schedule, with the first launch of this rocket type planned for the second half of 1995. Belgium has a 5-percent stake in this. According to Dehousse, ESA's science program will be continued.

The manned programs (Hermes, Columbus, and the DRS-1 data transmission system that also serves Envisat and Metop) produced the most animation in Granada.

The development of Columbus, in which Belgium has a 5-percent stake, is to be continued, the highlight being the continuation of the APM ([Attached Pressurized Module], the cylinder-shaped pressurized cabin that can be firmly attached to the international space station), which is to be launched in 1999. Funding of the APM is almost completely secured, with Belgium taking a 3.8-percent share. Dehousse said to have refused a request for extra involvement. Germany is putting up the lion's share of 38 percent, together with Italy at 31 percent. Paris has unexpectedly raised its share from 8 to 10 percent.

The second aspect of the Columbus program, the polar platform, is to be further developed with an eye to a launch in 1998. A green light has also been given for "precursor flights" of Freedom, funding of which is only secured for 66 percent, together with studies for a future space station (whether or not this is in cooperation with other partners). Belgium is participating in these three aspects of Columbus for respectively 9.45 percent, 5 percent, and 3.02 percent, and is attaching great importance to the selection of European astronauts for missions on board Mir.

From 1993 the space transport system Hermes will be reoriented towards greater collaboration with the United States and particularly with Russia. "You cannot talk about burying Hermes when there is a budget of almost BFr24 billion," said Curien, making the further announcement that at least 80 percent of the contracts will be given to European industry.

Mercator

The Mercator program for building a small satellite frame with multifunctional aims is somewhat at odds with the Belgian proposal at the Granada ESA conference to initiate the Artes telecommunications program and to take the lead in it. Paul Verhaert, of the Kruibeke firm Verhaert Design and Development, which had presented Mercator a month earlier to the Belgian Service for Science Policy Planning (DPWB), talked to the BELGA press agency on the subject.

Mercator, named after the famous cartographer, stands for "Miniaturized European Carrier for Applications of Telescience in Orbit." It involves construction of a minisatellite, weighing approximately 200 kg, in the form of a frame offering accommodation and subsystems for various payloads from 50 to 70 kg, for periods from one week to a year. The applications are multiple: Micro-, gravity-, and atmospheric research; earth observation; telecommunications; and global localization (for insurance purposes, nuclear waste transport, etc.).

According to Verhaert, total costs, probably in the region of BFr1.5 billion francs to which other European partners will be asked to contribute, will be very low. It will not be necessary to start from scratch, as the project is a redefinition of the Artep program, which was canceled by ESA.

Secondly, the satellite is so small that it can be launched in the space between the Spelda top and the upper payload in the Ariane rocket. The launching costs will thus be greatly reduced, and the problem of the queue for launching satellites and experiments can be surmounted. Mercator can always be placed easily in the Ariane on any one of the eight to nine flights that the European booster rocket makes annually.

Netherlands To Host International Radio Astronomy Center

93BR0184 Rijswijk POLYTECHNISCH WEEKBLAD in Dutch 12 Nov 92 p 1

[Text] The Netherlands is to have an international center for radio astronomy. The new center will process and

interpret data to be received from 10 European and two Chinese radio telescopes. The building of the center, near Dwingeloo in Drenthe, will start in 1993.

The arrival of the radio astronomy center is in line with the policy of the Ministry of Education and Science. Minister Ritzen's mission is to attract more international research facilities to the Netherlands. The Ministry will contribute 12 million Dutch guilders, with the rest coming from the EC and a few other European countries. The initial costs are estimated at about 20 million guilders.

The center is to be set up in Dwingeloo, at the Netherlands Astronomic Research Foundation (ASTRON) of the Dutch Organization for Scientific Research (NWO). It will provide services to the international radio telescope network VLBI (Very Large Baseline Interferometry). Eight observatories in Western Europe belong to the network, together with one in Poland, one in Ukraine, and two in China. Together they work as a giant telescope that is able to study very detailed cosmic radio sources deep in space.

The arrival of the new center will at the same time raise the image of the Netherlands in the field of radio-astronomic research. This country already had a certain reputation in this area. In addition to Dwingeloo (founded in 1956), since 1970 we have also possessed a very sizable radio-astronomic observatory in Westerbork.

AUTOMOTIVE INDUSTRY

France: Electric Vehicle Cost Problems Persist

93WS0033C Paris LE MONDE in French 6 Oct 92 p 39

[Article by Jean-Francois Angereau: "The 'Electrics' Are Sparkling"]

[Text] *The electric vehicle could be the panacea for curing one aspect of pollution. A few problems with their electronics and motors have yet to be resolved.*

In November 1974, in a report drawn up for the Interministerial Action Committee for Nature and the Environment, Inspector General for Bridges and Roads Saulgeot estimated that 10 percent of the automobiles in circulation in France as of 1990 would be electrified. Inspector General Saulgeot was definitely a visionary. But it must be recognized that he was slightly mistaken as to dates.

Very early on, to be sure, this type of vehicle, on occasions, may be said to have sparkled with promise. When the "Jamais-Contente," for example, on a day in May 1899 broke through the 100-kilometer-per-hour "speed barrier." And when engineer Gregoire, at the wheel of a CGE-Tudor, in 1942, covered a distance of 250 kilometers, averaging 42.32 km/hr, without recharging the vehicle's lead-storage batteries.

But despite these promises, the electric car has not yet invaded our daily lives. It is advancing in small steps. Almost timidly. But certainly more decidedly than in the past, and so much so that the interest in this type of vehicle is not dictated solely by the tensions in the oil market. This time, the automobile manufacturers appear truly committed to the adventure. Some 1,300 vehicles of this type are in circulation in Japan. Several hundred are circulating in Sweden and Germany. Eight hundred others streak through the streets of several French cities. Some are quasi minicars, like the Microcar Lyra. Others are full-fledged vehicles.

Some 250 to 300 utility vehicles Peugeot J-5 and Citroen C-25 are in service in France (Lyon, Montpellier) as well as abroad (Hongkong), in fleets belonging to collective associations, government agencies, and enterprises. Utility vehicles Renault Express and Master, in about equivalent number, made their first wheeled appearances under their own power in the city of Chatellerault in 1986. Some 50 Masters have covered over 500,000 kilometers collectively.

The intent of the two French automobile manufacturers to begin mass production of electric vehicles by 1994-1995 is now a given. But the leap between that and imagining that this "explosion" will lead to a rapid replacement of diesel or gasoline powered cars is a long one indeed that is best not hastily attempted. "For the present," says Jean-Yves Helmer, manager of the PSA Peugeot-Citroen Automobile Division, "the electric vehicle, for us, will be a town car."

Costly Virtues of Cadmium-Nickel

Mr. Helmer's opinion is shared by Mr. Claude Delarue, head of Renault's Department of Substitute Energy, who deems that, "The first electric vehicles with the range necessary to traverse France will not be available for another 20 years at best." The time for developing on an industrial scale those famous fuel cells that provide the clean energy used to power manned space vehicles.

Pending these new advances, and unless the electric vehicle can offer a range exceeding 90 to 100 kilometers, it will have to play the card of quiet operation and absence of pollutive emissions. These are assets that cannot fail to attract the mayors of large cities where daily routes do not exceed 40 to 50 kilometers. Such distances may seem modest, but batteries have had to make considerable progress to render them possible.

To start with, through the combined efforts of several manufacturers, such as European Battery Company and its subsidiaries Chloride and Sonnenschein, the performance of the old lead-storage battery was considerably improved. But the coin has its other side. These batteries are heavy (1,200 kg for a Master, and 400 kg for an Express), and their recharging time is relatively long (between six and eight hours for a range of 60 kilometers). On the other hand, their cost, at around 15,000 French francs [Fr], is "relatively low" for a utility vehicle.

Clearly, therefore, to achieve improved performance, a range of around 100 km, and higher acceleration rates, designers must turn to another electrochemical couple: cadmium-nickel. These batteries can support many recharging cycles (2,000), fast recharges under special conditions (one to two hours), and lower operating temperatures.

In short, they offer a quasi panacea if one excludes the very high price (Fr60,000) of a set of these batteries for a utility vehicle. Moreover, this electromechanical couple is all the more interesting in that France, via the Safi company, a world leader in this domain, is in an excellent position to impart thrust to this solution and industrialize it so as to bring the cost of these batteries down to just twice that of lead-storage batteries.

A joint development program between Safi and the French automobile manufacturers has been launched, aimed at reaching this point rapidly and bringing to market, first, (by 1994) a line of low-maintenance cadmium-nickel batteries, and then a line of totally sealed batteries. The near-term future of lead-storage and cadmium-nickel thus seems laid out, as attested to by the announcement of forthcoming electric car models designed for personal use, like the Renault Clio in 1994, the 106, presented two weeks ago in Florence, and the Peugeot-Citroen AX, expected by 1995.

This slight delay between the presentation of the prototypes and the coming out of the first vehicles may seem surprising. But, although the batteries have unquestionably posted breakthroughs, the rest of the motorization chain has yet to also make some forward strides.

The fact is that the motors available are of the direct-current industrial type and badly adapted, which, the thinking is, will be replaced at some time in the future by alternating-current motors. Two techniques are vying for ascendancy: the brushless motor mounted on the Renault Electro-Clio prototype and the small Matra-Renault Zoom, versus the asynchronous motor, which will permit doing away with the vehicle's transmission gear box, and which everyone agrees will be, despite the complexity of its control electronics, the solution of tomorrow.

"Existing products offer us a rough and ready compromise," says Mr. Delarue. "We must improve on them, develop dedicated products, and bring down the prices of the propulsion system control electronics." The more so, Mr. Helmer indicates, in that this latter item "represents around 20 percent of the cost of the electric vehicle, and the essential components are mainly of Japanese origin."

An Electronics That is Still Costly

PSA has recently invested Fr1 billion in a program involving Leroy-Somer for motors, Sagem for electronics, and Safi for batteries, whose aim is to reduce the price of an AX and an electric 106[1] to that of an equivalent combustion-engine model. This is an important effort, considering that the incremental cost of the first electric utility vehicles over that of the diesel versions is projected to be around Fr30,000. According to PSA officials, the necessary reduction could be obtained with a production volume of 50,000 vehicles a year. But this would require tax incentives on the part of the government, designed to orient the client toward these new automobiles, which at best cannot be expected to occur before the end of the century.

Between now and then, the manufacturers will be making every effort to develop vehicles that are specific, lighter in weight, and better suited to the new mode of propulsion. This is the reason for being of Renault's Zoom, Citroen's Citela, and the Elegie program aimed at the development by 1995, jointly with Renault, Siemens, and ABB, of a specific town car featuring fast acceleration, and equipped with batteries of a new type providing a 50 percent increase in range.

Several electromechanical couples appear promising. Notable in this regard is the sodium-sulfur approach developed by ABB, which, however, has the dual drawback of, for the time being, an utterly excessive price (Fr140,000 for a set of batteries for the BMW E-1) and of operating only at a high temperature (around 300°C). There can be no doubt that these operating conditions pose real control problems.

But let us not despair. Time will overcome these minor obstacles, and the sodium-sulfur approach will eventually find its niche, unless it is displaced by a rapid development of other electrochemical couples, such as nickel-hydride or lithium batteries. But within a 20-year or perhaps longer time frame, there can be no doubt that one of the oldest types of cell known, the fuel cell, will definitively find acceptance, writing End to the problems of range, since all one need do, depending on the type of battery used, will be to stop at the nearest service station and request a fill-up of hydrogen or methanol.

Footnote

1. The batteries of all these vehicles will be leased. At the time of purchase of the vehicle, the owner will place a deposit—of say, Fr5,000—for the batteries. This is expected to lead "more naturally" to turning in junked batteries at a collection and recycling center.

Citroen Uses New Process for Making Crankshafts

93WS0068A Paris TECHNIQUES ET EQUIPEMENTS DE PRODUCTION in French Oct 92 p 15

[Article entitled: "Citroen Adopts the Cold Box Process"; first paragraph is TECHNIQUES ET EQUIPEMENTS DE PRODUCTION introduction]

[Text] Citroen's Charleville-Mezieres foundry is the first in the world to industrialize the vertical-cast cold-box

method, a process that will enable it to cut the price of its crankshafts 15 to 20 percent.

The growing use of crankshafts made of spherulitic graphite iron (SG cast iron) instead of wrought steel has prompted Citroen to invest 104 million French francs [Fr] in a new, three-team shop that will eventually turn out 6,000 crankshafts a day. The automaker's new production equipment now produces 1,500 pieces a day, and the process is being fine-tuned. Traditional casting, which uses silicon-clay sand to form the molds, involves strong pressures that distort the mold and create holes, or contraction cavities, in the core of the pieces during solidification. A reserve a liquid metal—the sprue—is used to counteract the problem, but this wastes material and manpower. The four crankshafts in a 138-kg stack mold weigh 83 kg, for a yield that affects the price of the piece by 1.66 (it takes 166 kg of cast iron to produce 100 kg of pieces).

The new vertical-cast, cold-box process uses a sand + resin mixture to obtain a much more rigid mold. The quality of the material is better—no contraction cavities, better surface hardness, and a better-looking and more uniform piece—and the unwrought cast iron no longer needs to be heat treated. Moreover, the dimensional accuracy of the pieces requires less machining correction (+ or - 0.5 mm). "In the future, with rough-cast counterweights and a reduction in tolerances, we hope to reduce chips by 50 percent," stresses Alain Munos, who is in charge of cast iron. The stack mold now weighs 91 kg, or a yield of 1.12 (112 kg of cast iron are needed to produce 100 kg of pieces).

Citroen is accumulating other gains. After casting, the sand that is in contact with the piece (or 20 percent of the regenerated sand) loses its hardness and can be removed without mechanical tools. The part of the mold that remains can thus be reused thirty times or so. Another example is contact casting, which Citroen has patented. In contact casting, the mold is placed on an elevating platform and brought into contact with the furnace; feeding is reduced to a minimum and no heat is lost. This shows up in the price of the pieces: A Citroen crankshaft that sells for Fr143 and costs Fr100 to make on the traditional Charleville foundry line is produced for Fr87 using the cold-box method. Citroen expects a return on its investment within 2.6 years.

Renault's Production Methods for New Twingo Car

93WS0068B Paris TECHNIQUES ET EQUIPEMENTS DE PRODUCTION in French Oct 92 p 24-26

[Article by Michel Defaux: "Twingo, Or Stripping Down Production Costs"; first paragraph is TECHNIQUES ET EQUIPEMENTS DE PRODUCTION introduction]

[Text] Renault's small Twingo car, which was the star of the International Auto Show, spent years on the shelf. The elimination of secondary models, the use—with suppliers—of design-to-cost methods, and a stripped-down approach to investments now make it possible to contemplate producing the little car at a profit.

Though brand new, Twingo already has quite a history. Renault has been toying with the idea of making a small car since 1986, but the project, for which a style mockup was drawn two years later, stalled. In early 1989 Renault's president Raymond Levy assigned then-purchasing director Yves Dubreil the X06 project, whose job was to assess Twingo's profitability. "Unless prices could be brought down, there would be no car."

So began the cost hunt. A key idea was that there would be only one body type (compared to 41 for the Clio), a single engine, and one finish. This was fundamental to Renault's approach to Twingo, with the obvious financial repercussions for equipment makers and production.

Next, Renault went over investments with a fine-tooth comb. The automaker had invested Fr7 billion in Clio. "If we had proceeded in the same way [with Twingo], we would have had to spend nearly Fr5 billion. By restudying the project, we reduced the cost of admission to Fr3.7 billion: Fr1.2 billion for research and development, and Fr2.5 billion for industrial investments. That is a ratio of 1 to 2," explains Yves Dubreil, the project's director.

At every level, then, Renault attacked costs. The first component looked at was the engine. Renault's engineers chose the C engine, "a short-stroke, fairly flexible, and very pleasant engine" built in Cacia, Portugal. The methods department then asked for Fr500 to Fr600 million to bring the production plant up to speed. "Using the Kaizen approach, that is, the Japanese method of taking small steps at a time, the engineers looked at the entire process of building the engine, task by task. Then they adjusted requirements (dimensions, tolerances) and the actual machines. This meant buying equipment and keeping some [as well] by changing, for instance, bearings..." The end result was an investment requirement slashed to Fr170 million, three times less than originally planned.

Borrowing Clio's Facilities

The same approach was taken to equipment suppliers. The first rule of thumb is that henceforth there will be only one supplier instead of two. This will enable Renault to improve working relations with all its partners and hold down prices better. To cut equipment costs 15 to 20 percent without sacrificing any hardware, engineers advocate the design-to-cost method. "In this way we were able to meet the cost objectives that we had set in 1989." One good example is wiring. During the bid invitation, the supplier accepted the challenge of keeping to a set price. By taking up certain Renault technical taboos, revising connections, improving communication, and visiting the floor to meet body and wiring workers, the supplier exceeded the goal.

All angles were considered in deciding how to produce the new vehicle. The idea of building a new factory was raised, but Renault would not be able to recover the required investment of Fr2.5 billion. So was the possibility of making Twingo in the group's other plants, with the exception of Sandouville and Douai. Flins was chosen for two reasons: First, the plant already produces Clio, and Twingo's small single body could borrow the same stamping, iron-work, and painting facilities. Second, Twingo is likely to eat into some percentage of Clio's sales (expectations run as high as 50 percent) and production at one site will make it easier to restore the balance.

By investing Fr1 billion in Flins, Renault will be able to produce its newestborn at the rate of 800 a day. Fr290 million is being allocated to stamp work (shuttles between presses, line-start loaders, tool-working of the parts in pairs), Fr480 million to iron and finishing work, Fr87 million to painting, and Fr110 million to assembly.

Sheet Metal: The Bare Necessary in Automation

Renault's handling of sheet metal operations meshes perfectly with the small-steps approach cited earlier. At the start of the project, the Methods department announced a budget of Fr700 million for the sheet rolling mill. Since investments mount with the rate of automation, the engineers—asked to go back to their drawing boards—backtracked and trimmed automation to as little as 65 percent. Then they took a look at each station, investing only where it was justified. The result is a Fr480-million sheet-metal plant that is 82 percent automated against 97 percent for the Clio. Manual stations are back for preparation work, tack welding, and parts' geometry. Operators work in a non-automated environment for about 20 minutes during the course of manufacture, and perform the first quality-control and maintenance tasks. There is no change in finishing: Islands are automated and use robots (about 72 in all in the sheet-metal area).

Twingo reuses Clio's painting equipment. The only new arrivals are two stations, each of which use four ABB painting robots for the interiors. (Since Clio was soft-trimmed, it did not need such equipment.)

During assembly Twingo employs Clio's so-called TMA (automated mechanical section) technology. Machine parts (the engine and its surrounding pieces) and the front and rear gear trains are set up on a mechanism plate and automatically screwed on underneath the vehicle. The only new elements are two robotized stations, one to mount the huge and heavy pedals and bottom-bearing bracket assembly, and the other to put on the windshield. Easier to make and assemble, Twingo can be built in the record time of 14 hours, compared to 16.5 for the Clio. And there is absolutely no sacrifice in quality. "Our latest little one is in the same category as the R19, Safrane, and Clio," stresses Pierre Bossi, who is in charge of the manufacturing project. Twingo's manufacturing agreement is expected to be confirmed this week, with a quality mark, the RQA (Renault quality action) demerit, of 140 (162 is perfection). It will be marketed at 145.

Boxed Material: A New Design

Renault's new design is a small, likable car, with chase work on all four wheels! Twingo rethinks the single body concept already used in Espace, and adapts it to a small car. Short (3.43 m), wide (1.63 m), and high (1.42 m), the compact uses interior space in a new way: Twingo's sliding back seat can extend passenger room from 1.61 to 1.78 meters. Another original feature is its instrument panel, which packs control monitors into a thin bar behind the steering wheel. Other functions, such as the speedometer, are centralized in an electronic display at the car's midline. Twingo will be marketed in early 1993 for less than Fr55,000, and offers an array of equipment, in packages, that is unusual for its price range. Options include five speeds, tinted windows, a rear window defroster, and more.

The small Renault can be used for both city and highway driving, with a top speed of 150 km/hr (Cx = 0.35).

Renault plans to produce the Twingo at two sites. Valladolid, Spain makes Clios and Expresses and will begin manufacture of the automaker's latest at the end of the year (450 vehicles/day). Flins, which produces the Clio, is where the new car will first be manufactured. Daily production capability will be 800 Twingos. As early as next spring—again in order to keep investment down—Flins may institute a third night-shift team. That would boost production capacity from 1,600 vehicles/day to 1,950.

BIOTECHNOLOGY

French Claim Human Genome Experiment Success Will Drastically Alter U.S. Strategy

93WS0053B Paris LE MONDE in French 18-19 Oct 92 p 9

[Article by Jean-Yves Nau: "Americans Wondering About Their Molecular Genetics Research Strategy After French Successes in Mapping the Human Genome"; first paragraph is LE MONDE introduction]

[Excerpt] Nice—The fourth international conference of the association HUGO [Human Genome Organization], which brought more than 400 molecular genetics specialists together in Nice from 14-17 October, was marked by the recent discovery of the team led by Prof. Daniel Cohen (CEPH [Center for the Study of Human Polymorphism]-Genethon), which is going to accelerate research conducted throughout the world to map the entire hereditary heritage (genome) of the human species. This discovery, accomplished thanks to the generosity of the French public, via telethons, is going to shake up the research strategies adopted in this field, particularly in the United States.

[passage omitted] This discovery will provide only an initial analysis of the complexity of the human genome. To continue with the geographic metaphor, in 1993 it will provide a map at a scale of 1:1,000,000 whereas biological understanding requires a survey at 1:25,000,000. There will still be long and patient decoding work in much finer detail to identify all the human genes and to analyze their structures and functions.

Certain people are beginning to fear that when all the data become available, the ability to understand and to use them will be lacking. Learning the alphabet (the chains of the bases of human DNA) does not necessarily imply learning to read—decode—everything discovered. The French discovery risks shaking up the strategies adopted abroad, particularly in the United States, which thought it would dominate all the research perspectives in this field.

"Genethons" Abroad?

Several Americans were even considering obtaining patents on something which, from the French point of view, indisputably belongs to the heritage of humanity, i.e., is not appropriate to form the basis of any financial profit. Virtually all researchers had abandoned the systematic approach of mapping the entire human genome to adopt a different approach, chromosome by chromosome, with each team focusing on a very small and very specific fraction of the hereditary material of our species.

However, "the results obtained by Daniel Cohen's team upset the whole arrangement and require the rethinking of a number of existing programs," explains Prof. Jean-Louis Mandel (INSERM [National Health and Medical Research Institute]-Strasbourg), one of the world's leading specialists in this new discipline. "They clearly pose the problem of the organization of research in biology and its financing, by demonstrating that certain subjects can be dealt with only by pooling powerful data processing and robotics tools which are not available to conventional labs because of the enormity of the costs, and that public financing cannot cover them."

Already, the issue of creating equivalents of the French "Genethon" is coming up abroad. Prof. Cohen confides: "It is necessary, in my opinion, to create three or four foreign equivalent structures throughout the world, particularly for human DNA sequencing. For our part, we have very close ties with Prof. Eric Lander of the Whitehead Institute in Cambridge, Massachusetts (United States). This scientist had, at the very beginning, the same ideas as we, but he was not followed by the American scientific and political community. It was at that time out of the question to allocate all the money necessary to a single team."

The French discovery and the numerous articles which the teams from CEPH and Genethon have recently signed—and will soon sign—in the international scientific press will put an end to the multiple criticisms formulated in response to a enterprise completely atypical in the biological research area in that it is based on the creation of an industrial space and has at its disposal significant financial means of private origin (100 million French francs [Fr] this year).

"Many of our colleagues took a very dim view of this enterprise, some believing they could state that we were going to fall flat on our face, the others that nothing would come of all this," confides Prof. Jean Weissenbach (Pasteur Institute of Paris-Genethon). "In reality, we are now demonstrating the great efficiency of concentrating significant financial means. The money, much more readily available than that granted by public agencies, gives us a fantastic margin for maneuvering. With the sums collected at the time of the telethon, the French Association Against Myopathies (AFM) had a choice: either, as had been done in America, "to sprinkle" existing specialized teams, or to create and finance a heavy-duty research infrastructure. It was the second solution which was adopted. I believe that was the right choice and that this association is in the process of winning its bet."

This is so true that some of the big names in medical genetics, such as Prof. Jean Frezal, after having initially criticized the strategy adopted by the AFM and its president Mr. Bernard Barataud, now have the courage to acknowledge, in light of the scientific results obtained, that they were wrong.

Iceland Expands Thermophilic Enzyme Research Activities

93BR0105 Rijswijk BIONIEUWS in Dutch 23 Oct 92 p 3

[Article by Esther de Groot: "Iceland's Biotech Industry Shows Enthusiasm For Thermophilic Enzymes"]

[Text] Bubbling hot springs erupt majestically into an icy landscape. The products of the Icelandic biotechnology company Genis HF are self-evident: thermophilic enzymes (which come from the geysers) and low-temperature enzymes.

Genis is a small marketing and sales company, employing five people. The Icelanders have brought enzymes onto the market since 1989. These products are developed by three different organizations: IceTec, IceBioTec, and the molecular genetics department at the University of Iceland. IceTec concentrates on thermophilic bacteria and enzymes; IceBioTec works on enzymes which are active between 0 and 5°C; and the university group is involved in cloning genes for the isolated enzymes.

IceTec has a collection of about 500 thermophilic bacteria. They have been isolated from the local hot springs by "in-situ enrichment." In the actual environment of the geyser very few microorganisms are able to survive; an almost completely pure culture is present. By adding ammonium acetate it is possible to separate out single

organisms. Various enzymes can be obtained from these thermophilic organisms, such as xylanases, proteases, lipases, and cellulases.

Up until now IceTec has been able to develop very few applications for thermophilic enzymes. The institute is still very busily working on the isolation of the microorganisms. They are not yet able to obtain large numbers of enzymes.

One application is in the environmentally harmful bleaching of paper, a process which requires large amounts of hydrogen peroxide. At a temperature between 65°C and 85°C, the thermophilic xylanases break down the ligneous structure of paper, so that less hydrogen peroxide is needed for the bleaching process.

Fillet

Research into enzymes which are active at lower temperatures has reached a more advanced stage. Enzymes, such as trypsin and elastase, have been isolated from cod intestines. Cryophilic enzymes from the cod are more active at low temperatures and are easier to deactivate than their counterparts which, for instance, can be isolated from pigs.

These cryophilic enzymes have been obtained in quantities large enough to allow large-scale research. They can, for instance, be used as the fish processing industry, where they can help in softening those fish that are difficult to fillet. This is not without interest for the Icelanders when you realize that fish products form 75 percent of their exports.

Naturally, Genis HG is not simply targeting the home market, but, like so many small biotechnological companies, they lack sufficient capital to enter foreign markets on their own. The company is therefore busy trying to find R&D partners within Europe; they have already entered into an agreement with the Finnish company Finnzymes Oy.

EC Allocates 250 Million Guilders to "Biotec" Project

93BR0154 Rijswijk BIONIEUWS in Dutch 6 Nov 92 p 1

[Article by Jaco Quist: "EC Distributes Funding Within the Scope of 'Biotec' program's First Call for Proposals"]

[Text] The EC is once again supporting European biotechnology research through the incentive program "Biotechnology," which is better known by the abbreviation "Biotec." The 250 million guilders provided by this program will be divided among 125 projects. Dutch research groups will participate in 49 projects: 32 percent of the Dutch researchers who applied have received European funding. This is a higher rate of success for the Dutch than with earlier EC programs.

Through Biotec, the EC wishes to expand fundamental biotechnology knowledge in order to promote applications in agriculture, health care, industry, and environmental protection. Another major objective is the strengthening of the competitive position of European companies against companies in Japan and the United States. Biotec is the successor to the BRIDGE [Biotechnology Research for Innovation, Development, and Growth in Europe] incentive program which has been operational since 1990. Biotec also welcomes proposals in the fields of neurobiology, ecology, biodiversity, and "in vitro" toxicology.

Dutch research achieved notable success in the fields of molecular botany, vaccine development, protein technology, industrial microorganisms, antigen/antibody interactions, and bacteria/plant interactions. University researchers from Groningen, Wageningen, Utrecht, and Leiden received the EC funding. The Dutch business community also received funding through Biotec. Research proposals from companies such as Unilever, Gistbrocades, and Zaadunie [Seed Union] also received funding.

COMPUTERS

Germany: DIN Institute Adopts SGML as Standard for International Data Exchange

93WS0006B Duesseldorf VDI NACHRICHTEN in German 4 Sep 92 p 25

[Article by Bernhard Rose: "Documents in Uniform Data Format: Standard Produces Breakthrough for Electronic Data Exchange; DIN Institute Will in Future Provide Standards in International SGML Data Format"]

[Text] Munich, VDI-N—To internationally exchange documents and also their structural formats, a standard is needed that makes the data independent of any software system with which the document was created. This standard, SGML [standard generalized markup language], is now in the offing. Industry expects this to produce a considerable increase in efficiency.

Industry hopes that the German Institute for Standardization (DIN) in Berlin's plans to provide its printed standards on electronic data carriers as well in the internationally valid standard, SGML, will make their work a lot easier. Yearly, firms receive from about 3,000 to 4,000 new and revised standards, the distribution of which means a considerable expenditure for them. But these standards are frequently also a basis for their own operating standards. Adopting documents that up to now have existed only in printed form to the standards of the moment is a correspondingly time-consuming business.

Up to now, considerably faster electronic processing was impossible because there was no standard for the flawless exchange of standard documents, which conform to

quite specifically structured formats. This situation should in future come to an end. The people in Berlin hope that the switch-over begun in April to provide all of the approximately 23,000 DIN standards as documents in the SGML standard, perhaps on the CD-ROM data carrier or over data networks, will be completed within three years.

We may wonder why it is only now, 10 years after the invention of the personal computer and the triumphal march of electronic word processing, that the exchange of structured documents is practically feasible. It was not only the different EDP systems of the different manufacturers that prevented this up to now. What was lacking was a binding standard for the electronic exhcnage of texts as they appear in standards or other documents with specific formats. Since technical documents like, for example, operating instructions, are formatted in extremely complex ways. Aside from structured texts, they comprise tables of content, lists, cross-references, indexes, appendices, tables, mathematical and chemical formulas, and graphics.

It is true that as early as 1986, with the International Standard Organization's (ISO) SGML, a method was adopted by means of which the many different kinds of documents can be coded so that the text and its structural format are preserved in the same [original] form regardless of the input and output hardware. But in actual practice the coding of texts in accordance with SGML operating instructions proved to be too complicated.

It was only the development of a context-sensitive, so-called SGML editor in conjunction with screens that can handle graphics, which make possible a reproduction faithful to the original (wysiwyg, what you see is what you get), that produced the breakthrough. This editor now automatically produces the necessary SGML coding for the document in question. At the same time, the INES ([Interactive Standards Editor] based on SGML) editor was developed by the Darmstadt Center for Graphic Data Processing, Inc., on the basis of the software for electronic publishing provided by the U.S. company, Interleaf, Inc., and has now also been officially accepted by DIN in Berlin. At the same time, a so-called document-type definition (DTD) for DIN standards (DIN-DTD) was adopted.

This sounds complicated, but it is nonetheless actually quite simple and is considerably broad in scope. A company like Volkswagen, for example, which enters DIN standards electronically in an appropriate word processing system, recovers the DIN standards on the screen in fully identically reproduced form and format thanks to the wysiwyg display, just as though the document were there on paper. The data of a specific DIN standard virtually automatically fall into a given layout and appearance on the screen. The same should also be possible with Eurostandards and ISO standards. At the same time, the way in which the DIN-DTD is coded through the INES editor serves the international committees as a basis. The automatic conversion of international standards among one another is also being planned. Once an item is established as a DTD, it will be automatically so specified by the EDP system each time it appears.

A company standard, the document-type DTD for which has also been specified by the Berlin DIN and published this year as an initial standard (DIN V 33900) for a national standard, can be quickly obtained, printed out with a laser printer, and distributed. According to a statement made by Wolfgang Huebner of the Center for Graphic Data Processing, the "Interleaf 5" publishing technology offered by Interleaf is at present the first software for technical domumentation with which SGML-coded text data can also be displayed in wysiwyg on a computer screen. According to German Interleaf, Ltd., in Eschborn, industry's interest in the product is equally great.

But standards are only one example. Thus, important industries such as, for example, the automobile-manufacturing, aerospace, electronics, and software industries or also telecommunications companies are already planning to adopt SGML as a standard for the exchange of strategically important documents. The reason: An enduring exchange of structurally formatted documents should be guaranteed with SGML as an internationally valid standard. And this, to be sure, independently of suppliers of any publishing system whatsoever.

Thus, by way of example, the automobile manufacturer Ford's Worldcar Project plans to record all of Ford's documentation in SGML standard in accordance with Ford's own DTD. In so doing, Ford wants to obtain a worldwide, uniformly structured literature. As Manfred Bauer, who is in charge of technical documentation Europe-wide at Ford's head office in Cologne, sees it, suppliers will also in future deliver their documents to Ford electronically and in accordance with this uniform standard. Ford is currently collaborating with Interleaf on an appropriate SGML documentation data bank that will contain all of the service literature, among other items.

German Airbus is also going to make up the technical documents on its new four-engine A-340 jet in this format. Likewise Boeing, which wants to store the entire documentation on its new 777 aircraft on handy CD discs as data carriers within a year and a half. And the Open Software Foundation (OSF) has also established SGML as the standard for the exchange of its software documentation.

The consequences of this standard that is now gaining ground are quite far-reaching. For example, as a supplement to the Clean Air Act, the American Environmental Protection Agency (EPA) has ordered the automobile industry to publish all the documentation on any vehicle registered in the United States, regardless of where it was

manufactured, in SGML standard by 1996 at the latest. If the deadline is exceeded, companies may be fined $25,000 a day. The order stresses the great importance of accurate documents in order to verify vehicle pollutant emissions.

It can hardly be estimated yet how much industry will save in costs through this kind of standardized electronic documentation. One thing is certain: Because of circulation required by law, technical documentation is getting to be ever more costly, today accounting for about an average 6 percent of the costs of developing a product. In the automotive sector, according to Ford, this is barely 1 percent. Ford cites three years as the time it takes to amortize the necessary hardware and software investments of its company-wide electronic publishing system.

Financing, Research of German Computer Industry Noted

93WS0022B Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 2 Sep 92 p 8

[Article by TN: "German Information Technology Industry Finances 97 Percent of Its Research Itself; Massive State Subsidies in America and Tax Breaks in Japan: A Comparison of the Top Three Countries: America, Japan, and Germany"]

[Text] Frankfurt—State support for information technology, especially microelectronics as "packaging" for the raw material, information, is implemented through financial aid measures with direct and indirect subsidies. The direct financing measures apply to the promotion of research, regional aid, and compensation for losses incurred by state enterprises. The indirect measures are primarily tax measures. These are found especially in Japan, where there is still very extensive aid in the form of tax relief for research.

Furthermore, there is state aid for information technology through basic state provisions. The market is also protected against outsiders through customs duties. But there are also agreements and arrangements on shares of the market and basic conditions imposed by the state for and with the economy as well as the way the state procures equipment and goods, especially through each of the national telecommunications companies, which are under strong political pressure in connection with their purchasing policies.

By and large, it turns out that the world market for information technology is not a free market, as it is primarily portrayed in economic models and reports, but a disturbed market since the assignment of losses to state enterprises (example: the Bull Company in France) or customs duties (example: the EC import duty), but also agreements (example: the U.S.-Japan agreement on semiconductors) and the purchasing policies of telecommunications companies as well will lead to a disturbance of the market.

The term, information technology, is employed differently in the various countries. The distinction between research and development is also a difficult one, especially in the military, where development dominates as a rule. This is why, after examining all available documents that could be obtained relating to this subject, the following figures will have to be accepted as estimates.

State expenditures for research in Germany through the federal government, the states, and the European Community came to about DM1.4 billion last year. This includes about DM1 billion which the Ministry of Research made directly available for research institutes (DM330 million) and projects (DM670 million). Furthermore, the Ministry of Research finances the Fraunhofer Society and the Max-Planck Society, which in turn have several institutes that focus on information technology.

In addition, the German Research Association provides aid for information technology and the universities have their own information technology institutes. Of the DM1.45 billion in EC and Federal German resources, about DM300 million go to financial assistance for research projects concerning the economy, among them DM180 million from the Ministry of Research.

Last year about DM10 billion were spent for research on information technology in the economy itself, which were 97-percent self-financed by the state, with the exception of DM300 million. German industry's own participation in this research is tops in the world and is only comparable to Japan's. Altogether, it is estimated that national expenditures for information technology came to DM11.1 billion in Germany in 1991 and state aid amounted to 13 percent of these national expenditures for research.

About $16 billion were spent on information technology in Japan in 1991. The state directly financed only DM200 million of this. Under the Japanese system indirect aid through low-interest loans and tax aid for research: a 20-percent allowance on expenditure increases, a 6-percent allowance for research and development in small and medium-sized companies, and a 7-percent allowance for all investments in pure research, play a decisive role.

Since this tax aid for research results in tax losses amounting to about $1 billion a year, the estimated direct and indirect aid for research in Japan came to $1.2 billion in 1991. This is 7.5 percent of all of the economy's expenditures for information technology. Because of the dominant tax aid for research in Japan, there is less private company financing in the field of information technology in the Japanese economy than in Germany because tax aid for research has been abandoned here.

But, on the whole, the extent of state aid for research on information technology in Japan is, in terms of percentages, only half as great as it is in Germany. In Germany a large part of the information technology infrastructure

is covered by state contributions for research. This is the reason why the state's share of aid for research on information technology is 13 percent of all expenditures for research in Germany as against 7.5 percent in Japan.

About $26 million were spent on research on information technology in the U.S. economy in 1991. This is substantially more than the $16 million spent on it in Japan. The reason for this, however, is expecially the money spent on research and development for defense. State expenditures for aid for research on information technology come to about $5 billion. Of this amount, $2.5 billion are allotted to the civilian sector and $2.5 billion to the military sector. In addition to this, there are Department of Defense orders for development projects amounting to on the order of from $7 billion to $9 billion a year for the U.S. information technology industry.

Therefore, state contributions for civilian as well as military research on information technology amount to about $12 billion a year, $5 billion of which must be assigned to the domain of research in the narrower sense. In addition to the industry's $26 million, it may be assumed that U.S. national expenditures for research and development for information technology in 1991 came to from about $28 to $29 billion, from 30 to 40 percent of which was covered by state subsidies.

If we consider state aid for research on information technology alone, in the United States from about 30 to 40 percent of the expenditures for research in this field covered by state subsidies of the most diverse sort are essentially limited to military research and development. In Germany state subsidies account for about 13 percent of all national expenditures for research and are essentially concentrated on the sector outside of the economy, that is, the infrastructure, state research facilities of the most diverse sort,and also the economy to the smallest extent.

The German information technology industry finances about 97 percent of its expenditures for research without state aid. In Japan, as concerns financing these expenditures, the economy is dominated by the fact that, viewed in absolute terms, only about half as much is spent for research on information technology. Direct state subsidies are negligible. But the tax measures applied to facilitate research and development, which result in tax relief on the order of 7.5 percent of expenditures, are not insignificant.

In view of the enormous expenditures for research on information technology in America and the state aid for it, the differences in competitiveness in the field of microelectronics can certainly not be attributed to a lack of aid for research; rather there must be other factors that play a role in this situation. If we consider the tax components, the state's contributions in Japan and Germany are about the same, unlike the situation in America where the economy receives massive support from the state.

Center for Parallel Processing Established Near Aachen

93WS0022C Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 23 Sep 92 p 8

[Article by SEL: "Center for Massed Parallel Processing Should Make Technology Transfer Easier for Small and Medium-Sized Companies; Founded Near Aachen; Computer Performance for Laser Welding or Spray Casting Technology; Carrier User Association Expected To Take Over Majority Holding in Future"]

[Text] Aachen—A Center for Industrial Applications of Massed Parallel Processing (ZIAM) has been opened in Herzogenrath-Kohlscheid in the immediate vicinity of the former Aachen police station. Professor Monien (Leipniz Prize, 1992) as well as the Sentec Sensor Company (Hilden) and Parsytec (Aachen) hold shares in Carrier, Ltd. North Rhine-Westphalia and the European Community (EC) have come up with a total of DM6 million for the two-and-a-half-year initial phase. After that, the center is expected to carry itself. In the meantime, the Carrier Association, which will look after the interests of the users and later take over a majority holding of 52 percent in ZIAM, Ltd., has been formed. The center is supposed to serve as a turntable for the transfer of technology for small and medium-sized companies. With the computer technology of massed parallel processing, the outputs of many computers are interconnected. Access to high-performance computers is of great importance to the national economy. Efficient small and medium-sized firms have emerged as suppliers in the industrial sector in harmony with the big research institutes, technical colleges, and the Fraunhofer institutes. Firms like the Parsytec Group and Sentec Sensor are appearing on the parallel processing market as efficient suppliers. Industrial users, which are especially numerous in North Rhine-Westphalia, should, with the help of ZIAM, be provided with opportunities for engaging in parallel data processing.

Under the direction of its managing director, Andreas vom Hemdt, ZIAM has set itself the goal of managing computer performance. Computer performance on one of the most efficient machines in the world is of great importance to every software company in the field of parallel data processing and to many research institutes. In Andreas vom Hemdt's opinion, "professional processing time" is of considerable interest to small and medium-sized companies in particular. ZIAM will be offering them a team of applications experts who not only know how to handle parallel computers, but also master their technology and natural science application areas.

Thus, in North Rhine-Westphalia, for example, there are 100 small and medium-sized companies that produce plastic spray-cast parts. The production costs for a mold easily amount to DM10,000. The quality of a mold, that is, whether it meets optimal rheological requirements in

combinaiton with the materials and process parameters, can only be assessed by means of practical trials. But a few thousand trial runs would wreak havoc with any development budget. Professional service provides a remedy for this. Several tens of thousands of parameter variations can be numerically assessed in three dimensions in a massed parallel computer system. Then the optimal combinations as determined by the computer system are verified with tests and thus result in optimal solutions to production-engineering problems.

The situation with regard to the laser-welding technology is a comparable one. The bonding of the two materials can scarcely be observed or measured during the process. With the time required to compute them in a massed parallel computer system, numerical approximations of several tens of thousands of parameter variations can also be simulated for this and optimal parameter constellations can be selected. A similar situation arises in connection with the simulation of production runs. No one can experimentally check on an optimal layout of production machines, tools, materials, and temporary stocks, as well as combinations of work routines, since the expenditures involved are beyond any financial feasibility. A computer-engineered simulation pushes conventional computers to the limit of their capabilities. Computer times on the order of an hour for a few parameter variaitons hardly afford production planners a chance to achieve a meaningful number of variaitons. Access to a powerful computer can provide additional help in accomplishing this. The bid for a high-performance computer is of essential importance to a national economy in connection with worldwide competition. Considerably shortened product life cycles and the time it takes to develop products can only be reacted to through commensurate simulation capabilities.

Computer technology and access to appropriate providers of computer performance are getting to be more and more important to industry in competition with other regions. In the United States, for example—converting dollars into marks—DM1 billion a year in government appropriations with growing rates of increase are invested in high-performance computers. Based on this, it is to be assumed that the EC will launch a comparable program. Von Hemdt pointed out that the past has shown that many outstanding achievements obtained in university research or at major research institutes are only converted into industrial applications after a considerable lag in time. This is where ZIAM comes in. Specifically, this means the installation of joint projects and research teams with industry and research institutes.

ZIAM will itself take an active part in these projects with financial contributions or through specific project work. The long-term aspect of the servicing and further maintenance of the products of their research will be taken care of by ZIAM employees. Thus, the industrial partner is guaranteed that not all of the project know-how will leave after the scientists taking part in the project are promoted. On the other hand, scientists can stay on through ZIAM research and consultation jobs. Aside from the project work, ZIAM also takes charge of the mediation and middleman services between industry and science. To meet ZIAM's requirements and achieve the objective, an interdisciplinary team will be set up, which will fulfill the different technology and natural science requirements. The range of fields runs from mechanical engineering, physics, electrical engineering, computer science, and numerical mathematics to medical computer science, biology and chemistry. Along with the committed team, appropriate surroundings, especially the group of companies, must be available.

Von Hemdt pointed out that in other cases of promotion of technology the combination of an industrial company as an operational component and an association to tie together all their common interests has already proven itself. Today, some of the founding companies are holding their shares of the corporation ready in a trust until additional industrial partners are found and integrated into the association. No profits will be distributed during the first five fiscal years following the intitial phase; rather all profits will be reinvested in ZIAM. The association is being created for the following reasons: Experience shows that it is virtually ruled out for research institutes to become partners in a corporation. The association offers all members of the so-called "parallel processing community" from North Rhine-Westphalia's science and economy sectors the unbureaucratic opportunity to participate in ZIAM's activities. The association is to take over 52 percent of the shares as the majority stockholder.

Cost, Feasibility of IBM-Siemens-Toshiba Superchip Project Assessed

93BR0030 Paris SCIENCES ET AVENIR in French Oct 92 pp 18-21

[Article by Laurent Schwartz: "Microchips' Leap of the Century"]

[Excerpt] Two hundred scientists and $1 billion to design the chip of the future, an integrated circuit (IC) giving microcomputers power comparable to that of today's bigger mainframes. This is the mad challenge taken up by the three giants of data processing, IBM, Siemens and Toshiba. Their goal: integrating more than 250 million transistors on a few square millimeters of silicon....

IBM, Siemens, and Toshiba will be working together over the next 10 years in an attempt to develop a superchip that will force engineers to rethink current integrated circuits manufacturing techniques. The contemplated level of component integration comes close to the physical limitations of semiconductor materials.

A few figures are enough to illustrate this futuristic chip's full potential: It will store in random access memory (RAM) the equivalent of 25,000 typed pages, a capacity 20 to 50 times greater than that of most current PCs. RAM is a computer's reserve of "live" data, i.e., data the

user can immediately access and manipulate. For example, using an image processing software package, a video enthusiast will be able to manipulate 100 pictures on his microcomputer, compared to only two today. In other words, he will have four seconds of video-animated images to play with, instead of two still photos.

The stakes, however, are considerably higher than simple tricks performed by our video enthusiast. Medical imagery, mobile robotics, driverless vehicles, artificial intelligence, or even satellite data analysis leading to a better understanding of the universe are among the many technological fields that will benefit immensely from integration of the new chip. To get some idea of such benefits, just extrapolate the expected gain in power for a basic microcomputer to supercomputers used by NASA and others.... At this rate, it is still difficult to describe new applications thus made possible for the simple reason that they are yet to be invented.... [passage omitted]

Unprecedented Gamble

In this integration race, the superchip represents an unprecedented gamble. It has spurred the first project that directly skips one technological generation, that of 64-megabit memories. (A bit is the elementary unit of information stored in binary form—0 or 1—in a transistor) IBM and partners are aiming to outstrip the competition by ultimately marketing an incomparably more powerful chip for the same price. In the field of semiconductors, there is a law according to which, sooner or later, the price of a chip will drop and stabilize around $10 per unit, whatever its power. The explanation is simple: Every time a new-generation chip appears, it inevitably replaces the older models. Purchasers and computer and electronic equipment makers will always tend to use one single fast chip rather than four slower ones.

Thus, the maker of a new chip is almost certain to enjoy a monopoly market position and to benefit from it. During the first few months, a new chip sells at four to five times the price of others, until competition catches up with the initiator and drops the price to a minimum. In such a context, the three giants' strategy is clear. If they succeed in skipping one generation of products, IBM, Siemens, and Toshiba will have a lead of several years during which they will be able to profit by charging a premium for their superchip. Better still, in case of success, the three partners will weaken any competitors willing to remain in the market. Competitors face an unanticipated R&D effort which they will never be able to gain back on sales price, not having been first to come up with the new product. Aware of the threat, NEC [Nippon Electronics Company], ATT, Fujitsu and AMD quickly announced that they just might extend to the 256-megabit chip their current cooperation on the 64-megabit IC.

The financial risk, however, is commensurate to what is at stake. The $1 billion reportedly set aside for the superchip is no more than starting capital.... An extra $2 billion will be needed to complete the project. Given the drastic conditions in which circuit etching must take place—a dust particle of one-thousandth of a millimeter settling on the silicon is all it would take to block off a circuit—semiconductor manufacturing may be the most expensive industrial undertaking there is. Cleanliness control of premises plus high-precision production and control equipment represent astronomical costs. Professionals say daily production of 100 chips requires a Fr5 million investment. This is a purely symbolic figure, however, as a plant's annual production totals tens of millions of units. The IBM plant in Corbeil-Essonnes, near Paris, costs the company more than Fr1 billion every year just to support technological evolution of the facilities.... It should be mentioned that this plant is in charge of developing the most powerful chip as of today, a 16-megabit memory jointly designed with Siemens, which will be marketed next year. [passage omitted]

Race for Miniaturization

With the current state of knowledge, would-be manufacturers of the 256-megabit chip still face several unknowns. Before the first prototype can be made, it will be necessary to come up with much denser circuit designs. Until now, for subsequent integration, designers in electronics labs had been working with graphical databases containing layouts which contain experimental results on older chips. Computerized catalogs thus list hundreds of potential layouts, depending on the specific function the chip is to have. When designing a new chip, the objective is to reduce the overall size of components, so as to ensure faster information flow. This is very hard work, which led to today's chips, with 1 megabit of memory on a 37-square-millimeter silicon wafer—one-half of the surface needed seven years ago. But with the superchip dreamed up by IBM, Siemens, and Toshiba, the invaluable catalog may become obsolete overnight. In other words, designers will have to work without a safety net....

Another hurdle to be overcome: The 256-megabit chip will require 0.25-micron linewidths, which means that scientists must find a light beam of corresponding thinness, as a pattern's definition is proportional to the radiation's wavelength. Indeed, just as one cannot draw an object to scale with a pencil tip thicker than the object, it is not possible to illuminate a pattern with a light beam that is thicker than the pattern. [passage omitted] For the 256-megabit chip, the use of X-rays was contemplated for a while, as their wavelength can be as low as a few thousandths of a micron. The only problem is the well-known fact that X-rays will pass through almost any material. An X-ray-proof photographic mask no thicker than a few microns has not yet found its way out of research laboratories. As a result, the superchip will probably be photolithographed under very low-wavelength UV light with new photosensitive resins. It, however, belongs to the very last generations for which UV processes are likely to be at all useful. Afterward, it

will be necessary to solve the X-ray problem or to come up with a new manufacturing process.

At any rate, beyond the years 2010-2020, which should see 1- and 4-gigabit chips (1 gigabit equals 1 billion bits), engineers will be able to stop worrying as the race for component miniaturization will grind to a halt against an impassable physical barrier. Calculations show that the components of a 16-gigabit chip would be so minute (in the order of one-hundredth of a micron) as to have no electrostatic effect whatsoever on electrons. Once the system was turned on, electrons would reach a temperature of several thousand degrees and would move so fast that they would instantaneously destroy the semiconductor.

France: GIAT Industries Launches Advanced CAD/CAM Software

93WS0075A Paris INDUSTRIES ET TECHNIQUES in French 9 Oct 92 p 56

[Article by Jean-Yves Catherin: "GIAT Industries' Revolutionary CAD/CAM System"; first paragraph is INDUSTRIES ET TECHNIQUES introduction]

[Text] Ten years of research went into creating the first complete CAD/CAM system that automatically generates machining-operations sequences.

Philippe Herve, who is in charge of computer-integrated manufacturing (CIM) at Giat Industries, is not afraid of big words. As far as he is concerned, the Dimat system which the Tulle center has developed is the greatest revolution in CAD since the technique was invented. "Catia, Euclide, Cadds and other big systems will have to go back to the drawing board for CAD/CAM," he assures us. Designed by machinists for machinists, it is, according to Mr. Herve, the only system that incorporates "tolerancing" right from the design phase, automatically outputting the best machining-operations sequence once design is complete.

When the Tulle engineering and design department went looking for a 3-D CAD/CAM program for machine applications in 1981, all they found were systems conceived and built by computer specialists. They could draw superb Beziers curves, but were designed "by people who knew nothing about chips." The systems on the market focused on graphic and geometrical definitions of parts under design; the parts always required correction and enrichment before they could move on to the CAM stage on machine tools. Any skilled machinist can machine any part as long as he has its dimensions, positive allowances, and tolerances; the latter, however, correspond to a "dressing" that computer science cannot interpret. It was to fill this gap that the army, at that time the trustee of GIAT [Land Weapons Industries Group], financed a study of a machine-oriented CAD/CAM systems.

In Dimat, tolerances are not just written, they are givens. Dimat's modeler is based on the concept of maximum volume dimensioning; a 40 +/- 0.2 male dimension will be written "40.2 + 0 - 0.4", and a 20 +/- 0.2 female dimension will be written "19.8 + 0.4 - 0." A minus sign clearly indicates that the material is inside and that the dimension is therefore male. This enables the binary computer to distinguish male from female dimensions.

Within the Dimat architecture, the Defmat module provides a morphological, conceptual, and functional definition of the part, to which the Techmat module adds a technological definition (material, initial and final hardnesses). This modeling system generates the input data of Gagmat, an automated operations-sequence generator that computes the machining process. The Gagmat expert system uses the Propel inference engine, which is written in Lucid Common Lisp and includes about 250 built-in rules and three know-how rule bases. The first [base] holds the "suboperations sequence" knowledge and locates the dominant technologies and all the machining volumes in each suboperations sequence. The second combines a machining volume with a machining process, made up of all the volume operations. For each of them, Gagmat describes the class, type of work, tools capable of doing the job, and parameters. The third sequences (runs) the volume operations.

Gagmat selects the solution from among the possible choices by determining the best support and best tool, using a system of rules weighted from 1 to 10 according to how imperative they are. The generator includes a heat treatment and positions it in relation to the other operations. For example, the operations sequence of a detente case that took two months for a skilled methods engineer to write can be run in only 17 minutes.

According to Jean-Pierre Tintignac, CAD/CAM engineer in Tulle, Dimat has no competitors at this time. It is the first complete CAD/CAM tool. GIAT and IRPL developed Dimat (110 person-hours), and Itmi developed Gagmat. For the time being the system is running on an Apollo DN 4500 station, but the industrial version under development since July 1, 1992 will run on a station supporting the UNIX Standard (Sun, Silicon Graphic, HP) beginning in March 1993. Modules for lathe work and forging/casting are being written. The Tulle team says it is willing to work with partners to develop occupation-specific applications.

Italy's Elsag Develops Hybrid Character Recognition Systems

93WS0075D Paris INDUSTRIES ET TECHNIQUES in French 9 Oct 92 p 101

[Article by Mirel Scherer: "Recognition of Characters on Anything That Moves"; first paragraph is INDUSTRIES ET TECHNIQUES introduction]

[Text] The Elsag-designed system, which recognizes numbers or letters on moving objects, has broad applications.

Character recognition is a nice complement to bar-code systems and in some cases can even replace them. An example is the new system developed by the Italian firm Elsag, which can identify characters on moving objects, whether vehicles or merchandise.

Users can choose between two configurations. The first, christened Slam 10, was designed to read and record numbers on a wide range of documents, including bank and lottery bills, restaurant tickets, payment checks, and so on. It can process as many as 8,000 documents an hour. The second, more powerful one (Slam 20), was developed to check the correctness of information on packaging and wrapping: product codes, batch numbers and expiration dates on food, pharmaceutical, or cosmetic products—nothing escapes it. Just as efficient in direct-mail sales, the machine can process return mail at the rate of 18,000 documents an hour.

The system's design, which integrates artificial vision and optical character recognition, accounts for its technical performance. A camera placed near the path of the object to be identified captures the data on, say, a license plate. The image is then digitized. In practice, depending on which sensor is used, the pictures will be either digital from the start or analog (photographs). After filtering the signal to regularize it, the system will perform a "characteristics extraction" operation. This process aims to uncover the discontinuities between light and shaded areas to highlight contours. Elsag designed a tailor-made computer, Emma 2 (which stands for multi-mini-associative elaboration), to solve the computational problems. The computer contains several processors working in parallel in a hierarchical structure, and can calculate large volumes of data in real time using complex algorithms.

There are many potential applications for the system. Real-time reading of vehicle license plates, for instance, would optimize management of highway, tunnel, and parking lot tolls by facilitating entry and exit. In the same way, Slam could supervise merchandise shipped by sea, road, or rail through immediate container identification. Proper and immediate identification of containers in port terminals will improve the management of receiving, storage, and shipping. The system's advantages here are obvious: loading and unloading could be sped up, and more rational use could be made of storage room or handling equipment. Indeed, containers are still identified by employees who capture identification codes at computer stations—a tedious and error-prone system.

Activities of French Neural Network Coordination Group Noted

93BR0144 Paris ELECTRONIQUE INTERNATIONAL HEBDO in French 5 Nov 92 p 13

[Article by Henri Pradenc: "Neural Networks Are Industrial Candidates"]

[Text] Prepare industry for the introduction of neuromimetic technologies. That is the objective of the coordination group created a few months ago by the CNRS [National Center for Scientific Research].

Six hundred and fifty publications dealing with neuromimetics in 1979, more than 2,000 in 1981! The eighties have kept up this pace. To date, some 380 patents have been registered on this subject by various laboratories. This is an indication that research studies have reached a preindustrial stage. The industrial phase, therefore, can not be far. At the beginning of the year, this was enough to incite the CNRS to create the CRIN [Coordination of Industrial Research] Club on "Neural Networks," to facilitate dialogue between industry and laboratories, which were bursting with activity. The club boasts 350 members, one-third of which are businesses. Among the corporate members are industry suppliers such as Philips, Thomson, and Mimetics, as well as end users such as Lyonnaise des Eaux [Lyon Water Company] or representatives from the banking and insurance sectors.

The club's mission is not financial; it is to spark collaboration by helping businesses and research laboratories to formalize their relationships. For the moment, however, their priority is to educate. A periodic bulletin has been created to give updates on the state of the art and to publicize the work of various laboratories, be they public or private. Seminars on specific topics are organized. These serve 50 to 60 participants at a time. In about one year, smaller working groups will be established around various areas of specialization.

Improving Response Time Through Direct Implantation on Silicon

Shape recognition, be it optical character reading, speech recognition, or artificial vision, constitutes a generic theme around which neuromimetic applications are developed. The spectrum, however, is larger; ideas for more industrial applications should result from these topical specific seminars. The first of these met in April and dealt with classification by neural networks. The second met in September, the topic being "Industrial Process Identification and Control." Their learning capacity makes neural networks a new tool by which industrial processes can be analyzed. This technology makes it possible to understand a complex industrial process that is difficult to model through the use of conventional techniques. This subject has attracted much interest from industry. "Members of the club want to know what to expect from all this," notes Jean-Lionel Beraud, club organizer. Another aspect of the club attracting interest is performance. Currently, software-driven neural networks are lacking in speed—a handicap, especially in the industrial arena. The solution? Improve the response time by directly implanting neural networks on silicon. Certain products are being announced by manufacturers, as are the results of the studies carried out in the context of European research

programs. The club actively publicizes developments of these new circuits, even though a truly industrial circuit is not, as yet, available.

Certain applications are on the agenda for future discussion groups: diagnostics (neural networks will detect breakdown risks) and prediction. Research within this context is being conducted by Lyonnaise des Eaux as well as by the EDF [French Electricity Company] to estimate consumption of water and electricity. The pharmaceutical industry's R&D laboratories could call upon neural networks to predict the properties of new molecules.

ENERGY, ENVIRONMENT

Germany: Prospects for Bitterfeld Chemical Center Outlined

93MI0047 Wuerzburg UMWELTMAGAZIN in German No 10, Oct 92 pp 66-67

[Text] A ray of hope is appearing on the horizon for the crisis-torn region surrounding the chemicals metropolis of Bitterfeld. A 530-hectare industrial park will not only serve the marketable core business of Chemie AG that has survived from the GDR era but will also attract investors who command a fairly large share of the market and can thus safeguard existing jobs. Examples include the western German detergent producer Dreco, which is taking over the detergent factory, and Omniplast, which will continue operating the pipe extrusion plant.

Moreover, other companies are expected to relocate to Bitterfeld, bringing their own technologies with them. Examples of these are Bayer AG, Heraeus, and Sidra Hydrochemistry.

Numerous Utilities

If industry is to be installed successfully, however, a utility infrastructure must be created. The area has a central power supply grid. The gas-fired power station will be privatized and run in the future by a consortium made up of MEAG of Halle and the Texan company Enron Power Corporation. There are plans to construct a hazardous waste incineration plant with an annual capacity of 60,000 tonnes in conjunction with a chemico-physical treatment plant to handle solid waste disposal within the industrial park. The Bitterfeld Waste Disposal and Recycling Centre AG was founded at the end of June. It aims to bring the plants on stream by 1995-1996.

Progress has already been made as regards sewage disposal: It was announced on 8 July this year that work had officially begun on the construction of the joint industrial and domestic sewage works. The 300-million German mark [DM] project is scheduled to be at least partially on stream by December 1993. The sewage works should be fully operational by mid-1994 at the latest.

Exemplary Solutions

"This could be an attractive and economical solution for other locations," said Uhde GmbH chairman Prof. Lothar Jaeschke in praise of the ambitious project at a press conference. The company, which had been operating a pilot sewage treatment plant in Bitterfeld for two years, was commissioned to design and build the sewage works jointly with Preussag-Noell GmbH. The project will be financed by both the federal and the land environment ministries.

The brief for this investment project was:

- Disposal of industrial effluent from the factories in the future Bitterfeld-Wolfen industrial park, and
- Treatment of the domestic sewage from more than 26 of the affiliated "Lower Munde" and "Wolfen" sewage association districts with a total of about 100,000 inhabitants.

The building work is to be completed within two years.

The plant will be able to treat 422,000 average inhabitant units, equivalent to about 77,000 m^3 sewage per day. It has been commissioned by a holding company, GKW (Joint Sewage Works) Bitterfeld-Wolfen GmbH. Chemie AG Bitterfeld-Wolfen holds a 48-percent share in this company, and the "Wolfen" and "Lower Munde" sewage associations each have a 26-percent share. The people in charge at GKW are particularly proud of the speed with which the planning, license application, environmental compatibility study, town planning procedures, and public hearing have been completed. The representatives of the GKW management were pleased that, "We can state with some satisfaction that there have been no objections in this respect."

It is the first time that such a large-scale plant will be built with bioreactors working in conjunction with industrial and domestic effluent treatment. Uhde GmbH is responsible for biological effluent treatment, sludge dewatering, and subsequent sludge incineration. Preussag-Noell Hydraulic Engineering GmbH is designing and constructing all the pumping stations and pressurized pipe lines that will convey the sewage association and industrial park effluent to the sewage plant, as well as preliminary chemico-physical clarification and sludge thickening plants. The pigment will be extracted from the azo dye production effluent by a special reductive process.

Tower Bioreactors

Four tower bioreactors developed jointly by Uhde and Hoechst AG form the core of the biological purification stage. Built in the form of compact towers, the reactors take up much less space than conventional plants. The sealed tank design prevents any malodorous fumes from escaping.

As all the machines are enclosed, noise is kept to a minimum. Owing to their height, the reactors use oxygen in a particularly efficient manner and therefore have a

low energy consumption. The virtually maintenance-free aeration system with radial flow jets ensures a high level of plant availability.

The first step was the search for a site for the joint sewage works. Professor Jaeschke describes the difficulties involved: "As we had to give way to a major industrial development, we were eventually offered a triangular site with sides nearly 350 meters long that was difficult to build on." The screening plant that is used instead of a large preliminary clarification tank for pretreating domestic sewage and the bioreactors made for a space-saving and architecturally attractive solution. The adjacent private land remains green.

Additional Systems

The joint sewage works' special safety equipment includes five equalizing and storage tanks and a safety tank. Individual flows can thus be analyzed and evaluated on the "polluter pays" principle and, if necessary, treated in metered quantities in the chemico-physical preclarification plant.

All the tanks are above ground to rule out the possibility of uncontrolled leaks. "This is a no-cost safety standard designed to protect the groundwater," explains Professor Jaeschke.

In order to deal with the many kinds of elluent pollution, the plant also includes a special pre-treatment plant for dye effluent, and facilities for simultaneous activated carbon adsorption in the biological reactor to remove substances that are not readily degradable. Provision is also made for simultaneous phosphate elimination.

For the companies responsible for the building work, it is particularly important that a large number of local suppliers and building contractors are also involved. Of the orders placed so far, which amount to a total of DM15 million, orders worth DM12 million have been placed with companies in the new federal laender. "These figures are a clear indication of the growing capacity of local industry," says Professor Jaeschke. All those involved are convinced that this project will act as a pointer for the region and will thus pave the way for further industrial development in Bitterfeld and Wolfen.

France: Automobile Industry's Recycling Strategy Discussed

93WS0053A Paris LE MONDE in French 9 Oct 92 p 17

[Article by Pierre-Angel Gay: "Burning Obligation To Recycle"; first paragraph is LE MONDE introduction]

[Text] Twelve million junked cars per year in Europe. Automakers are beginning to turn their attention to them.

The "green" car is in style. Making the best of a bad situation, automakers are now in heated competition following the example of German industrial groups which have long been subjected to the pressure of the "Greens." BMW pioneered in France last year by boasting that its new Series 3 is "80 percent recyclable." With perhaps less than full candor, since ferrous metals, which represent more than 70 percent of the weight of a vehicle, have long been recovered....

Now, all its competitors, including the Latins, are following suit. Renault is outstripping the others, presenting its new Twingo as... 90 percent recyclable. Fiat, for its new Cinquecento, is devoting an entire brochure to the subject. And it assures that chlorofluorocarbons—those notorious CFCs, destroyers of the ozone layer—no longer cover their upholstery. That asbestos has disappeared from brake and clutch linings. That aromatic solvents are no longer used in anticorrosion treatments, thus respecting the purity of the air in the passenger compartment. That the Cinquecento, finally, has entered the era of the recycling of plastics, henceforth marked with an international code enabling easy identification of their composition.

It is true that following the adoption of much more restrictive standards in the area of fuel consumption [1], recycling of wrecks may become compulsory in Europe. France and Germany have decided to draft, with the assistance of automakers, a system of free recovery of car bodies accompanied by the obligation to reprocess 95 percent of the weight of the vehicles. In the Netherlands, it was the used-car dealers and garage owners themselves who proposed establishment of a new-car tax to finance a recycling infrastructure. Ultimately, in Europe there are 12 million junk cars which must be processed each year—1.8 million in France out of a national total of 23 million cars. That means mountains of sheet metal, glass, plastics, and fabrics to be reprocessed. As for the sheet metal, this is well on its way. The metal parts, already largely reprocessed, make "the automobile one of the best recycled products," assures Claude Gandillot [2]: 100 percent for cast metal, 85 percent for aluminum alloys, 70 percent for battery lead, and 30 percent for steels. "From catalytic converters," he continues, "98 percent of the platinum and 80 percent of the rhodium are also recycled."

These are extraordinary percentages which should not mask the difficulties. Designed many years ago, the vehicles currently reaching scrapping age did not benefit from the research conducted in the interim for new, less polluting and more readily recyclable materials. Also, after having each established their own separate recycling networks—Renault in association with Metal Europe, Engelhard, and SARP; PSA at Saint-Pierre de Chandieu near Lyon—the two national automakers decided this year to join forces and to participate in the creation of an industrial center, managed by the Compagnie Francaise des Ferrailles (CFF) and capable of processing 200 vehicles a day at Athis-Mons in Essonne. Renault and PSA will next combine the results of their respective experience to jointly organize a collection system.

The road for the "green" car promises to be long and arduous. It could well include some failures, as evidenced by the recent warning issued by the National Center of the Automotive Professions (CNPA) about the impossibility of reprocessing the 300,000 metric tons of used motor oil collected each year because the only reprocessing plant in business in metropolitan France, at Lillebonne (Seine Maritime), has inadequate capacity. Forced to store the used oil on their premises, the approved collection centers have stopped accepting it. At the risk of causing the tanks of the garage owners, service stations, and car dealerships overflow....

Footnotes

1. To reduce carbon dioxide emissions, France and Germany have decided to limit, by the year 2005, the average consumption of automobiles to 5 liters per 100 kilometers.

2. Gandillot, Thierry, [The Last Battle of the European Automobile], Editions Fayard.

France: Plasma Furnace Destroys Industrial Waste

93WS0062B Paris PRODUCTIQUE/AFFAIRES in French 5 Oct 92 pp 3, 4

[Article entitled: "Enthalpie Synthesizes and Destroys Molecules with Its Plasma Torch"]

[Text] The ceramic furnace manufacturer Coudamy established Enthalpie, a company specializing in thermal plasma applications, in 1989. "We are the product of the Coudamy group's industrial experience and the scientific experience of the plasma chemistry lab of the University of Limoges," explains Philippe Roumilhac, an engineer at Enthalpie. "The company uses plasma technique in a broad range of applications, including toxic waste treatment, the synthesis of ultra-fine powders, and surface treatments."

Through vaporization, the process can synthesize ceramic, metal, and composite powders used to increase mechanical strength and to make superalloys or ceramic tools. Enthalpie synthesizes, on a semi-industrial scale, aluminum nitride for high-power micro-electronics, titanium nitride used as cutting tool inserts, tin oxide employed in substitution, and cadmium oxide for silver/tin-oxide alloys that are used as electrical contacts.

The jet generated by plasma treatment is also useful for spraying on surface coatings. Enthalpie has developed a wholly original process for "filling in" granite, in which the jet turns the surface of the granite sheets granular.

Heavy Metals Denatured in the Plasma Furnace

If what makes thermal plasmas unique is their significantly higher temperature compared to traditional combustions (2000 to 2500 K), that same temperature enables them to destroy industrial waste that is resistent to incineration techniques. Enthalpie can vitrify used catalysts containing heavy metals, recover usable metals, pyrolyze the distillation residues of petroleum, and denature nuclear waste in its plasma furnace. Although the method is still costly, the future of the technique could not be brighter considering how difficult it is for many manufacturers to dispose of some of their products.

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Germany: Degussa-Kat Group To Recycle Catalytic Converters

93WS0075B Paris INDUSTRIES ET TECHNIQUES in French 9 Oct 92 p 74

[Article by Andre Larane: "Germany Recycles Catalytic Converter Platinum"]

[Text] Five German companies have teamed up in an association dubbed Degussa-Kat-Verbund to recycle used catalytic converters. They will set up a collection system that will cover Germany. A partner in the association, the MG Metall und Recycling company, already has experience in collecting battery waste. Moreover, it is building a demolition installation near Frankfurt that will allow it to recover and reuse the converters' stainless steel cases as well. MG Metall's facility will deliver the ceramic cores to Degussa so that it can extract their precious metals. The platinum and rhodium in the catalytic converters make it especially profitable to recycle them.

The Degussa company, which floated the idea for the association, is among the world's top makers of catalytic converters, producing 17 million a year. It plans to reuse the metals recovered to line new converters. It has just begun operating a high-temperature electric furnace, with a high recovery capacity, at its Hanau-Wolfgang factory for that purpose. The furnace will recover nearly 5 g of platinum from about 3 kg of used catalytic converters.

The recycling market is becoming lucrative. In Germany, automobiles already equipped with converters represent 14 metric tons of platinum and 2.8 tons of rhodium, worth a total of 650 million German marks [DM]. Their converters will be worn out in five to 10 years. In Europe as a whole, 10 million catalytic converters were installed in automobiles in 1991. Their number will double between now and 1994. Only 200,000 converters were recycled in 1991. Manufacturers expect that number to climb to 1 million in 1995, and to at least 8 million in the year 2000.

France Opens Environment Information Center

93WS0089A Paris AFP SCIENCES in French 22 Oct 92 p 30

[Article entitled: "The French Environmental Institute Is Up and Running"]

[Text] Paris—Officials of the French Environmental Institute (IFEN) announced that it was up and running on 20 October in Paris. The Orleans-based public institute aims to provide the public with the statistical, geographical, economic, and legal data needed to make environmental concerns part of economic policy.

"It is not IFEN's job to generate the environmental data itself. Its goal is to operate a network that is capable of providing decisionmakers with credible scientific information," stressed Yves Pietrasanta, president of the new institute. IFEN was created in November, 1991, and placed under the authority of the Ministry of the Environment. The center is also expected to play an international role, in cooperation, notably, with the future European Environmental Agency.

For now, acknowledged its director, Jacques Varet, IFEN has only a "very limited" staff of 30 and a budget "cushion" of 30 million French francs [Fr]. Its staff should ultimately swell to 150 (including 100 budgeted positions) in 1995, and its budget should grow to about Fr160 million.

But IFEN already has 50 partners, including such research establishments as the National Scientific Research Center (CNRS), the National Museum of Natural History, the Bureau of Geological and Mining Research (BRGM), the National Institute of Agronomic Research (INRA), and the French Institute for Research on Exploitation of the Ocean (IFREMER). It also counts EDF [Electricity of France] and the SNCF [French National Railway Company] as collaborators.

Max Planck Institute Builds Germany's First Entirely Solar House

93MI0101 Bonn DIE WELT in German 29 Oct 92 p 9

[Text] A large south-facing glass facade, dark solar cells on the roof, no chimney, and no mains electricity. These are the features of Germany's first house to generate its entire power requirement. It was developed by the Fraunhofer Institute of Solar Power Systems (ISE) and will be commissioned by Federal Research Minister Heinz Riesenhuber in Freiburg tomorrow.

It took engineers more than three years to develop the house. It will demonstrate that even at our latitudes a house can be heated in winter by solar power alone. Even the washing machine and television sets will run on solar power. Food will be cooked on a new kind of hydrogen stove.

Power is supplied by a 36-square meter solar collector and a novel solar generator. A seasonal system stores the energy on a hydrogen and oxygen basis in the cellar of the house. This is the first time that hydrogen technology has been demonstrated in a home in Germany. There is a catalytic combustion system, primarily to generate the additional heat required for heating and hot water when the sunshine level is really inadequate in winter.

Building the house alone cost 600,000 German marks [DM]. The sophisticated solar technology cost a further DM800,000. The Research Ministry in Bonn and the Land of Baden-Wuerttemberg are spending DM5 or 6 million on the experiment over the next five years.

An ISE employee who has been involved in the pilot scheme from the outset will be the house's first occupant.

Germany: Earth Remote Sensing Research at DLR Berlin Branch Described

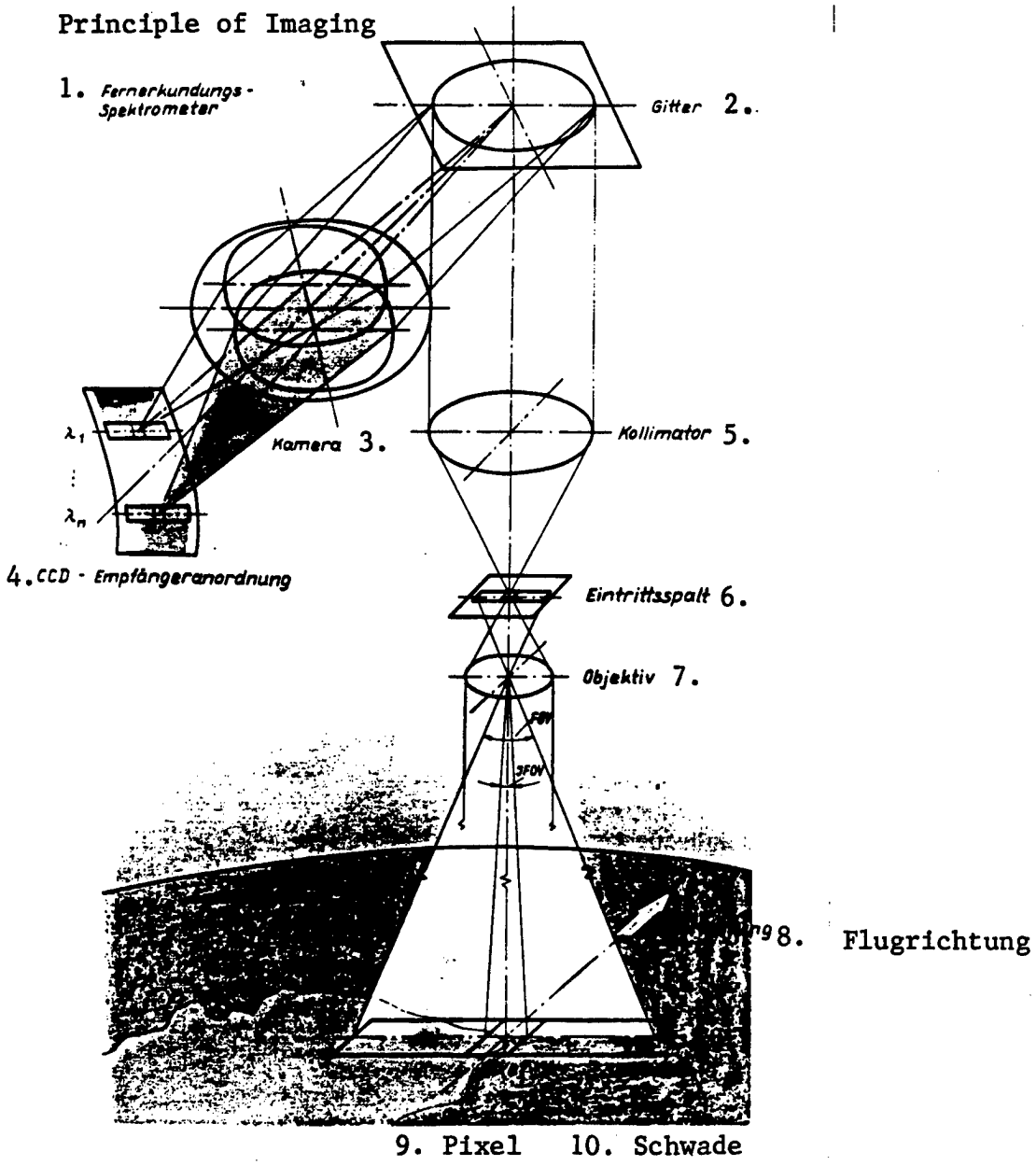
93MI0128 Cologne DLR-NACHRICHTEN in German Oct 92 pp 7-11

[Article by Drs. Andreas Neumann, Bernd Piesik, Maria von Schoenermark, and Prof. Gerhard Zimmermann, all of the German Aerospace Research Establishment's Institute of Space Sensor Engineering: "Environment-Oriented Earth Reconnaissance at the DLR Center in Berlin-Adlershof—International Priroda Project Forms the Core"; first paragraph is DLR-NACHRICHTEN introduction"]

[Text] This article gives an overview of earth reconnaissance research at the Institute of Space Sensor Engineering at the DLR [German Aerospace Research Establishment] in Berlin-Adlershof. The primary focus is on contributions to the international Priroda project, which is scheduled to enter the scientific experiment phase in 1993.

The increasing effect that human beings are having on the natural environment, and the regional and global consequences, have been confronting earth reconnaissance with new demands in recent years. Assessing the condition of our environment, monitoring mesoscale and global phenomena, determining environmentally relevant parameters, their space-time dynamics, and their anthropogenic modification would all be impossible without air- and satellite-borne measuring systems. Remote earth reconnaissance provides the input values necessary not only for geoscientific research and modeling climatic phenomena on a global scale, but also for assessing regional environment problems and the whole subsequent governmental and industrial decision-making process.

In recent years, earth reconnaissance, spurred on by the availability of new technologies, but primarily in response to the complexity of geophysical, oceanographic, and climatic phenomena has increasingly been adopting complex sensor systems. These involve a combination of active and passive measuring systems operating on various electromagnetic radiation wavelengths ranging from microwaves through thermal infrared (TIR), visible and near infrared (VIS/NIR), to ultraviolet (UV) radiation. Specific wavelength ranges are used to investigate particular phenomena: For example, the visible spectral region for ocean color, microwaves for ocean surface condition, and thermal infrared for surface temperature. Such multisensor measurements set earth reconnaissance a series of method-related tasks: optimal,



Principle of Imaging Spectrometer

Key: 1. remote sensing spectrometer 2. grating 3. camera 4. CCD [charge-couple device] receiver line array 5. collimator 6. entry gap 7. lens 8. direction of flight 9. pixel 10. window

selection of optimum sensor combinations to solve each specific problem; combined evaluation of measurements from different spectral regions, and hence the exploitation of synergies. Last but not least, there remains a need for research that will provide a physical understanding of the measurement data acquired and develop processes for deriving geophysical parameters from remote measurements. Such research can be advanced by missions that involve complex satellite-borne equipment and provide experimental data both for methodical studies and for preoperational use.

Priroda International Earth Reconnaissance Mission

Priroda (nature) is the name of a comprehensive mission currently being prepared to test complex remote reconnaissance methods. The experimental basis of this major

scientific program is a special research module scheduled to dock onto the Russian Mir space station during the second half of 1993. The module will carry a payload of unprecedented complexity covering almost all the spectral regions and measuring procedures used in earth reconnaissance, including nadir-looking, scanning, and panorama microwave radiometers, synthetic aperture radar, altimeters, an imaging VIS/NIR spectrometer: photographic and TV cameras, a lidar, and an ozone profile measuring device. The scientific experiment program currently involves research teams from the CIS, Bulgaria, Czechoslovakia, Germany, Finland, France, Italy, Poland, Romania, Switzerland, and the United States. The major objectives of this complex program are to study land surfaces (snow cover, soil and vegetation characteristics, inland waters, ecological mapping), the oceans (global monitoring, surface temperature, wind field and surface roughness, ocean color, bioproductivity, interactions within the ocean-atmosphere system, ice cover), the atmosphere (global processes above the oceans, maritime atmosphere in tropical regions, the lower stratosphere and troposphere, aerosol and trace gas monitoring), and ecological research (anthropogenic influences on aerosols and trace gases, ecological catastrophe areas, state of vegetation). The remote measurements obtained with the Priroda sensors will be backed up in selected areas of the world by extensive ground truth and airborne measurement programs.

The fact that the DLR will make the MOS sensor available means that German research teams can use data from all the Priroda sensors free of charge. With this in mind, a scientific program has been drawn up, with support from DARA [German Space Agency] and involving a total of 16 university and DLR research teams, to use Priroda data for current research programs, carry out special ground measurement programs, and ensure intercalibration with other earth reconnaissance mission sensors. It will focus primarily on:

- Calibrating and processing Priroda data;
- Examining the information content of Priroda data for geoscientific and ecological research purposes;
- Performing experiments with a view to geoscientific and ecological applications.

At its branch in Neustrelitz, Mecklenburg-Vorpommern, the DLR's German Remote Sensing Data Center [DFD] is creating a Priroda data user center that will provide data transfer with the CIS and access throughout Germany. Project management and coordination under the German scientific program are being handled by the DLR Institute of Space Sensor Engineering in Berlin-Adlershof.

The MOS—Modular Optoelectronic Scanner

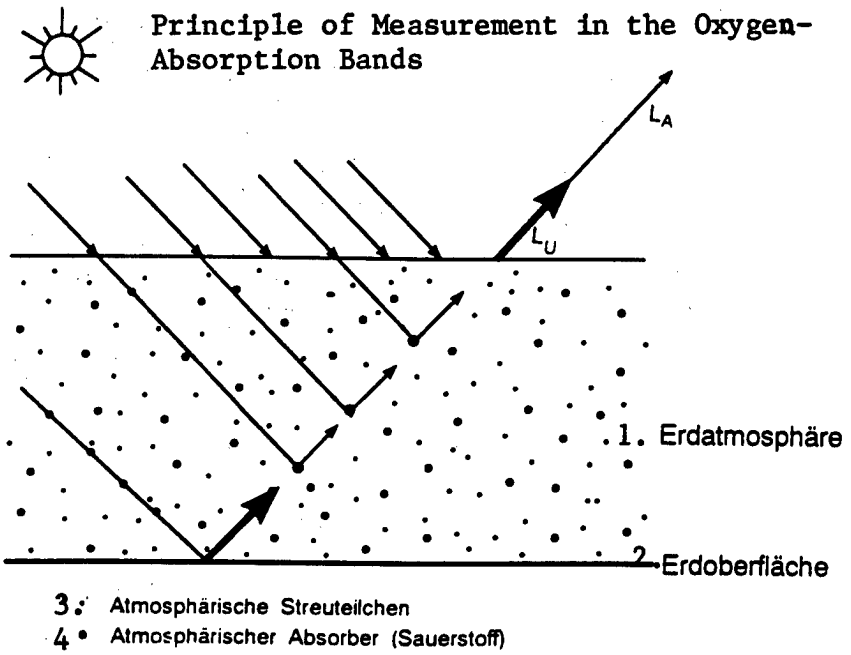
The modular optoelectronic scanner, which was specially designed for remote ocean-atmosphere system sensing in the visible and near infrared spectral region is an experimental contribution from the Institute of Space Sensor Engineering to the Priroda module. The sensor consists of two separate imaging spectrometers: MOS-A with four narrow 760-nm oxygen-absorption band channels for atmospheric parameter measurement and atmospheric correction, and MOS-B with 13 VIS/NIR-range spectral channels for inspecting the biosphere investigations with particular reference to interactions in the atmosphere-ocean system, and for measuring substances contained in water. Both spectrometers are designed as imaging plan as grating spectrometers (see figure 1), and positioned on the same platform in such a way as to provide congruent lens coverage. As the sensors will be used to study mesoscale phenomena, it was designed for medium spatial resolution. Special attention was paid to high spectral resolution and radiometric accuracy, and a special in-flight calibration system ensures that the parameters are maintained. Internal calibration lights provide sensor sensitivity, linearity, and adjustment monitoring data, and the spectrometers are recalibrated with extraterrestrial solar radiation several times per year, thus making it possible to calibrate the readings with great accuracy in physical radiation units.

Scientific Utilization of the Berlin DLR Center

As a result of the scientific and experimental work previously carried out at the former Institute of Cosmos Research in Berlin, the earth reconnassaince experience and priorities of the DLR Institute of Space Sensor Engineering lie in the remote sensing of the atmosphere-ocean system. The institute's new prioritization is placing increasing emphasis on aspects of remote mesoscale and global sensing climate- and ecology-relevant phenomena that occur above the ocean and land. The emphasis is on scientifically methodical studies regarding the information content of different spectral regions and sensors, radiation transport modeling, parameter inversion and atmospheric correction, and the testing and use of remote sending methods. Combined satellite- and ground-based experiments form a major component of this work, which, until 1995, will be based largely on the Priroda mission and the associated ground-based experiments, which will investigate aspects of remote sensing of the atmosphere-ocean system and the derivation of parameters regarding nonmaritime ecosystems from satellite measurements.

Remote Sensing of Atmosphere-Ocean System

Various parameters are of particular importance for remote ocean sensing: Substance concentrations in water established by remote data are used to study bioproductivity oceanic activity in the CO_2 cycle, and water pollution, while variations in ocean color in space and time contribute to the study of ocean dynamics. Such measurements require use of The VIS/NIR spectral range (400-1,000 nm), which uses sensors with high spectal resolution and high precision, radiometric is ideal for these measurements. As absorption by pure water is very low between 400 and 700 nm, backscattered light in this range mainly contains information on the composition, concentration, and nature of matter suspended in the water. Remote measurements using



Principle of Measurement in the Oxygen-Absorption Bands

Key: 1. earth's atmosphere 2. earth's surface 3. atmospheric scatter particles 4. atmospheric absorber (oxygen)

satellite-borne sensors present additional scatter and attenuation effects caused by air molecules and aerosols in the atmosphere. An additional signal component is created, which is far greater than the signal reflected directly off the water. Typically, only around 10 percent of radiation measured by the satellite derives from water. Water content measurement therefore requires corrections to the data on atmospheric effects, for which measurements in the NIR range can be used, owing to the great increase in absorption by water above 700 nm.

Interference is also caused by the effect that the water surface has on the ocean's reflective properties (roughness and foam), the amount of radiation reflected off the water's surface being as great as the amount returned from the water. The scattering effects in the water, on the water surface, and in the atmosphere interfere with one another in the measurement signal received by a satellite. One way of separating the atmospheric and surface components is to use narrow-band measurements at 760 nm oxygen-absorption range. Figure 2 shows this principle in simplified form. The reflected radiation has two major components: the atmospheric component L_A and the background component L_U. At 760 nm, the oxygen in the atmosphere is highly absorbent. This absorption affects the background component more strongly than the atmospheric component owing to the greater distance covered. The two components can be seaparated by performing measurements at 758 nm and 760 nm. The variability of aerosol distribution at different altitudes means that more than two spectral channels are required in the absorption bands for the process to be effective (for MOS-A).

Remote atmosphere-ocean system sensing uses high spectral resolution measurements, typically with between 6 and 10 channels in the VIS/NIR range. In comparison, the number of parameters derived is generally small (two to four). The large number of spectral channels is required to distinguish different types of substances contained in water, to adapt integration procedures to different types of water (the open ocean or coastal waters), and, more particularly, to increase gradation precision in establishing individual parameters. The problem of distinguishing different substances contained in water, is typical of coastal waters, where anthropogenic influences (pollution) are particularly noticeable.

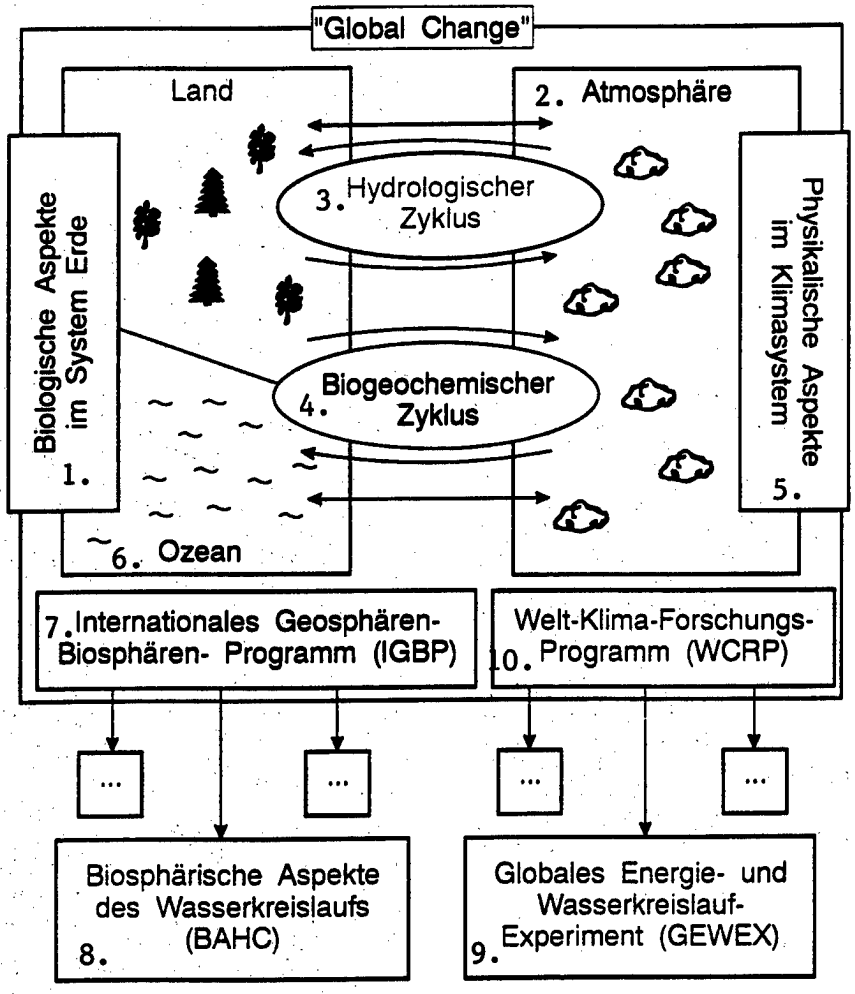
One difficulty in evaluating remote sensing measurements lies in assessing their information content. Multivariant analysis processes (main component and factor analysis) can be used for this purpose, as they make it possible to break the large mass of measurement data down into a limited number of informative parameters, taking account of signal noise and differing levels of variability in the spectral channels. These mathematically derived values must then be prepared for geophysical interpretation, for instance the deduction of concentrations of substances contained in water. An approach that can be used in typical cases involves using model data, previous knowledge, and ground truth measurements to verify retrieval algorithms (i.e., the quality of information extraction and its accuracy). The main

problem in remote ocean sensing lies with the investigation of coastal areas and, therefore, the development of methods for distinguishing different contents (chlorophyll yellow or organic-inorganic substances).

To support and verify the research presented here on remote atmospheric and oceanic parameter surveying, the Institute of Space Sensor Engineering is working with the Sebastopol Marine Hydrophysical Institute, the Warnemuende Institute of Baltic Sea Research, and NASA on a joint ship-borne expedition to various measuring polygons in the Black Sea, the Mediterranean, and the Atlantic, where it will measure the biological, chemical, and physical parameters of the ocean and the atmosphere on site. These measurements will be synchronized with Priroda sensor reading on the marine areas concerned, and will also be linked to the American SeaStar program; it will thus be possible to integrate the scientific results and intercalibrate the sensors used (particularly MOS-SeaWiFS).

Derivation of Ecosystem Parameters From Satellite Measurements

As part of the international program of research into global change, an attempt is being made to integrate both chemical and biological systems into a wide-ranging environment modeling project. A key role will be played by water transport, which is being studied under the core project on Biospheric Aspects of the Hydrological Cycle (BAHC) as part of the International Geosphere-Biosphere Program (IGBP) (see figure 4). The Institute of Space Sensor Engineering is working on contributions to the BAHC program in the form of case studies based on Priroda data. In the future, key input parameters for



Links Between Various Water Cycle Research Programs

Key: 1. Biological aspects in the system earth 2. atmosphere 3. hydrological cycle 4. biogeochemical cycle 5. Physical aspects in climate system 6. ocean 7. International Geosphere-biosphere Program (IGBP) 8. Biospheric Aspects of Hydrological Cycle (BAHC) 9. Global Energy and Water Cycle Experiment (GEWEX) 10. World Climate Research Program (WCRP)

global observation medels will be derived from satellite data. This is the only way to make the wide-ranging measurements required to monitor the changes taking place in ecosystems. The Priroda mission provides an opportunity to study the use of synchronous multisensor data, as it will draw on satellite and ground data in the VIS, IR, and microwave regions over a test site in Oberpfaffenhofen.

This research work aims to integrate land surface, vegetation, and atmosphere so that evaporation values can be deduced as an essential ecosystem characterization parameter. Defining these parameters remains a problem, despite intensive research, as it involves a variety of procedures and models. The long-term aim of the local evaporation model used here is to derive all the requisite input values from satellite measurements.

It is assumed that the atmosphere's potential evaporation requirement can be described in terms of meteorological variables. Research into evapotranspiration, which is plant-specific (and thus not reduced by groundwater shortage), requires knowledge of land exploitation, extent of plant cover, and stage of vegetation development. Real plant-specific evapotranspiration is determined by the hydrological properties of soils and precipitation. Defining such parameters for large areas remains a problem, however. The work at the Institute of Space Sensor Engineering is pursuing a solution whereby remote sensing data will be used to measure evapotranspiration. The different transpiration categories are determined from spectral signatures, which are derived from measurements taken with the MOS imaging spectrometer and the MSU-E multispectral scanner. This requires processes for correcting atmospheric influence in the satellite data, which are also under development at the Institute of Space Sensor Engineering. The classification scheme used for spectral signatures is based on the input parameters required for the transpiration model.

A particular problem for the required mesoscale and global assessment is what is known as the mixed pixel problem, namely, the fact that the parameters to be defined are obtained over areas in which differering background classes contribute to the hydrological cycle. Special studies are therefore under way with a view to solving this problem once the requisite spatial resolution of remote sensing systems for defining representative water resource parameters for large areas (of between 10 and 100 square kilometers) has been achieved.

FACTORY AUTOMATION, ROBOTICS

French Cini Company Installs Stereolithography Machine

93WS0068C Paris TECHNIQUES ET EQUIPEMENTS DE PRODUCTION in French Oct 92 p 7

[Article entitled: "Cini Adds Stereolithography"; first paragraph is TECHNIQUES ET EQUIPEMENTS DE PRODUCTION introduction]

[Text] The small company that specializes in models, mockups, and inspection rigs has just invested 2 million French francs [Fr] in a stereolithography machine so that it can diversify.

Cini, a small Nancy family business that employs 96 and boasts sales of Fr48.2 million, has a tradition as a modeler. The company makes scale-one style mockups, master patterns, and forming stakes that are used by sheet metal and car body manufacturers to produce prototype parts. It combines its modeling tradition with high-performance design tools. Cini connected its three Euclid-IS stations made by Matradatavision and one of its two RS/6000s equipped with Dassault Systemes' Catia to five numerical-control machines. In 1992, the company acquired an Agie wire electroerosion machine and a stereolithography machine made by 3D Systems. "In order to diversify, we installed a stereolithography machine, the ninth of its kind in France," stresses Yannick Seeleuthner, who is in charge of development at Cini's shops. The Fr2-million machine should enable the company to meet new needs, including those of research and engineering departments, mockup makers, and designers, both in the auto and flask or medical industries. The machine is an SLA 250 model, which can make prototype parts in a cube of 250 by 250 mm. "It is a quick way to materialize and picture in three dimensions a 2D CAD drawing. What used to take modelers three months to make will be stereolithographed in just 30 hours. We will then be able to rapidly distribute prototypes to research and engineering departments for style analyses, and to methods departments so that they can prepare product lines. We will also be able to detect production problems very quickly."

The purchase entails a two-day training session which two of Cini's staff people—Eric Boffin, CAD/CAM director, and Yannick Seeleuthner—are attending. The session will include instruction on how to run the machine but also on what precautions to take in designing parts. For hollow objects with enclosed spaces, for instance, it is important to plan escape routes for the resin. Likewise, care must be taken to prevent the formation of any defects in intermediate layers, or upper layers will be poorly anchored. In fact, each part requires a separate study. "Modelers must analyze the efforts the material will make during hardening, to meet the estimated 0.1-mm manufacturing tolerances."

Firms Report CIM Advantages, Implementation Difficulties

93WS0091A Duesseldorf VDI-Z in German Oct 92 pp 22-30

[Article by Raymond Shah (VDI-Z and Compulex NCA): "CIM: Computer-Integrated Manufacturing"]

[Text] **Three years ago the opinions of select companies in Europe concerning the technical and economic aspects of CIM were presented by the VDI-Z [1]. This paper is at once an updating and an expansion of that earlier work**

with particular emphasis now placed on organizational aspects such as the desirable integration depth and the logistical basis of a CIM program as well as methods of overcoming difficulties in the project organization and execution phases. Not only are previous case examples introduced, but two very topical CIM projects are also described. Finally, the expected and the actually attained improvements of the CIM projects discussed are analyzed. The results of a CIM pioneer, who as long as five years ago had reached a remarkable high level, are represented in great detail [2,3].

CIM Goals

The essence of computer-integrated manufacturing (CIM) is integration—an integration that must involve every employee regardless of specialty. Without a thorough reorganization and restructuring of the entire company, integration cannot be achieved. The most important prerequisite for the success of a CIM program is therefore the elimination of the divisive effect of conventional organizational forms (thinking in terms of divisions) and the limited technical attainments of the past (automated islands). This is the only way that all existing company resources can be optimally utilized.

All CIM-users questioned agree that production-oriented efficiency measures alone no longer suffice to ensure the continued existence of the entire company on the market. For many companies, today's market is characterized by ever shorter innovation cycles, an increasing variety of products, and unpredictable sales fluctuations. Especially in highly competitive cut-throat markets, these conditions lead relentlessly to a war of survival that can only be won by the most skillful utilization of all company resources.

Consequently, most of the CIM projects examined were undertaken with the strategic goal of improving market adaptability by implementing shorter reaction times. The second most important goal was to shorten manufacturing throughput time, both with respect to the introduction of a new product as well as for the production time itself. Following in the hierarchy of company goals are improvements in the industrial process, the optimization of economic efficiency and a reduction of the amount of tied-up capital.

Concurrently with plans for an all-inclusive information flow, each CIM project contains a program for an all-inclusive material flow as well. Essential for the success of the program is sufficient integration depth. Armin Stockert, logistics and assembly director at the MTU in Friedrichshafen, elaborates: "An all-inclusive logistical chain, i.e., a CIM-assisted combination of all company resources engaged in filling a project contract, is difficult to achieve. In practice, a computer-oriented, project development that meets the requirements of modern CIM-, logistic-, lean-production and just-in-time strategies can only be implemented when the three basic components—man-machine-material—are involved together in both the overall system as well as in individual projects right from the beginning."

The MAHO AG in its new Kempten plant is a prime example of a CIM program with strong logistical lines. According to Gerald Juettner, director of the technical information processing department in Pfronten, the new plant was designed so that all cubic bulk components like spindle heads, operator stands, and tool carriages can be completely worked centrally for the entire company group. The heart of this plant is the combined production system that incorporates roughly 7,000 m^2 of the overall area of about 20,000 m^2.

Presently, 17 machines are integrated in the combined system; 15 more machines will be added during the next expansion stage. The company anticipates the following improvements will result:

- Improved adherence to schedule,
- Increased flexibility (to lot size 1),
- Shortened processing time (to less than 5 h/workpiece),
- Reduced throughput time (to less than 5 days/order),
- Improved quality (keeping machining accuracy precision to from 0.002 to 0.003 mm),
- Automated material flow.

A special goal is to maintain a smaller stock and thereby reduce the amount of tied-up capital while at the same time increasing productivity and flexibility.

Flexible Scheduling

Juettner notes that one special feature of the combined production system is the establishment of a "stock requirement indicator" as the basis of production scheduling. It indicates whether the workpiece will be required in the next five days or at a much later date. If the workpiece is required immediately, it enters the automatic storage and retrieval system, which has 220 stock spaces. All workpieces are funneled in and out of the combined production system through the storage and retrieval system. If the workpiece is required in the next five days, it enters the stock room, which is directly adjacent to the goods entry area; it has a total capacity of about 1,000 Europallets. This stock room serves both as unmachined parts storage and shipping room. If the workpiece is required at some later date, it goes to a large storage area outside of the plant.

By dividing the process into planning, administration, and management levels, a significant demarcation of functions between the planning done in the Pfronten plant and the administration and management exercised in the Kempten plant is achieved. Under this program, production orders can, on the one hand, via the host computer be directly undertaken and processed by the assembly plants and affiliates of the company group (internal customers), or, on the other hand, by outside companies (external customers). The customer order administration subsystem generates the appropriate

orders with due consideration of disposition time. The orders are scheduled on a precise weekly basis.

Until the request for delivery, which occurs about six weeks before the item is needed, the orders are exclusively managed by the customer's contract administration. This assures the highest degree of flexibility, even when the production program is subjected to scheduling changes. At the time a customer contract requests delivery, the request is scheduled by the customer's contract administration and then given over to the Kempten plant, where it is submitted to the decentralized contract order administration. The stock administration subsystem manages the entire inventory in the stock room, in the automatic storage and retrieval system, as well as in the enamelling and shipping rooms. The production schedules are transferred to the Kempten plant by Pfronten and are further developed there in the production planning system, taking into account the available machining stations. Finally, all production assets required in Kempten for the project (e.g., production and clamping plans, mounting devices, machine tools and NC programs) are stored and managed in the production assets management system.

Production control system MAHO FS 2000 is the integration module for the interlinked machines of the combined production system. In this function, it takes over the production orders released from the customer's contract order administration and executes a detailed plan within the prescribed two-day contract stock period. The contract stock is controlled by the customer's contract order administration and coordinated with the capacity of the automatic storage and retrieval system.

By means of a direct interface with the machine tool presetting, the production control system provides for the automatic transfer of NC programs and machine tool actual data to the individual machining stations. It also accepts reports from the machine control systems (e.g., program start, program end, malfunction) for further evaluation; it optimizes the contract order sequence and deals with tasks related to the online systems operation testing and the online diagnosis reports.

Integrated Material and Data Flow

Another new CIM program, which exhibits a high degree of integration both for the material as well as the data flow, is that used by Erowa AG in Reinach, Switzerland. According to Basil Obrist, the technical director, a new type clamping system is the basic component of the extensive automation peripheral equipment of the integrated production program, which is divided into three levels: the communications, the production, and the handling levels. Other basic elements are the material-handling robot and inductively run industrial trucks. The high iterative accuracy (in the µm range) of the clamping system, which was first developed for use with cavity sinking EDM machines and eventually was used as a workpiece clamping system in milling; lathe work; and flat-, spherical-, profile-, and coordinate-grinding. Ferdinand Traxler, consultant and sales manager of Erowa Inter AG, explains: "The building of the material-handling robot, which has an integrated several-day-capacity plate magazine, has made it possible to develop flexible production cells."

The electrode and workpiece identification system (EWIS) is the basic element of the integrated data flow. This system serves to store the offset data determined at the set-up and measurement stations in the code carrier of the workpiece pallet and the electrode holder. Even in the event the magazine were loaded randomly, the robot identifies unambiguously on the basis of each workpiece's code carrier.

Basis: Substrings and Process Strings

Substrings and process strings represent the heart of every CIM program. For the most part, a substring is identical to one or several of the known CA technologies: CAD (computer aided design), CAP (computer assisted planning), CAM (NC programming and manufacturing), and CAQ (computer assisted quality control). Since every CIM project begins with a substring as the point of main effort, the CIM projects treated in this report can be divided like those initial components.

A particularly efficient method of classifying CIM projects is the concept of the "process string," introduced in the BMW. According to that definition, a process string is to be understood as the sum of causally interdependent job steps. By means of "process management," it is attempted to handle all upcoming specialized steps, not compartmentalized, but rather from the integrated point of view of a value-creating chain. The important characteristics are:

- Decisions based on the global usefulness of all measures instead of on the local usefulness of an individual measure,
- Optimization or business reengineering before system use,
- User-oriented solutions rather than technology-oriented solutions,
- Subdividing into small, manageable, and decisive performance stages, rather than "monster-size" projects,
- Clear positioning of information processing (IV) projects in "building plans" in which all interfaces and data flows are established,
- Rapid prototyping in order to draft the later "applications design" of the IV-systems together with the users (look and feel).

Lothar Heggmair, director of IV-systems product development at BMW, reports that the first experiences gained with this approach were very positive. However, there were problems in two areas:

- The question of unequivocal responsibilities in the user organization in the case of overlapping processes, and
- Insufficient flexibility in the design and realization of system components.

Project Organization From the EDP Point of View

Even from the viewpoint of the EDP developers and users, each CIM program consists of several components, wherein the integration of the individual data-processing projects must again be the main goal of the project organization. "In the first phase of a data-processing project, an exercise in problem analysis is presented," Franz-Otto Vogel, the director of the industrial information technology department at the Friedrichshafen MTU, explained. "The principal component of this problem analysis stage is the representation of the rough concept, in which the technical requirement concept is much more important than the data-processing solution. If several solution concepts are reasonable and possible, then they are developed concurrently and compared with each other. A detailed evaluation of economic efficiency takes precedence over the usefulness factor and approval and release."

The success of data-processing is very much dependent, in Vogel's opinion, on just how precise, realistic, and technically feasible the formulation of the problem analysis report is. Specifically, this means that the qualifications and team behavior of the project group members are decisive.

Experience shows that the interface problems are considerable when integrated data-processing systems are introduced. MTU resolved this by having all involved fields represented in a coordination committee. For example, in the most important subgroup "material planning," seven fields were represented.

Franz-Otto Vogel continues: "In the course of the project each of the representatives of the specialty fields had the assignment of presenting the solution concept in his own specialty field and then to give his blessing to the necessary decisions or conclusions."

Nor is moving a project out of the nebulous initial stage to the requisite structured and systematic form for implementation a simple matter. To accomplish this, MTU uses a procedural technique modelled after the comprehensive team and project management system devised by J. C. Fendrich, Hamburg. "The elimination of natural interest and influence which conflicts right at the onset of a project pays off because then costs involved in any later changes are avoided," Vogel explains. "Most sins are committed during the project planning and start-up phases. The most frequent reasons for schedule and cost overruns, as well as conflicts, are insufficient precision in goal-stetting and planning as well as failure to establish a consensus and a common will between the customer, decision-maker, and the participating specialists." [3]

Problems in the Execution

Even after a project has been brought into a suitable systematic form, converting it into accepted practice is extremely difficult. Vogel confirms this: "The attempt to project the strategically required desiderata to raw company reality must necessarily be a sobering experience." Experience shows that many factors are involved which tend to result repeatedly in project delays and difficulties. One basic problem lies in the different strategies and goals; another in unsystematic or differing approaches. The requisite cooperation between several managerial teams can be made difficult through the lack of information depth and varying levels of information. Later, in the solution of complex problems time constraints may cause too little research of causes, and, all too often, jumping directly into initial measures without detailed investigations.

Varying and unsystematic approaches in connection with opposing goals often result in long decision-making processes. Plans for the future are often the underlying cause of inadequate planning and preparation, since the direct time pressure factor is not there. In many companies, deeply rooted specialty-oriented and compartmentalized thinking comprise another unavoidable circle of problems, just as do personal relations and competition among all levels of the hierarchy.

Worker Qualifications

Most of the CIM-users queried confirm that qualified personnel contribute decisively to the success of the entire program. Total computer-assistance—the basis of every CIM project—can only be realized when not just the organization, but the workers as well, are qualified to meet the new demands. The new requirements especially call for higher qualifications on the part of all workers. For example, efficient utilization of the EDP-system may even require knowledge beyond the use of the system itself. That is true for workers at all levels. Usually, the training can be handled in-house, whereas in the case of CA-technicians (CAD, CAM) external training programs are often used.

Routine activities like communicating with other workers have to be reorganized and practiced. Double lines of communication can develop unnoticed. For example, care should be taken so that the expanded decision-making powers of the individual worker acquired through access to a broad array of information does not lead to either unnecessary frictions or contradictions.

An important aspect of proper qualifications is team-oriented cooperation. Thus, for example, since 1990 the central training office and the responsible specialty representatives in the MTU have been dealing intensively with such training and familiarization with "integrated team and project management." To this end, the people responsible for the project at MTU are being supported and advised by the Projecting Company of Hamburg.

Quality Assurance

Many CIM-users emphasize that quality assurance has to assume an especially important role in CIM operations. Quality assurance can no longer be viewed simply as

local measures taken to correct a possible production error. It must now be understood as a global task that involves every worker. Computer aided quality control (CAQ) is an important part of the information system within a CIM solution. Both quality control itself as well as the transmission of its findings over the information system have to be executed in such a manner as to ensure a short reaction time.

In a flexible manufacturing system (FFS) at Carl Zeiss, Oberkochen, a CNC measuring machine was integrated in the overall system for this purpose. It was integrated so that a computer-assisted evaluation of the measurement data is made and the derived machine tool corrections and floating zeroes transferred directly to the machine control systems. Guenter Modrich, director of Zeiss's central manufacturing office, claims that this represents an important step in the direction of an automatic computer-assisted error correction system.

Zeiss has this system integrated in a company-wide quality regulator circuit in which not only manufacturing (CAD/CAM) but quality assurance as well are computer-assisted connected with each other in the check planning and control level as well as in the testing level.

To keep quality concerns constantly foremost in the minds of all workers, Friedrichshafen's MTU has coined the expression "integrated quality management (IQM)." The purpose of IQM is to ensure optimal quality in the broadest sense throughout the entire process of filling an order. The data-processing systems CIMOS (integrated PPS system) and QUISS (quality, information, and control system) provide the basic components of IQM. CIMOS delivers the planning and control data necessary to keep on schedule to all participating parties. QUISS provides the requisite data for quality control and the observance of quality and delivery regulations. Project collaborators are included through the use of systematic thought-methods [3].

Anticipated and Actually Realized Improvements

Despite several new approaches to determining the economic efficiency of a CIM program, there is still no sure method to quantify its usefulness. On the basis of rough criteria, the 13 users were asked to express their opinions as to the relative importance of the various factors. These factors mostly pertain to the manufacturing performance (throughput time, flexibility, productivity, and availability) as well as to quality and costs. In addition, factors that extend over many fields, like updating and coordination, are also taken into account. Comparison between the anticipated and the actual realized improvements are summarized below.

Among the expectations, two factors were considered to be of prime importance, namely, a shortening of the throughput time and increased flexibility. Improvement in economic efficiency and a reduction in the amount of capital tied up in stock inventories were also considered very important. Among the improvements so far actually achieved, shortening of the throughput time again is seen to occupy first place. The two next factors in the hierarchy of achievements are found to be increased flexibility and increased productivity.

Of particular interest are the results achieved at Friedrichshafen MTU, which have been quantified to a great extent.

Following is a summary comparison of the anticipated and the actually realized improvements: With respect to throughput time, it was expected that it would be reduced by 93 percent, it was actually reduced by 62 percent; flexibility was expected to increase 85 percent, it actually did increase by 60 percent; productivity was expected to increase 63 percent, it actually increased 53 percent; availability was expected to increase 41 percent; economic efficiency was expected to increase 76 percent, it actually increased 45 percent; tied-up capital was expected to be reduced by 68 percent, it was actually reduced by 35 percent; quality was expected to increase by 58 percent; data redundancy was expected to be reduced 49 percent; updating was expected to increase 49 percent, it actually increased 34 percent; island solutions were expected to be reduced 38 percent; coordination actually increased by 34 percent.

Following are the results and efficiency successes of the measures introduced to date to improve the overall execution of a contracted order (quantifiable and non-quantifiable influence factors):

- Reduction of throughput time of house parts by more than 40 percent,
- Shortening of delivery time for parts bought outside by 20 percent,
- Reduction of overall procurement time of final products by 40 percent,
- Drastic reduction in overall contract fulfillment time between receipt of order and delivery of product,
- Reduction of assembly time from four to one week,
- Reduction in resources tied-up in stock and circulating inventories by about 100 million German marks [DM],
- No additional administrative personnel needed despite a turnover increase since 1978 of 80 percent,
- Reduction in spare parts billing time from 14 days to one day. Interest gained thereby is more than DM1.5 million per year,
- Reduction of product receipt preparation time from one week to two hours,
- Immediate release of items held in customs,
- Reduction in value of inventory-taking differences to 1 percent,
- Reduction in preparation of inventory-taking difference statement from eight weeks to two hours,
- Machine, inventory-oriented recycling control of "old" parts in the CIMOS material planning,
- Machine, dispositive consideration of alternative status code,
- Data-processing assistance for all kinds of orders and cooperative projects,
- Safe decisions when there is competitive bidding,

- Recognition of "critical" parts when stock is received and before storage and conservation.

Commenting on the above results, Armin Stockert concludes: "These results were reviewed and checked as far as possible by the company controlling office. Most of the savings listed above could be verified as early as the mid 1980s after the introduction of the integrated CIMOS-PPS solution. Consequently, most of these advantages are already in place."

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LASERS, SENSORS, OPTICS

Germany: Market, Developments in Sensors Viewed

93WS0021C Duesseldorf WIRTSCHAFTSWOCHE in German 2 Oct 92 pp 105, 108

[Article by Jens D. Billerbeck: "Silent Partners"]

[Text]

Sensors

Industry Needs Systems That are More and More Intelligent for Automation

Boldly, the milling head eats into a solid block of aluminum. Not a single human is there when a workpiece of complicated shape is created from this block over time. The dimensions of this workpiece deviate from the desired values by only a few hundredths of a millimeter.

The specialist who programmed the machine pockets the praise. The success is based on a group of silent partners. These are sensors that monitor every movement of the milling head and actuate the control system to provide a correction if the head threatens to go off course. Vertical and horizontal movements, rates, arcs and surface quality—there are sensors for all needs.

The requirement for highly specialized sensors has increased dramatically because of the parallel trends of automating manufacturing methods and improving products with these methods. An end to the sensor mania is not in sight. The world market for sensors in civilian use will more than double from 30.7 billion German marks [DM] in 1991 to DM65.1 billion by 2001. This is according to a study by Intechno Consulting, a market research company from Basel.

Plant construction and process technology have the greatest demand today. These areas purchased sensors for DM10.7 billion in 1991. Automobile manufacture was in second place at DM4.3 billion. Medical technology, building control and security technology as well as general machine construction followed at a great distance.

A somewhat different distribution results from the growth expectations. Here, automotive manufacture is in first place. This is because airbags, antilock braking systems (ABS), automatic wheel-slip regulators (ASR) and vehicle management systems have an enormous demand for sensors. These technologies are now gaining acceptance on a broad front. The next places go to information and communication technology and the environmental area.

Norbert Schroder is the director of Intechno. For 1992, he foresees a German share of the world market of 16 percent. This is in third place following Japan at 19 percent and the U.S. at 35 percent. Diether Schaudel is director of Endress + Hauser, a Swiss sensor manufacturer. He also emphasizes the current good position of the German sensor industry saying, "Technically and in application competence, Germany is still ahead."

Guido Tschulena is a sensor expert at the Battelle Institute in Frankfurt. He analyzes what makes up this lead, saying, "Europe and primarily Germany are made strong by the many small specialized companies. They can provide technical advice and react quickly." With the exception of a few mass applications in automobiles or household appliances, sensors are not purchased off the rack.

Sensors

Europe is in first place for sensor demand.

However, the demands for precision and speed of the sensors are growing by leaps and bounds. Because of this, the small-business sensor industry with its chronic lack of capital faces considerable challenges in terms of manpower and R&D investment. Schaudel sees this clearly, saying, "Keeping the lead will become more difficult." The industry wants to measure better and better and with ever increasing precision so that even complex processes can be automated economically.

Besides this, the need for inexpensive sensors for very specific data, for example the acidity of liquids, is growing. Here, the food industry is voicing its desires. The automotive industry is demanding simple equipment for measuring electronic conductivity. Such equipment allows the determination of the state of engine oil.

Environmental monitoring makes special challenges for sensors. For this area, systems spanning the world are

being built. Microwave sensors in measurement satellites detect radar echoes reflected by the earth, for instance, to track the diseases in trees.

The Intechno head Schroder knows that sensors will have to solve new measuring tasks in the future. "Detecting rapidly changing processes, determining chemical state variables with high selectivity, and high speed in image and speech recognition."

To achieve this, the manufacturers must risk taking new technological paths. They are miniaturizing sensor elements and accommodate them together with electronic amplifiers and evaluation units on a single chip. Wolf-Dieter Gisevius is the technical consultant of the working group for measuring sensors (AMA). "In this way, initial signal processing can be done directly on site," he says. "This eliminates errors when transmitting sensor signals that are often weak."

The branch is being electrified by another slogan—biosensors. This term designates sensors used to monitor biological processes. For example, a brewer can only control fermentation if he continuously knows the alcohol and glucose content. Appropriate systems have only been available until now in the DM10,000 price range. New techniques are needed that dramatically reduce sensor costs. In the food industry, continuously working systems are needed to detect enzymes or ascorbic and amino acids.

To stick up to the competition from the U.S. and the Far East in the future, too, the sensor industry is thinking of a remedy. Tschulena from Battelle sees one way for permanently competitive sensor production in Europe. "The manufacturers must be prepared to a greater degree to divide the work," he says. In his opinion, a small-business sensor-producer could well use the services of specialists in the development of new systems. Such specialists are acquainted with specific technologies such as thin-film methods, integrated optics or micromechanics. This cost-saving division of labor is already practiced by Euchner + Co., the sensor manufacturer in Leinfelden-Echterdingen. This company supplies machine-tool manufacturers. The company from Swabia uses a glass component the size of a paper clip. The IOT Development Corporation for Integrated Optic Technology mbH in Waghausel near Heidelberg has worked an extremely fine structure into this component using an ion-exchange method. This structure serves as a key element in an optoelectronic sensor that detects changes in distance of fractions of a light wavelength.

This is one example of a situation where both companies can profit from one another. "The situation for sensors will be different than that of microelectronics or computer technology," says the AMA consultant Gisevius, optimistically. He considers the variety of vendors in Europe and Germany a strategic weapon in the international competition. "And we will not let this weapon be knocked out of our hand," he promises.

System Technology

Underwater Sensor Finds Natural Gas

As a rule, the slogan is "The Smaller, The Better" when the further development of sensors is involved. In the end, automobiles should carry as little weight as possible. Bulky sensors also hinder work on machines.

A few people, however, use that slogan in reverse. Scientists at the Institute for Physics at the GKSS Research Center in Geesthacht near Hamburg, for example, have developed a four-meter-long giant cigar with a complex inner life. This sensor can detect natural-gas sources on the ocean floor. On the one hand, it detects leaks in pipelines. On the other hand, it supports natural-gas prospectors in locating new sources.

The device can operate at a depth of up to 300 meters. It is connected to a ship by means of power and data cables. As it has its own drive system, it can navigate to a limited degree on the ocean floor. A pump takes in six liters of water per minute. Membranes that are impermeable to water separate the gases contained in each sample. The gases are fed to a test cell. A laser beam shot through the collected gas serves as the sensor.

Methane absorbs some of the laser light. The higher the concentration, the more light absorbed. The sensor, Medusa, is already undergoing successful tests in the Norwegian Gullfaks field. Medusa stands for Methane Detection for UnderSea Applications.

The GKSS physicists are continuing development on the system so that, for example, it can register pollutant introductions and locate underwater depots of poison-gas bombs from both world wars.

MICROELECTRONICS

Silicon Actuator Prototype Developed With BMFT Support

93WS0006A Duesseldorf VDI NACHRICHTEN in German 4 Sep 92 p 28

[Article by Richard Sietmann: "BMFT Joint Project for Microsystem Technology; Silicon Actuators Gradually Making Progress, but We'll Have To Wait a While for Marketable Products"]

[Text] Berlin, VDI-N—The Ministry for Research and Technology's (BMFT) emphasis on support for microsystem technology is producing its first results: Prototypes of "actuators made of microstructured silicon for hydraulic and pneumatic applications" could be used as micromechanical injection pumps or precise attitude controls for communications satellites.

The Fraunhofer Institute for Microstructure Technology (IMT) in Berlin, the Robert Bosch Company (Reutlingen), the Draeger Works Joint Stock Company (Luebeck), and MBB [Messerschmitt-Boelkow-Blohm] in

Ottobrunn participated in the joint project, "Microstructured Silicon Actuators," in connection with the BMFT's emphasis on microsystem technology. While IMT was also investigating the general principles governing actuators—a miniature linear motor consisting of a permanent magnet driven by tiny coils, for example—the industrial partners had agreed among themselves to limit the development projects to valve.

Thus, at Bosch they immediately developed three different microvalves—on the basis of thermomechanical, piezoelectric, or electrostatic operating principles. They are designed for the injection of fuel in internal combustion engines.

The thermomechanical microvalve involves a two-stage tongue valve that consists of a thermally controlled flexible tongue like a bimetallic strip and a pneumatic diaphragm tongue controlled by dynamic pressure. Its mode of operation is based on the fact that the stream of liquid follows the deflection of the flexible strip and in the process is guided either over or under the diaphragm tongue that follows it, which makes the latter close of open the exhaust jet.

The silicon diaphragm's stroke measures only about 45 µm. The laboratory model operating pressure of 4 bars is sufficient for injecting gasoline. While it is true that thermal switches are normally quite sluggish because of their slow cooling mechanisms, with this system one quickly benefits from the cooling effect of the stream of liquid, which produced response times of 0.5 ms in laboratory tests.

The alternative version, the electrostatic plate valve, also basically consists of three silicon plates. The upper and lower sections form the enclosure of the valve chamber with its intake or exhaust port while a mobile plate constitutes the core in the midsection. A total thrust of only 8 µm is required to open or close it and it is suspended over eight spring webs in a Si [expansion not given] frame. The overall height of this microvalve is 1.5 mm.

The midsection and the upper section with the intake port also function as a condenser; the application of voltage results in theattraction of the mobile plate, which presses down on the intake port over sealing lips and closes the valve. In the same way the mid and lower sections constitute a condenser: Switching the voltage to these sections draws the plate down and opens the valve.

The chief problem with electrostatic valves lies in their dielectric strength. Great enough dielectric strength can only be obtained when the gaps [between the plates] are small and the voltage levels high. With the given specifications—rate of flow 100 ml/min, pressure differences of 4.5 bars, and response times of 1 ms—switching voltages of 400 v would be required. At Bosch they obtained 180 v with the first laboratory models. Development engineer Hans-Peter Trah attributes the low voltage to the distortion of the closing plate and thinks that the dielectric strength can be substantially improved on when redesigning the valve with appropriate stiffeners.

They cannot yet, however, say when micromechanical gasoline injection systems will appear on the market. Since their introduction depends less on whether thir prescribed function can be technically realized than, especially, on whether this solution to the problem can be realized at production costs that are geared to the market. And Trah feels that this economic aspect of the situation "cannot yet be settled today."

The microvalve has been more specifically requisitioned to be used in controlling ion engines, which Helmut Seidel and Dieter Bosch of MBB may present. Ion engines are meant to serve for the precise attitude control of satellites and are developed for commercial communications satellites, among other uses. The microvalve is responsible for precisely controlling the ion beam at switching times of from 1 to 2 ms, a pressure of 1 bar, and switching outputs of less than 200 mW.

The prototypes were built with a thin, 10-µm silicon diaphragm which was coated with a 1-2-µm layer of gold to conduct the current. On the side of the diaphragm there is a permanent magnet so that, when current flows through it, the diaphragm is deflected by the Lorentz force, after which the flow of gas is cut off.

The dimensions of a valve installed in a conventional dual in-line housing are 8 x 2 x 1 mm^3. Its light weight—only 0.3 g including the ceramic holder—makes it especially attractive for space applications. An array of many of these microvalves would, moreover, make virtually analog flow control possible. Additional work on the valve is now expected to assure the long-term stability of the components.

Typical of the prototypes developed in the joint project is the fact that the size of the periphery necessary to control these micromechanical actuators many times over exceeds that of the miniaturized components. It is understandable that packaging was not accorded the highest priority when they were developing the operational model. But the actual likelihood lies first of all in developing real microsystems, that is for instance, by coupling a microvalve with a flow sensor, complete with electrical controls, with a completely automatic control system. "Only then will we be able to really exhaust the full potential of this technology," Helmut Seidel of MBB thinks.

Launched in 1989, the main emphasis on support for microsystem technology was at first limited to the end of this year and was funded with DM100 million a year. In its new view of support for information technology, the BMFT continues to place great importance on microsystem technology. The program is as of now supposed to be extended for a period of six years. The specific arrangements are at present in progress with the

determination of new projects and the participants hope that, despite a strained budget situation, funding will at least be maintained.

German Developments in Microsystem Technology Viewed

93WS0021A Duesseldorf WIRTSCHAFTSWOCHE in German 2 Oct 92 pp 99-100

[Article by Rudolf Schulze: "Ink in the Channel"]

[Text]

Microstructures

Electrical, Mechanical and Optical Functions are Now Being Combined on One Chip

The semiconductor chip is just as insignificant as every other one. However, this one can not only acquire and process data, it also has the senses of sight, hearing and smell. Even this is not enough. Mechanical tools are also on board. Such a multifunction chip is the goal of microsystem technology, a young engineering discipline.

It will revolutionize technology to an extent that cannot even be imagined. Herbert Reichl is a professor in the area of electrotechnology at the Technical University of Berlin. He draws parallels to computer technology saying, "Similar to the developments there, our imagination today is not adequate to predict the potential hidden in microsystem technology."

The trend, however, is clear. Hans Joachim Rolke is a physicist for Siemens in Munich. He says, "Mechanics, optics, electrotechnology, and even some chemistry and biology, developed separately from one another before. Today, these technologies overlap in microsystem technology."

Silicon forms the basis. Tiny structures can be produced in three dimensions from this hard, solid semiconductor material, using the same processing methods the microelectronics industry uses for its integrated circuits. These structures form not only sensors and electronics but also stepper motors, pumps, valves or turbines. Possible applications of such miniature packages from this leading-edge technology include medical microrobots wandering through human blood vessels eliminating deposits. Also, attached in large numbers to the outer skin of aircraft, they recognize where the desired laminar airflow breaks down into turbulence and reestablish the fuel-saving ideal state via small corrections in the surface shape.

Initial applications of the new technology are already known. The images on flat monitors, for example, those of portable televisions and laptops, consist of numerous colored dots. These dots are brought to life by thin-film transistors. Ink-jet printers could not be built until microsystem engineers learned their trade. The channels in the print head have a diameter of 85 micrometers (one micrometer is one thousandth of a millimeter). This is about the size of a human hair.

Europeans form the leading edge of this technology in the world. So that they remain there, the EC Initiative on Microsystem Technologies composed a 27-page paper in April of this year. They sent this paper to the EC Commissioner Filippo M. Pandolfi in Brussels. He is responsible for science, research and development, and for information technology and innovation. The initiative is already supported by over 150 European representatives from research and industry.

The action was coordinated by Professor Wolfgang Menz from the Nuclear Research Center at Karlsruhe and Juergen Gabriel from the VDI/VDE Technology Center for Information Technology in Berlin. Its goal is to have the EC provide research funds.

Pandolfi will determine with his coworkers this autumn whether funds can be made available for microsystem technology in the third EC blanket research program active now. Otherwise, support will not be forthcoming until the fourth blanket research program starting in 1994. The best-case scenario of the German initiators would be at least 100 million German marks [DM] flowing annually for about six years. The Federal Ministry for Research and Technology (BMFT) has freed just as much until now. From 1990 to 1993, DM400 million are available for microsystem technology. However, these funds will soon be exhausted. Besides, the basic researchers received very little because the program is "a moneymaker for small businesses," as the research secretary Heinz Riesenhuber stated scarcely 10 months after the start.

In the future, the basic researchers are also demanding their piece of the support pie. As the till in Bonn is empty, the begging trips to Brussels are starting. Hans-Peter Lorenzen is responsible for microsystem technology in Section 414 of the BMFT. Regarding the German beginning, he says, "Our goal was first to show the applications of microsystem technology in initial products and to prove that economic conversion is possible even for small companies."

A prerequisite for support was the proof that the applicant had the know-how of at least one microtechnical manufacturing method. These would be thick-film or thin-film technology, semiconductor technology, micromechanics, integrated optics or fiber optics, and new material technologies. These projects led to sensors precisely measuring inclinations to one thousandth of a degree of angle (HL Planartechnik GmbH, Dortmund), a microlinear motor (Fraunhofer Institute, Berlin) or microvalves from Bosch (Reutlingen), Dragerwerk (Lubeck) and MBB (Ottobrunn).

When the developments of microsystem technology will appear in large quantities on the market is an unanswered question. According to Bosch developer Hans-Peter Trah, the economic aspect cannot be clarified yet. Daimler-Benz has consolidated its activities in the

microsystem area in the Microelectronics Corporation headquartered in Heilbronn. For a transitional period, the company is still operating as Telefunken Electronic GmbH. Gerhard Jakobs is responsible for sensor systems and sensors in the microtechnology area. He is convinced that, "One day, a microsystem will combine 8,000 mechanical, 10,000 optical, and 100,000 electrical components on a single chip forming a microbrain with eyes, ears, and hands."

There, where precision engineers run up against mechanical limits and where microelectronic specialists have created the basis for thin-film, photolithographic and etching techniques, microsystem technicians start. New modules, some using three-dimensional structures, are created using the methods proven in the semiconductor industry. Some of these methods have been further developed.

Depending upon the arrangement of the molecules in the crystal, the etching liquid acts with different strength in different directions. This creates holes, tubs, ditches or thin bands. This directional etching is used intentionally to produce, for example, electromechanical microsensors for washing machines and automobiles.

"When the American company Analog Devices brought an acceleration sensor on the market for only five marks, we were shocked," says Arno Steckenborn. He is the director of the Technology Center for Microtechnology at Siemens, Berlin. "We looked for selected special areas with real applications, for example, modules for glass-fiber networks, telephone and fax equipment."

Scientists at the Nuclear Research Center at Karlsruhe (KfK) specialized in purely micromechanical components. Two years ago, they introduced a microturbine with a rotor having a diameter of only 0.3 millimeters. Now, samples of just as tiny a stepper motor are being created using the so-called Liga method. "This is a new basic technique to produce complicated microcomponents through a combination of X-ray lithography, galvanoshaping and casting technologies using plastics and other materials. These microcomponents can now be produced inexpensively. Before, they could not be produced mechanically at all," says Peter Bley from the KfK Institute for Microstructure Technology, explaining the Liga process.

"We still have an advantage with our technology throughout the world," says Bley, just back from an extended research trip in the U.S. He is certain of this. "But we need the support from the federal and Land levels for the construction of suitable X-ray sources."

However, one company in North Rhine-Westphalia has already made the risky jump into practical application. To prepare series production of tiny components made of plastic, metal and ceramics in the micrometer range using the Liga method, MicroParts Corporation for Microstructure Technology mbH has been founded in Dortmund. The partners include Hoesch, Huls, Rheinmetall, Steag and VEW. The Department of Commerce in Duesseldorf acts as a sponsor. The Department is supporting a Center for Microstructure Technology to be finished in Dortmund by the end of 1993 that can be used by MicroParts GmbH. One product has already been developed, a connector for optical waveguides.

Germany: Electronic, Biologic Sensors Used to Monitor Pollution

93WS0021D Duesseldorf WIRTSCHAFTSWOCHE in German 2 Oct 92 pp 108, 110

[Article by Bernd Palm: "Clams on Guard"]

[Text]

Environmental Protection

Monitoring of Emissions and Pollution Damage Has Very Few Holes

Thirty years ago, there were operators of refuse-incineration plants, power stations and industrial plants who had amazingly low consequential costs after installing dust filters. They created this advantage using a trick. As soon as it became dark, the flue gas was routed around the filter and was fed unpurified into the environment via the smokestack.

They could usually do this without penalty. No measuring equipment registered their criminal behavior—in contrast to the practice today. Almost all chimneys today contain measuring equipment that constantly measures the most important concentrations of pollutants. The results are recorded and checked from time to time by the responsible authorities.

Primarily in the last decade, the legislators gave the manufacturers of measuring equipment for environmental protection and the users of such systems scarcely time to breathe. Jorg Hermann is director of the environmental technology section of the Technical Control Board of Bavaria (TUV Bayern). He says, "In 1964, incineration plants needing approval had to measure and record just two pollutant components in the flue gas. The Technical Guidelines for Purification of the Air (TA Luft) of 1974 already required detecting eight different gases and dust." The new requirements for recording, among other elements, nitrous oxides, hydrogen chloride or hydrogen fluoride such as created in refuse-incineration plants, could not be satisfied at that time. At first, there were no suitable measuring devices.

Once the industry developed powerful, tested and qualified hardware, even the installation of an emission-value computer became mandatory with the Large-Scale Heating System Regulation of 1983 to the Federal Pollution-Damage Protection Law (BImSchG). The authorities responsible for checking pushed for this to relieve the load on their testing personnel. Until that time, they had to look completely through rolls of paper containing the measurement records to find anywhere the limits were exceeded. Now, the computer detects excessive

values immediately. From 1984 to 1986, around 1000 incineration plants in the former German territory were equipped with emission-value computers. From 1985 to 1987, about 300 measuring systems for sulfur dioxide and oxygen in desulfurization plants followed. In the next round, from 1989 to 1990, approximately 200 denitrification systems received recording equipment for nitrous oxides and oxygen. Refuse-incineration must detect even more values in the future because of the most recent tightening in the TA Luft.

According to current estimates, a few thousand measuring systems must be replaced by new, broadband equipment by 1994. Besides dust, oxygen, carbon monoxide and sulfur dioxide need to be detected in two-thirds of the cases. Ten percent of the systems need measuring equipment for nitrous oxides and hydrocarbons. The refuse-incineration plants need sensors for hydrochloric acid and hydrogen fluoride. Complete monitoring of the most important sources of pollution is supplemented by a measuring network covering a wide area also to detect pollution damage, thus the incidence of pollutants. The largest network of this type is the Air Hygiene Monitoring System of Bavaria (LUB) with 64 measuring stations. Similar measuring networks exist for checking the water quality of endangered rivers such as the Rhine.

Industry is among the most important users of those plants requiring monitoring. The development of measuring equipment that is becoming more and more sensitive together with decreasing limits for pollutants do not just point the finger of guilt at industry. Industry also uses the higher precision to increase product quality and reduce energy consumption. The costs for gas and power can be reduced by up to 30 percent in the glass-melting processes by intelligent use of sensors and computer-aided control systems. This is according to the experiences of the VDE/VDI Association for Microelectronics. A real-time thickness measurement provides a savings in raw material of up to 10 percent in the manufacture of plastic foils.

Highly developed analysis and measurement systems are adequate to determine quantitatively emissions and pollution damage. However, they can only indirectly determine the real effects on the environment. This hole is closed by biological measuring systems known as bioindicators. The botanist Nylander recognized their usefulness in 1866 while studying the reaction of lichen to pollutants in the air.

"Bioindicators are organisms or societies of organisms that respond to pollutant stress by changing their life functions or concentrating the pollutant," explains Professor Uwe Arndt. He is from the Institute for Soil Improvement and Plant Ecology at the University of Hohenheim in Stuttgart. For example, certain bacterias that live in water emit light under favorable conditions, similar to glow worms. If such luminous bacteria suffer damage from toxic materials, their light intensity decreases measurably. The Dr. Bruno Lange GmbH of Duesseldorf sells the bacteria needed for the test as freeze-dried canned goods.

The reaction of the zebra clam *Draissena polymorpha*, living in the Rhine, to even slightly increased pollutant concentrations in the water is even easier to detect. It quickly closes its shell. At the Bad Honnef Inspection Station of the Office for Water and Refuse, zebra clams are already standing guard. The mollusks react even to a quantity of fifty-thousandths of a gram per liter of the pollutant PCP (pentachlorophenol). The *Draissena* monitor has also proven its suitability as an early warning system that can very quickly detect environmental sins involving the herbicide Lindan, which has been prohibited in the meantime. As soon as the clams are belabored by pollutants, a bell rings for Professor Dietrich Neumann and Jost Borcherding, scientists at the Zoological Institute of the University of Cologne. A magnet glued to the clam shell has activated the switch. To be able to differentiate between accidental movements of the clam shells and reactions to pollutants, a small computer monitors a large number of clams equipped with magnetic switches. The computer does not trigger the alarm until several clams register pollutants at the same time.

Fish, water fleas, algae, and bacteria are also been tested as early warning systems. Some are already being used. A working group being supported by the Federal Ministry for Research and Technology and by the Federal Office of the Environment in Berlin is developing and testing biotest methods to monitor the Rhine using different organisms. This is because one type does not react to all materials.

Down to earth and quietly, another bioindicator in Bavaria is doing service as a pollution collector. This is kale. The Technical Control Board of Bavaria is using vegetables grown in a laboratory to detect dioxins in the environment of refuse-incineration plants. Until now, there has been no continuous recording method for the approximately 140 dioxins that are more or less toxic. For two months, the kale stock stands in the suspected air and concentrates the dioxins within itself. Then, the pollutant content of the plant is analyzed.

Trends in Western European Semiconductor Industry Viewed

93WS0022A Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 21 Sep 92 p 10

[Commentary by Prof. Karl Tetzner: "Microelectronics: Europe Reorganizes Its Interests in Semiconductor Industry; End of Competition for More Miniaturized Structures in Silicon Technology Already in Sight"]

[Text] Munich—The European semiconductor industry is reorganizing itself. It has recognized the fact that it can no longer compete in all areas. Development is instead moving more toward specialization involving application-specific integrated circuits (ASIC for short) and

toward chips for the favorably developing automotive electronics industry, the entertainment electronics industry, which is at present going through a crisis, and, of course, for the computer and the booming telecommunications industries.

Viewed worldwide, Europe's semiconductor industry hardly occupies a leading position. With a sales volume of DM3.2 billion, Philips ranks 10th in the world, followed by SGS-Thomson occupying 13th place with DM2.3 billion, and Siemens in 16th place with DM2 billion. These sales figures from the Dataquest market research institute are calculated in dollars and are therefore dependent on the wildly fluctuating exchange rate of the American currency.

In the past Philips and Siemens had taken pains to be fully involved in the quantitatively very important memory chip market. This proved to involve extremely heavy losses. About 85 percent of this part of the market is controlled by the Japanese, who are in turn under pressure from the Korean semiconductor industry with Samsung leading the pack (in 12th place in the world). NEC and Toshiba occupy first and second place respectively, each with an 8 or 7-percent share of the world market, and Hitachi occupies fifth place (6.4 percent).

On the other hand, the United States has retained its competence in the microprocessor field. Intel (third place with a 6.7-percent share of the semiconductor market) and Motorola (fourth place with 6.4 percent) still set the standards. Their products and the derivatives of the latter could in no way compete with [those produced in] the Far East up until now.

The Europeans were temporarily of the opinion that they had to keep up with [the Japanese and the Americans] in the memory chip sales race, a fact which the plants built in Nijmegen and Regensburg with big investments bear witness to. Philips and Siemens had joined forces, whereupon Siemens was already buying know-how from Japan on the 1-megabit memory chip. Today it is clear that this big commitment scarcely pays.

Philips soon dropped out of this business and Siemens is in the process of restructuring. What else is one supposed to do if every memory chip from Regensburg is saddled with a loss of about a dollar? Year after year the company had to cope with three-figure millions in deficits.

In the meantime, Siemens's restructuring is producing results. In fiscal year 1989-1990 its chip sales still accounted for 27 percent of its total business transactions. In the following 12 months they had already dropped to 20 percent. During the same period ASIC sales increased by almost the same percentage. But, as a system manufacturer, Siemens cannot completely abandon its own semiconductor chips. However, activities relating to them had to be reduced to about 15 percent of total semiconductor sales.

Internally, this means that Siemens can live with an annual loss of DM100 million in this field of operations if the company's competence is preserved in all the fields it operates in. The other reason for holding onto chips is the recognition of the fact that the company cannot get by in, for instance, the field of chip structures without the advances made in this area. Chip technology is and will continue to be—somewhat casually put—the forerunner, the playing field, the—so to speak—"breaking-in" medium. Nowhere can the next step, for example, toward reduction of the width of the structure for the purpose of increasing the packing density, be studied so well as with the integrated circuit since in it the entire surface of the chip is homogeneously occupied.

The trend is a well-known one: Roughly every three and a half years the bit capacity of the electronic circuits is quadrupled. It began in 1971 with the 1-kilobit chip; at that time it replaced the core memory, which had reached its limits. By 1980 the industry attained the 64-kilobit chip and by 1983 the 256-kilobit chip was ready to go into production. The 1-megabit chip followed in 1987 and three years later the 4-megabit chip. The 16-megabit chip is imminent, the 64-megabit chip is ready for the laboratory, and the big 256-megabit is being "thought up."

In itself so consistent, this sequence of events holds dangers. Development costs rise by 25 percent from generation to generation and production costs by nearly 45 percent. This results in sums that even the big producers cannot bear the burden of alone. So they join forces. Even the bitterest of competitors pool engineers and finances, as demonstrated by the example of collaboration between IBM, Siemens, and Toshiba as of this 13 July on the development of the 256-megabit chip.

A team of scientists and engineers in company strength at IBM in New York is expected to develop this chip by 1997. Whether it will then also be jointly produced is to be decided on later. It is also known that IBM and Siemens are collaborating in the development of the 64-megabit chip. Furthermore, there are at least a dozen alliances between competitors in the United States and Japan, in part for strategic reasons and in part because of the costs involved.

So, is the demand for bit capacity keeping pace with the supply to the extent that it is quadrupling every three or four years? At present at least, an oversupply is to be noted, a fact manifested by the price. A 4-megabit chip made in Korea can be had for $10 today, and soon possibly even cheaper. In mid-1991 it cost $35. But part of this drop in price is compensated for by an improved production yield.

Actually, no one can today, with certainty, predict whether the semiconductor chip will be sinking into a whirlpool of oversupply until the end of this century or whether new consumers will appear on the scene who need chips with a capacity of a gigabit (IG). New laptop computers and translation computers the size of one's

hand with performances that cannot yet be realized with present-day technology, videophones with brilliant images transmitted overtelephone lines, digital high-density television, and new kinds of multimedia computers will probably stimulate demand.

Uncertainty recently arose when Siemens, after a rather long pause, surprisingly announced that a new chip plant is unnecessary, even though they had at first vociferously called for subsidies for such a plant in connection with the increased joint effort with IBM to produce the 64-megabit chip, which—as the reader will remember—led to bizarre discussions of our position [in the world market]. Since then, Siemens has soberly assessed the situation and come to the conclusion that they can produce between 6,000 and 7,000 wafers a day in Regensburg, 11,000 at the Austrian plant in Villach, and another 3,500 at a French production plant. Today, the company management thinks that this number of wafers, from each of which a large number of chips are produced, will suffice, especially since the percentage of production accounted for by memory chips is, as noted above, declining.

As uncertain as the future may be, memory chips will continue to be developed. First, they are aiming for the 1-gigabit chip with the existing technology, which will reach the limit of what is possible with the means available today. It will require a structure width of 0.19 of a micrometer. This is little more than 1,000 atoms next to one another and it can scarcely be attained with today's masking techniques.

The production of structures as fine as this for printed circuit paths and transistors would be technically possible with X-ray lithography, for example, but this is extremely unpopular because of the slow rate of production (see BLICK DURCH DIE WIRTSCHAFT, 9 March). Great efforts have to be made to stabilize the processes employed in the laboratory in terms of production techniques in such a way that the reject rate is low enough for economical production. The experts think that, as is recognized today, the race for still more miniaturized structure widths for 4-gigabits will finally be coming to an end.

What happens after this is pure speculation. This ranges from organic-biological processes to, on top of these, inorganic physical systems of a completely new type. There still appears to be enough time since the 1-gigabit or 4-gigabit chip will not be ready for production until after the turn of the century anyway. At any rate, "the new one" should be revealed in its rough outlines soon.

Philips Develops Plastic Semiconductor

93BR0083 Rijswijk POLYTECHNISCH WEEKBLAD in Dutch 15 Oct 92 p 1

[Article by Rene Raaijmakers: "Dopeless Plastic Semiconductors"]

[Excerpt] Plastic semiconductors are full of minerals which are needed to make them conductive. "Doping" is necessary, even to a large extent. Ratios of one kilogram of doping material to one kilogram of polymer are not uncommon. Researchers from Philips Physical Laboratory (the "Natlab") and from Syncom have now jointly succeeded in developing intrinsically conductive polymers which require no doping and are therefore more appropriate for manufacturing electronic semiconductor components. [passage omitted]

The manufacture of electronic components requires conducting plastics with a small bandgap. Groningen-based Syncom and the "Natlab" succeeded in developing these polymers. The results of the research were published a few weeks ago in POLYMER BULLETIN.

The Philips inventions have been given the exotic names "polysquaraine" and "polycroconaine"—one would hardly dare to use the word "plastic!" These brand-new polymers are similar to all other plastic semiconductors in that they also consist of so-called conjugated chains. In conducting polymers, double and single bonds often alternate in the main chain. They must be positively- or negatively-charged (by using dopants) to allow electrons to flow through. Doping either "donates" electrons to the polymer chains (for example, Li becomes Li+) or it "absorbs" them (for example, I3 becomes I3-).

No Doping Required

Polysquaraines and polycroconaines are special in that they do not require doping. The secret is attributed to the structure of the polymer chains, which consist of electron-repelling and electron-attracting conjugated groups. The chains consist of a regularly alternating building blocks which have electron-donor and electron-acceptor characteristics. As these groups exchange electrons among themselves, the plastic is said to be "self-doped," or intrinsically conducting.

In addition, it also has the narrow characteristic bandgap required for semiconductor materials. As the bandgap of polysquaraines and polycroconaines approaches that of infrared light, these materials are suitable for manufacturing infrared detectors (they can be used for the production of infrared light-sensitive diodes).

Belgian MIETEC Develops Electrothermal Chip Simulator

93BR0106 Zellik TECHNIVISIE in Dutch 14 Oct 92 pp 10-11

[Excerpt] [passage omitted] Postmanufacture error detection in integrated circuits [ICs] is very expensive. Four years ago, the design department of MIETEC [Microelectronics Technology] (a Brussels-based company) therefore requested the Electrotechnical Department of the Catholic University of Leuven (ESAT-MICAS division, laboratory of Professor Sansen) to build an electrothermal simulator. The purpose of this

simulation software was to make it possible to check the electrical and thermal properties of IC's.

The simulator took four years to develop and was partly financed by the IWONL [Institute for Scientific Research in Agriculture and Industry] of the metropolitan district of Brussels. This simulator is already used whenever problems arise or are suspected. At the moment, the user interface is being improved and further research is taking place using "case-studies" to compile design rules which would enable, analog/digital IC designer to develop power-switching chips without thermal problems.

Technivisie talked with Eng. W. Van Petegem of ESAT and Eng. B. Graindourze, cell libraries manager at MIETEC Alcatel.

Electrothermal Effects

Analog ICs can be designed using a public domain simulation software program called SPICE. This program does not however take into consideration that electrical and thermal effects can actually affect each other and that the temperature from one component to another can vary in a circuit. These effects can have significant consequences in high-speed digital circuits (e.g., circuits used for telecommunications applications) and in power circuits (e.g., when drivers are integrated in the chip). [passage omitted]

In order to examine the thermal behavior of an IC, a finite element package must be employed which includes a thermal model of the IC. Special attention will be paid to the thermal loads (surface heat sources) and the peripheral conditions (e.g., packing). If only the thermal behavior is checked, without considering the electrical behavior, no accurate results will be obtained either (also see the above example). If significant thermal effects are apparent, the only way in which a true simulation of the IC can be obtained is by adding an interface between the existing SPICE program (which simulates the electrical behavior) and the finite element analysis program. For the latter, the French package "Systus" from Framatome + CSI [Compiegne Science Industry], sold in Belgium by Dynamic Engineering, was chosen. A relevant simulation was obtained following a few "repetitive processes" between these two programs.

Software Development and Hardware Tests

This assignment, the writing of an interface and the checking of both packages, seems to be self-evident, but is in fact, a difficult assignment which will be executed in the laboratories in Leuven.

The operation can be described as follows: For each temperature distribution obtained using the finite element package, the adapted electrical operation is calculated, then this data is used to calculate another temperature distribution. This "repetitive process" continues until the changing results are within narrowly-defined limits. With each transition from one package to the other, the data and the model are converted as a function of the specific program (SPICE and Systus).

It needed also be checked whether the model structure matched the actual structure. In order to determine this, MIETEC developed test structures (IC-structures, usually diode structures). The temperature was monitored by measuring the diode voltage. Direct temperature measurements, for example, using infra-red thermography, are not accurate enough due to reflection problems (on the metal tracks) and the insufficient resolution of the measurements themselves. Temperatures must be measured on a surface smaller than 30 square microns, which can sometimes be difficult using infra-red techniques. The above-mentioned test structures enable parameters to be determined for the temperature model. The model was checked by performing a simulation on a few chips whose performance was already known, and then comparing the measurements.

Reducing the 'Time-to-Market'

The objective of this simulator is to reduce the "time-to-market" by minimizing the risk of a problem occurring during the development phase. The simulator will detect problems before the masks are manufactured, before the ICs are produced, and before the lengthy life tests are finished. Both the electrical and thermal characteristics of the developed IC will be screened.

The simulator can also be used to compile design rules for the thermal risks. Since no risks taken during the design of an IC, a considerable number of safety factors will be employed. If a simulator is unavailable, this situation can lead to an unnecessary accumulation of safety factors. Regarding the thermal effects, this usually entails the moving of components further away from each other, resulting in an increased use of silicon and a decrease in profits, etc.

By using adapted design rules, the amount of space required can be decreased so that, comparatively speaking, smaller ICs (or more complex ICs which use the same amount of space) can be obtained. This results in a lower price for the component which is a competitive advantage for MIETEC.

Dutch Institute Develops Fast Parallel Processor

93BR0118 Rijswijk POLYTECHNISCH WEEKBLAD in Dutch 22 Oct 92 p 1

[Article by Wim Raayen: "New TNO Processor Brings Virtual Reality Nearer"]

[Text] In the battle for the development of very-high-speed computers and parallel computers, Europe currently has a substantial technical disadvantage when compared to America and Japan. However, TNO [Dutch Central Organization for Applied Research] is dedicated to reversing this situation in the short term. TNO's new

"Parallel Texture Processor," with its enormous processing power and flexibility, is now an important contender in the race to the top.

A "helicopter view" of an imaginary landscape can be displayed on a large screen with, for example, a detailed view of trees, rivers, mountains, and buildings. With a little imagination, you can picture yourself inside an airplane that is flying just above the surface of the earth. In no time, the computer can make this scenario even more exciting and realistic by creating fog and other types of awkward weather conditions.

The screen is not the latest toy from Nintendo or Atari, but a demonstration of the Parallel Texture Processor. This new technology, which provides computers with a enormous amount of processing power, has been developed by the TNO's Physics and Electronics Laboratory. The various processor elements can communicate extremely quickly, not only with each other, but also with other systems and with the user.

These features are promising, especially when used for the simulation of an environment, like the previously-mentioned imaging system. TNO uses scanned photograps to realistically reproduce the fantastic structure of the environmental elements. This requires an enormous amount of processing power; all the more so if the images change continuously. The processor must be capable of processing the user's control signals in order to produce uninterrupted new images.

Processor Chips

To achieve this high processing power, the architecture of the texture processor consists of parallelly operating processor chips. Eng. P.L.J. van Lieshout, the group leader for parallel processing at the TNO laboratory, stated: "One advantage of this type of architecture is that it is scalable. You can decide by yourself how many processors you wish to connect to each other in parallel. The more processors, the greater the power, but the more expensive the system will be."

Software is the most important aspect of the texture processor. "Software provides more flexibility for imaging systems than hardware. Moreover, software is cheaper and less risk is involved during the development phase."

Hardware, nevertheless, has one major advantage: speed. To take optimum advantage of hardware and software, TNO chose a design which uses existing advanced processing chips. These chips can be replaced by faster or more efficient chips which appear on the market. "Existing hardware is much cheaper than chips which are developed 'in-house,'" stated van Lieshout. The TNO laboratory is currently evaluating applications for the processor. The laboratory forms part of the TNO's Defense Research Department. Much attention is therefore paid to imaging systems for flight simulators. The researchers are also working on a "Platoon Fire Control Trainer," an environmentally-friendly alternative to artillery exercises.

The researchers do not, however, wish to limit their scope solely to defense applications. They consider that they are now in possession of a technology which is suitable for a much wider market. The parallel architecture is also particularly suitable for quickly and adequately solving all kinds of complex problems.

TNO is now actively canvassing industry in its search for an manufacturer who is prepared to commercialize the processor. The director of the laboratory, Eng. P. Spohr, stated: "We also wish to convince the Ministry of Economic Affairs about the importance of the new technology. We now possess an internationally competitive technology which requires adequate government support, otherwise this unique chance will be lost."

Virtual Reality

TNO is doing more than just looking for applications of the new technology. In this respect, "virtual reality" is the magic word. Researcher Dr. G.J. Jense says that this technology need not be enveloped in a cloud of secrecy. According to Jense, the architecture of the new processor shows real promise. A "virtual reality" which provides real-time video, audio, and environmental signals requires a computer with high processing and communication power. According to Jense, this makes the TNO processor an ideal platform for virtual-reality-based training systems and simulators and for remotely controlled robot applications.

SGS-Thomson Introduces Multidiscrete Chip

93BR0143 Paris ELECTRONIQUE INTERNATIONAL HEBDO in French 5 Nov 92 p 36

[Article signed J.-C. G.: "Up to 150 Discrete Semiconductors...on a Single Chip!"]

[Excerpts] SGS-Thomson offers the market a service whereby several discrete components, such as diodes, thyristors, and other security components can be integrated into a single chip. These "multidiscrete" circuits are not, however, integrated circuits.

Cautiously stated a year ago at the "Componic" fair, ASDs [Application-Specific Discretes] are integrated component networks (Schottky, Zener, or Transil diodes; triacs; thyristors; resistors; capacitors). When first released, they were dedicated primarily to protection functions. They can be used, however, in numerous other applications, the operation of fluorescent lights, for example. [passage omitted]

Vertical Monolithic Structure

Thanks to the ASD concept, it is now possible to confer upon complex components the same advantages inherent in integrated circuits or specific circuits with regard to discrete components (increased reliability,

space and cost reductions of at least 40 percent), without hurting performance quality. ASDs are designed in a vertical, monolithic structure (both wafer sides are masked and processed) that has a reputation for its capacity to handle strong currents (up to 100 A/mm^3 for 1 ms). The results are evident: 50-A peak currents per line for a CMS [surface-mounted circuit] SO8 package or a DIL8 [dual inline] package and 70 A for a SIP4 [single inline package]. The maximum chip surface of these packages, i.e., processable on existing assembly lines, is 4 x 5 mm; this is two and one-half times the size of the most complex chips developed to date (2 x 4 mm), and they can accommodate up to 54 components. The electrical current capacity of the unit, due to the structure's verticality, is regrettably also its principle limitation: The necessity to provide a common point between the components in the layout. All components are indeed mounted on the same silicon substrate and, unlike integrated circuits, the process does not allow the use of silica insulation layers.

Although initially adapted to the needs of computer manufacturers, this approach has obvious application possibilities for the automotive and telecommunications sectors—e.g., protection or other functions. These sectors are important, given that a minimum production run of between 100,000 and 500,000 units are required to justify development of a particular product. A minimum lead time of six months before delivery of the first samples is considered normal.

NUCLEAR R&D

Belgium: Operation, Applications of Rhodotron Accelerator Noted

93BR0188 Brussels ATHENA in French Oct 92 pp 28-31

[Article by Pierre Dewaele: "The Waltz of Electrons"]

[Excerpt] Ion Beam Applications, the Louvain-la-Neuve firm, is once again breaking ground in the particle accelerator field. Currently, it is electrons that are gaining speed!

After having attained a leading place in the proton accelerator market, Ion Beam Applications (IBA) is today endeavoring to capture the electron accelerator market. At the end of last year, an agreement was reached between the [French] Atomic Energy Commission (CEA) and IBA. At stake is the construction of the rhodotron whose underlying principle was discovered by the CEA's Jacques Pottier. The device is a high-frequency accelerator operating in the vicinity of the well-known FM radio band. It is revolutionary in that it is capable of producing a high-power, ultra-high-energy flow of electrons—an effect that had previously been difficult to achieve. [Passage omitted]

Rhodotron

In 1986, Jacques Pottier capped his career with the discovery of the rhodotron, which can produce not only ultra-high-energy electrons but also ultra-high-power electrons. The system operates 100 percent of the time, and is theoretically 100 times more efficient than conventional accelerators. The basic principle is simple: The electron flow forms loops in a cavity at a frequency of 110 MHz, at which optimal results are obtained. It is this frequency that determines the dimensions of the coaxial cavity. The system operates in metric waves, i.e., the path of one center-to-center rotation by the electron flow equals the wavelength—3 meters. In such a structure, according to the laws of physics, the magnetic field is null at the median, and the electrical field is maximal. The electrons cannot therefore undergo any deflection because of the magnetic field. This concept is important because everything is calculated so that maximum energy is imparted to the electron.

One MeV per Rotation

The electron path is also very interesting. The particle is shot from a 50-kV electron gun toward the center of the cavity, occupied by a powerful electrode with a 500 kV potential difference. At the instant it arrives at the center of the electrode, the electron possesses a charge of 550 keV and the voltage drop is reversed. As a result, as in the case of the linear accelerator, the particle is repelled with a force of 550 kV. The electron thus acquires more than 1 million electron-volts (MeV) in a single pass through the center. To acquire still more energy, however, it must return to the cavity's center. An electromagnet is placed against the wall of the cavity. It causes the electron to make a 180-degree turn. At that point, the voltage is again reversed. The particle is once again drawn to the center, and so on. Thus, each time the electron passes the center, it gains 1 MeV. The flow of electrons thus describes a trajectory that resembles a corolla, hence its name "rhodotron" since "rhodon" is Greek for "rose."

This specific path is a product of one of the electron's major characteristics. Because of its very low mass, it can rapidly approach the speed of light. According to the laws of relativity, although it is possible to nearly approach the speed of light, no particle can exceed it. After its initial acceleration, the 1-MeV electron is already moving at 95 percent of the speed of light. Since the particle can gain no further speed, it gains mass as in the famous equation $E = mc^2$, where "E" represents energy, "m" mass, and "c" the speed of light. Each electromagnet must therefore be adapted to the energy of the electron so as not to deflect its path. The rhodotron allows the electron to cross the diameter 10 times and, thus, to gain 10 MeV with a theoretical power of 20-100 kW (50 kW guaranteed) or two and one-half times higher than what is currently achieved. It is possible to obtain an electron flow of 1, 2, 3, 4... MeV only if the flow is allowed to escape after 1, 2, 3, 4... passes through the

center. This constitutes another advantage of the IBA-built device: It can be adapted to the requirement. In addition, it is fitted with fully automated control during maintenance or in the event of breakdown, as well as during operation. Another advantage over its older cousins, the rhodotron presents practically no danger because there is no external radioactivity once it is unplugged. With IBA, safety is assured.

Quasi-Universal Applications

If this machine is so warmly received by industry, it is because its applications are many and diverse. Beyond a certain level, irradiation by an electron flow entails the sterilization of whatever is subjected to the flow. A 10-MeV electron flow can penetrate 10 cm of water and is sometimes adequate to sterilize a certain volume.

Nevertheless, it is often necessary to convert the electron flow into X-rays, thereby allowing deeper penetration of the substance. This conversion is accomplished by projecting the electrons onto a metal plate, thereby causing X-ray emission. The key property of X-rays is their ability to penetrate any form of matter. They can be slowed down substantially, but there will always remain a portion that succeeds in getting through whatever the volume of the matter.

The two main applications of electron or X-ray irradiation are sterilization of agro-food products and of medical equipment. The EC requires that electron flows not exceed 10 MeV, and x-ray flows not exceed 5 MeV. Even at these levels, there is no danger of radioactivity because production of induced radioactivity only starts at 15 MeV. Subjecting a harvest to one of these two radiation procedures makes it possible to eliminate all microorganisms, ensure the sanitary quality of the product, and thus preserve it longer. Pepper, for example, which we import in great quantity, is always irradiated. Frozen products from countries suspected of not respecting hygiene rules are also irradiated. Dairy products cannot be sterilized by this method, however; it alters their taste. On the other hand, it is possible to consider irradiating such products' packaging, thereby increasing their shelf-life.

Until now, the medical field has constituted the best market for this technology. It makes it possible to sterilize instruments, as well as transfusion sacks, before use. Previously, steam was used, but that was expensive. Today, most firms use ethylene oxide, which puts people at risk, considering the danger of explosion. Moreover, ethylene oxide pollutes the environment. The U.S. Food and Drug Administration is in fact planning to prohibit its use.

Think Environment

A third field of application that is steadily expanding is the treatment of plastics. Plastics are formed from linear chains. In order to improve the performance of plastics, chlorinated radicals are added; these are the PVCs used in the manufacture of electric cables claddings, for example. When such substances burn, highly toxic smoke is produced. By subjecting the linear, non-chlorinated chains to a flow of electrons, their structure is altered with the linear structure becoming reticulated, thus increasing resistance to heat. They then become at least as effective as the chlorinated plastics. In the automotive industry, engines and car bodies can also benefit. It is above all, however, for tires that the results are the most interesting. At very high levels, a flow of electrons is able to reduce tires to teflon powder, leading to the manufacture of the famous frying pans and motor oils, for example. Other radioactive sources, like cobalt, do the same work as electron accelerators, but there still remains the issue of the resulting radioactivity that poses many problems from an ecological standpoint. The rhodotron is not only itself nonpolluting; it also fights pollution. Certain water purification plants in the United States are already equipped with linear electron accelerators. Subjecting used water to these flows makes it possible to eliminate germs and toxins that endanger bacteria that purify the water.

The market is therefore very substantial. But if the stakes are so high, could there not be another firm, for example a French one, that enters into competition with IBA. "The only ones capable of competing with our Walloon firm would have to turn the project over to the Japanese. Clearly, we were the only ones able to manufacture the entire machine. Moreover, thanks to our proton accelerators, we have achieved a good reputation in our field," explained Yves Jongen, IBA general manager. The Walloon Region has again shown its confidence by granting a reimbursable loan of over 54 million Belgian francs [BFr]. This type of assistance need be repaid only if the project succeeds, i.e., if the company sells its machines. The odds are that such will be the case, thanks in part to the company's previous successes, notably the well-known "Cyclone" proton accelerators. At IBA, they are proud to be able to say that a similar loan for Cyclones has been almost fully reimbursed. There remains then the matter of cost, which is not excessive given the machine's capabilities—BFr100 million, the same price as the older, less powerful linear models.

Ion Beam Applications is therefore one of the most active Walloon firms, having continued to grow since its establishment in 1986. In this case, as in the case of the earlier particle accelerators, it can be assumed that contracts will pour in. That is exactly what we wish for them.

SUPERCONDUCTIVITY

French Research Center Develops New High-Temperature Superconductors

93MI0137 Bonn WISSENSCHAFT WIRTSCHAFT POLITIK in German 28 Oct 92 p 6

[Text] Researchers at the High-Temperature Center in Orleans, a National Scientific Research Center (CNTS)

institution, have succeeded in developing a new family of high-temperature superconductors.

These are bismuth-based oxides with two- and three-dimensional structures. The precise chemical formula for the discovery is: $(Ba,K)_2 (Pb,Bi)O_4$. Marina Licheron and Francois Gervais stress the important property of the new superconductor—the extreme simplicity with which it switches between conductive and insulating states.

Dynamic Development

Six years after the discovery of the high-temperature superconductor, initial applications can be clearly identified, the Federal Research Ministry claims. "Development is proceeding suprisingly rapidly, and has lost none of its characteristic dynamism," says Dr. Heinz Riesenhuber.

Firstly, there are energy applications: from electricity generation, to its conveyance and conversion, right up to storage and other components, superconducting technologies save raw materials and greater efficiency mean more intelligent energy consumption.

Fishing Cans Out of Trash

By generating the largest, and detecting the smallest, magnetic fields, superconductivity is even now playing its part in the sorting of mixed materials for the waste industry.

Superconductivity antennae, filters, bolometers, and spectrometers can make remote sensing for climatic research and communications technology purposes more effective. Superconducting bolometers are used as heat source detectors.

As regards transport, magnetic overhead monorails, for example, can play an important part in the long term in reducing carbon dioxide emissions, and preventive health care can be provided faster and more accurately with noninvasive examinations, i.e., without causing injury, using "SQUIDs" [superconducting quantum interference devices]. A "supercold" computer is also on the horizon.

TELECOMMUNICATIONS

Scandinavian Consortium Presents Digital HDTV System

93BR0009 Paris ELECTRONIQUE INTERNATIONAL HEBDO in French Sep 92 p 33

[Article signed E.F.: "First Terrestrial Digital HDTV Demonstration"]

[Text] Amsterdam—A Scandinavian consortium has rekindled controversy over the European HD-MAC [high-definition multiplexed analog components] standard by proposing a digital solution which could be operational before the turn of the century.

A Scandinavian consortium caused a major stir at the IBC '92 exhibition in July by unveiling a first-generation digital high-definition television with ground-based transmission. Named HD-DIVINE for High Definition-Digital Video Narrow-Band Emission, this system is the result of a combined effort of Swedish Telecom, Swedish Broadcasting, Telecom Denmark, and Norwegian Telecom on one hand and the industrial companies Telia Research, Digital Vision, and Sintef Delab on the other. Using a 1,250-line, 50-Hz, 2:1 interlaced studio signal—meeting European specifications—DIVINE compresses the data and transmits the resulting signal by digital modulation along a conventional 8-MHz-bandwidth UHF frequency. The system could be operational before the year 2000, at least, this is the consortium's objective.

Appeal for Cooperation Between Manufacturers

The development of HD-DIVINE has taken 18 months and has cost approximately 70 million French francs [Fr]. During this relatively short period, the group asked the Swedish company Digital Video to design a HDTV codec which would reduce the data transmission frequency from around 900 Mbit/s (for a standard studio source) to approximately 24 Mbit/s. The codec uses a hybrid coding algorithm based on the DCT [Discreet Cosine Transformation] technique, which is also used in videoconferencing systems with movement prediction and compensation. At the sound level, DIVINE can transmit four audio channels of compact disk quality. The audio coding is based on developments made in the framework of the EUREKA-147 DAB [Digital Audio Broadcasting] project, as is the global transmission method of the compressed HDTV signal, which implements a frequency-division multiplexing method. The modem used was developed by Sintef Delab. A second development phase has been launched to improve and integrate the overall system. In this regard, an appeal for cooperation has been made toward other European companies. Numerous tests in the actual environment are planned for the autumn.

The Scandinavian group did not want to place their project in direct competition with the European standard HD-MAC, which is intended for satellite television. They have followed the same path as the United States by targeting terrestrial retransmission of the signal (in the United States, however, the signal must fall within a bandwidth of 6 MHz instead of the 12 MHz used by HD-MAC). The prime question remains: Why build the "television of the future" around an analog system (HD-MAC) when the future is in digital systems in so many other fields?

German Eunet Computer Network Described

93WS0022D Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 2 Sep 92 p 8

[Article by RE: "A Million Computers in Eunet Dialogue: Biggest German Network for Open Electronic Communications"]

[Text] Frankfurt—The German UNIX Users Association, Registered Association, (GUUG), in Munich, and the Company for Added Value Service in Telecommunications, Ltd., in Bonn, have announced the founding of Eunet Germany, Ltd., in Dortmund. The companies reported that the new concern is expected to take over the operation of Eunet from the University of Dortmund in the course of the year. They said that this network has been in existence since 1982 and that, with over 500 subscribers, it is the biggest network for open electronic communications in Germany. It is as well a cooperative network of UNIX computers in Europe that is open to users from both the academic and commercial sectors.

As a pan-European network in, for the time being, over 20 countries from Iceland to the CIS, from Norway to Tunisia, Eunet offers network services: E-Mail, Netnews, and Intereunet. Furthermore, network crossovers provide for connections throughout the whole world. Thus over a million computers in the Internet union, which spans the globe, can be communicated with through the Intereunet service.

As Andreas Schachtner, one of the two managers of Eunet Germany, Ltd., (Emil-Figge-Strasse 80, 4600 Dortmund 50) emphasized, the provision of Eunet services will in future be improved locally through "point of presence." The provision of services is to be expanded along with the provision of complete Eunet packages. And lastly, OSI [Open Systems Interconnection] services in accordance with the X-400 standard are to be initiated in Eunet Germany, Ltd.

At the present time GUUG counts over 1,500 companies or private users as members and is thus, according to its own figures, the biggest European association of its kind. Membership in this association founded in 1985 is open to anyone. They support open computer systems that are in particular initiated by the UNIX computer operating system.

Along with the association's Eunet-linked computer network, GUUG maintains a program library with public domain software. GUUG is also a member of EurOpen and [advances] the interests of members of standardization committees like POSIX [Portable Operating System for Computer Environments], usr/grp, X/Open, OSF [Open Software Foundation], and UNIX International.

Riesenhuber Announces Support for HDTV Research

93WS0022E Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 25 Sep 92 p 8

[Article by KT: "German Support for Research on Digital High Density Television; Joint Project Under Overall Control of Heinrich Hertz Institute; Criticism of HD-MAC Transmission System; Television Receivers Built on Modular Design Principle in Future?"]

[Text] Frankfurt—Minister Riesenhuber has announced support for digital high density television (HDTV) at Photokina in Cologne. For this purpose, a joint project has been created under the overall control of the Heinrich Hertz Institute, to which the firms Bosch, Grundig, ITT Intermetal, and Thomson Consumer Electronics belong, and also the German Institute for Aerospace Research and the Institute for Broadcasting Technology. The last-named will present the results of its relevant research projects that have been in progress for several years now in Munich on 2 October.

With this support, the course has been set—at least in Germany—for a digital HDTV system with seven-channel sound, which could, in Riesenhuber's opinion, in due course supersede the HDTV with an HD-MAC analog picture-transmission system, which is at the present time in process of being preliminarily introduced. Known as EUREKA [European Research Coordination Agency] 95, HDTV with HD-MAC has been elaborated by many European firms and institutions since 1987 as an alternative to Hi-Vision with Muse transmission, which was designed in Japan at a very early point. Flanking subsidies through groups like Vision 1250 made possible many demonstrations in the past until finally the Olympic summer games were telecast Europe-wide daily from Barcelona this year with this 1,250-line system to about 700 television receivers with the new 16-to-9 picture-tube format.

Riesenhuber described this system in Cologne as successful from the technological point of view. He said that it is now the primary task of the industry, the Telecommunications Office, and broadcasting promoters to introduce it and in so doing help to make this technology a market success. However, the minister had to admit that this system has not gone uncriticized. But he described the debate in which "digital HDTV" is demanded as "misleading." It is, he said, in no way relevant to the whole chain [of transmission] between the camera and the home television set. He said that HDTV studios and television receivers are already largely digitalized.

Actually, the criticism is focused on the HD-MAC transmission system alone. This system still processes the picture signal through analog circuits and thus prevents the transmission of high density programs from earth-based transmitters. But this means that about 85 percent of all European television subscribers are excluded from

HDTV—so many of them use a conventional roof antenna. Only the small remaining number of them could be served by HDTV/HD-MAC, which is suitable for satellite and cable transmission.

Now, after the European industry, a few governments, and the EC have sunk sums involving three-figure millions into HDTV/HD-MAC and have gotten it practically ready to be introduced, they are looking for a way out. Despite all the shortcomings encountered in introducing the existing system by about 1994 and later, if digital HDTV is fully developed and the necessary microchips are available—which will probably take five years or more—they are today obviously still inclined to follow up with the digital version. Even before then, as of about 1995, with PALplus a process will be offered that fills the wide picture tube in the 16-to-9 format. Still to be considered is the D2-MAC transition system, which is being implemented with difficulty and which also can only be received via satellite and cable.

If developments should take the course sketched above, new ideas for television receivers would have to be considered. Today the subscriber is, out of habit, inclined to buy a complete television set to last for the next 10 years. In so doing, he would in future soon run into difficulties because of the above-indicated rapid technical changes now taking place. Perhaps the solution lies in splitting today's "all-purpose" set up into modules, as we have long been accustomed to doing with the hi-fi technology. One proposal seems to be just that: The television set of the future will consist of first of all a central unit composed of the picture and sound component. Various tuners can be connected to it (plugged into it): for D2-MAC, HDTV/HD-MAC, both combined with satellite receivers. The modules for PALplus and for digital HDTV are added later. The central unit is supposed to be provided with the new picture tube in the 16-to-9 format, which today already exists in three sizes.

Industry-Network Conflict Continues

93WS0046A Paris LE MONDE in French 29 Sep 92 p 37

[Article by Michel Colonna d'Istria: "Clouded Agenda for Digital Television"]

[Text] Digital television promises more programs or more quality for tomorrow. Is this a reason to obstruct the innovations available today? Network interests are in conflict with those of the electronics industry.

Digital television represents the future. This is the consensus whether in Washington, Brussels, Paris or Tokyo. But when does the future begin? This is where contention arises among experts, manufacturers, producers, broadcasters, and politicians who come to blows, each backing up his position with "rational" arguments in favor of his agenda, his priorities, his particular vision of transition toward a future television whose image and sound will be generated and transmitted as zeros and ones as computer data already is.

This agenda item became the central issue at hearings held from 22 to 24 September by the Parliament Office for Evaluation of Scientific and Technical Options, because it will partly—but only partly—determine the answer to another question that is crucial to Europe's electronics industry: will its new television products, currently based on D2-MAC and shortly on HD-MAC (1), have time to gain acceptance from the public before the tidal wave of a new generation of equipment now under study, particularly in American laboratories?

Several points bear repeating here. Current television is "analog" because the data constituting the image (namely, brightness for light intensity and chromaticity for color) is transmitted as a modulated electric current. This data linked to its support, can become irreparably distorted when reproduced repeatedly or transmitted under difficult conditions, as for instance in the case of a video cassette that has been copied too many times.

In digital television, the image is coded then transmitted in terms of 0 and 1 before being "retranslated" (or decoded) as image. The information is thus independent of its physical support and can be more easily manipulated or compressed. This advantage reappears at every stage of the television process from production to transmission and display.

In production, digital techniques are already in common use as they facilitate mixing, special effects, and storage. This is why modern television facilities are known as "digital component" studios: the image (as well as sound) information is broken down into separate colors and handled digitally according to studio standards (4 2 2) which are universally accepted, whatever the subsequent transmission protocol.

At the other end of the sequence, the television set remains by definition partly analog, since the eye recognizes shapes and not digits. To adapt to digital television, the set will require a decoding unit.

Image Compression

The current debate focuses on transmission as the central link in the chain. At this stage, the advantage of digitalization resides in image compression. This means that a single transmission channel can carry more programs (quantity) or more information (quality) than is presently possible. In simple terms, the two options correspond to simple compression in one case and digital high definition in the other.

Since neither the services proposed, nor the costs, nor the agendas arising from these two options are similar, it would actually be appropriate to speak in the plural about the digital televisions being readied, particularly by various United States manufacturers.

In the first option, simple compression, General Instruments, Scientific Atlanta and Thomson Consumer Electronics (TCE) are all working on systems that will increase satellite or cable broadcasts four-fold or more

for the same throughput. Consumer electronics (decoders) at affordable (but yet undetermined...) prices are expected to be available starting in 1994. Two essential points should be noted: the quality of these systems will be no better than that of the present American NTSC (1), which is mediocre. And this research is being carried on without any regulatory restraints, at the initiative of the industries concerned, particularly cable or satellite operators (Hughes for example is ordering from Thomson) with a view to offering complete services.

The second line of development is land-based digital high-definition television (HDTV). The FCC (with broader powers than those of our Superior Audiovisual Council) is planning to choose one of the systems in 1993 and is allowing three years to grant broadcast licenses with a first airing around 1998 and generalized use by 2008. In this case, the outcome is clearly more remote for the contestants in the arena: ATT and Zenith; General Instrument and MIT (with two projects); the ATRC consortium composed of Thomson, Philips and the NBC network; and lastly, Japan's NHK.

Palaver

It is in this context that the question of European strategy must be placed. "The French should not lose time in rear-guard palaver. It is better to be partners with the Americans today than to produce under American license later," as Andre Rousselet put it, betting on digital "decompressors" by 1994 (LE MONDE, 24 September).

In the view of the head of Canal Plus, the D2-MAC analog transmission standard designed in the 1980s has had too many setbacks to be a winner. It can now only support, and temporarily at that, sales of 16/9 format television sets; presently, only D2-MAC allows access to this new large screen format which is notwithstanding the second point of universal consensus for the future.

Of course European industrialists and French authorities see things very differently. With some variations, their arguments rest on a simple premise: Europe is ahead; it must not switch horses in midstream after all the work already invested; the regulatory and competitive context is very different from that of the U.S.; genuine digital television is not coming that soon. "Each product must come in its own time," as Pieter Bogels, head of the EUREKA 95 project, repeats tirelessly.

It is toward this project that European manufacturers have spent ECU450 million (including about 40 percent in subsidies), since 1986 when they took up the HDTV challenge against the Japanese, who were then working with the Americans. Their strategy, considered progressive, is based on the high definition HD-MAC standard which will be seen on D2-MAC sets already available at present. "A bird in the hand is worth two in the bush. We have the best production system in the world, we are ahead with the 16/9 sets, and we're fighting to decide whether to go on. Unbelievable!" as Pieter Bogels protests.

Interests

Alain Prestat, CEO at Thomson Consumer Electronics, also talks about the "step backward" that copying the American model would be, since current FCC tests are "of a caliber achieved by the Europeans in 1988." Both men agree with the minister of industry, Dominique Strauss-Kahn, who predicts a lead of at least 10 years for European products (LE MONDE, 25 September).

As for "missing the digital bus," the Europeans deny the charge. HD-MAC being a basically digital standard, dependent largely on coding and image compression except for final transmission to the user, the EUREKA 95 energies were not wasted. They are, in fact, complemented by several European RACE or EUREKA (Vadis) projects which are exploring this field. Further, the Europeans and particularly the Rennes CCETT (the government research center which contributed a great deal to achieving DAB digital radio), are working on a third application of digital broadcasting: the wireless "nomad" television which will hopefully be a reality by the end of the decade.

If the debate acquires such passionate intensity, if the agendas are as unstable as yo-yos, it is because the interests at stake are essential. European manufacturers, notably Philips and Thomson, are manufacturing two-thirds of the European television sets and one-third of the American ones. They need to sell new products in Europe right away. And therefore they need programs (such as those in the 16/9 format) which exploit these products.

But whereas European electronics has become concentrated, European television has remained national. There is no European equivalent for the American FCC, able to enforce changes that are naturally repugnant to networks—again, national networks—who will derive no direct benefits from them. For these industrialists, the effect of predicting the digital option era is catastrophic if it leads to a wait-and-see attitude on the part of the public or if it serves as an alibi for the networks. "To invoke the future, the digital, in order to return to the past, to SECAM, what dialectics!" one expert ironically commented.

This is a clear reference to Rousselet, who has been accused of using these means to keep his place as king of pay networks. While there is no indication that the head of Canal Plus is also defending his interests, nobody can ignore the fact that electronics innovations have seen the light of day only with the well-timed support of "contents" people. The success of the CD in the music world proves it, as does the failure of Betamax in VCRs.

And the fact is that Rousselet through pay TV holds the key to the most obvious "contents" for television innovation. This very strength is an argument he can use in his favor.

The three current television standards (NTSC in the United States and Japan, PAL and SECAM in Europe)

are analog. For the future, two HDTV broadcast standards have already been tested, the Japanese Muse and the European HD-MAC. Both combine analog and digital.

The D2-MAC intermediate transmission standard (analog except for sound and data) is already available in Europe now, via satellite or cable. While not high-definition, it improves not only sound but also image stability and access control options, as well as making the 16/9 large screen format possible. Thanks to this standard, it will be possible later on to watch HD-MAC programs without changing sets just as viewers with black-and-white sets have been able to go on watching networks broadcasting in color.

Joint Venture for Coded Transmissions

93WS0046B Paris LE MONDE in French 11-12 Oct 92 p 17

[Article by M. C. I.: "Canal Plus and Murdoch Want to Impose Their Technical Choices for Pay TV"]

[Text]

Private Alliance for "Europe of Decoders"

Canal Plus and News Corporation, Rupert Murdoch's multimedia group, announced on Thursday, 8 October, a "strategic" agreement to develop in Europe new television services based on the technologies of satellite transmission, digital compression, and encryption.

Canal Plus is established in several countries, with 3.5 million subscribers in France and 1 million elsewhere; News controls Sky Television in Great Britain. Together they clearly dominate the market of pay networks in Europe, and this alliance seeks to retain this advantage in response to the challenge of American groups. Beginning with a task force to launch joint projects within six months, the two allies want to lock in the market of new interactive television services: theme channels, pay-as-you-go viewing and so on.

To achieve this they must control decoders. As Marc Tessier, president of Canal Plus International, emphasized in a FIGARO interview on Friday, 9 October, the future "belongs to those in a position to increase their offerings to their subscribers while using a single box." He added that "in pay TV, the price of admission increases every day. Therefore the first in line gets the bonus."

By deciding together which digital transmission technologies can increase programming availability (LE MONDE DE L'ECONOMIE, 29 September), the two partners will have the means to impose these technologies on the market. They may thus overtake not only their competitors but also public authorities and regulations. The fact is that by choosing to assemble a "Europe of Decoders" quickly and by themselves, the two partners are clearly diverging from the path of "official" European common research on tomorrow's television, based on analog, public and "open" standards. This speed strategy has already been successful at Sky Television which assimilated its main competitor BSB in 1990 after 18 months of ferocious battle.

Deutsche Telekom Offers Special Services in France

93WS0075C Paris INDUSTRIES ET TECHNIQUES in French 9 Oct 92 p 83

[Article by Laurence Girard: "Deutsche Telekom Comes to France"]

[Text] "I would like to sell my product in Germany, complete with an efficient after-sales service, but without having to create a subsidiary." The answer to this question, asked by a French technical director of Udo Huck, the president of Deutsche Telekom France, can be summed up in three digits: 130. Those are the first three numbers of Germany's equivalent of the green number. The service is available internationally. A German customer can call the number at no cost. He will think he is dialing Germany, but will, in fact, be talking to a technician in France. The illusion will be perfect if the latter speaks flawless German....

This example illustrates the first forays of the Germany telecommunications carrier Deutsche Telekom into the French market. Besides the 130 service, it is marketing a private satellite communications service. The General Regulations Directorate (DRG) granted it a license to do so this year. Strengthened by its experience in the former eastern German lander, DT is offering to install in eight to 10 weeks the VSAT antenna network French companies would need to round out their private networks with satellite linkups.

Deutsche Telekom France's sales are expected to total 6 million French francs [Fr] in 1992. That makes these initial forays trivial. But competition on international networks is only just beginning. Although Deutsche Telekom and France Telecom announced in March that they were creating Eunetcom to provide joint global network services, the company does not yet exist. If European deregulation is stepped up, the German carrier may decide to go it alone.

By way of preparation, Deutsche Telekom is changing its look. A privatization plan should enable it to scrap its duties as a public administration and find new money. It is also preparing to totally reorganize. Instead of structuring itself around its big product lines, Deutsche Telekom will organize itself around customer targets: residential for 50 percent of its turnover (DM47 billion in 1991), business (30 percent), big accounts (20 percent), and mobiles. Its organization will be decentralized. It is a model seen at AT&T and British Telecom, and that France Telecom is also trying to imitate.

EC Operators Launch Videophone Program

93BR0096 Rijswijk POLYTECHNISCH WEEKBLAD in Dutch 15 Oct 92 p 2

[Text] The PPT's [telecommunications operators] in Germany, Great Britain, Italy, Norway, and Holland, together with a few industrial companies, are jointly developing a videophone network for users throughout Europe.

PTT Telecom is coordinating this "European Videotelephony Program." The five telecommunications operators have now installed 100 videophones in 50 institutions and companies (e.g., at the Dijkzicht hospital in Rotterdam and at Heineken). Eight manufacturers have jointly decided to standardize the videophone: Alcatel, Dornier (Daimler-Benz), GPT [GEC-Plessey Telecommunications], Philips Germany, SAT [Telecommunications Company, France], Tandberg, Matra, and Aethra. The objective is to increase the number of videophone conversations and the duration of each conversation. The videophone is a godsend for the hard-of-hearing and can be used as a forerunner to multimedia applications (e.g., for transmitting medical photographs).

A survey carried out by Philips among 40 directors who tested the videophone revealed that they did not consider videophone to be such a spectacular improvement over the ordinary telephone. Although videophone is indeed gaining a reputation as an exclusive and colorful accessory, the directors found that using a conventional telephone was more relaxing. Nevertheless, 75 percent of the directors expect that their companies will use this new equipment in the future.

France: Data Transmission Via Cellular Telephone Planned for 1994

93WS0109 Paris MICRO-SYSTEMES in French Nov 92 pp 158-161

[Article by Bernard Neumeister: "Data Transmission Via A Digital Cellular Network"—first paragraph is MICRO-SYSTEMES introduction]

[Text] In 1994, any subscriber to the digital cellular telephone network, the GSM, will be able to use his portable telephone to send and receive computer data. In fact, the network will then offer different types of links through analog or digital lines, at a speed of up to 9600 bauds.

After Radiocom 2000, after its most direct competitor, SFR [French Radio Engineering Company], the GSM is the next revolution in cellular radiotelephony. Based on a fully digital technology, it will offer not only traditional telephone services with much better audio quality, but also data transmission services. Nevertheless, it took 10 years to achieve this technical performance, which became a standard adopted by 18 European countries and many others: Australia, Singapore, Hong Kong, Qatar, etc.

Although the French GSM network, named Itineris, was open on 1 July 1992, it still covers only the Paris-Lyon corridor. By the end of this year, the area covered will reach from Dunkirk to Nice. The GSM has many advantages. In addition to its audio quality, its fully digital technology, and its future data transmission potential, it uses frequencies around 900 MHz, released by the military a few years ago. These frequencies provide better performance in an urban environment, because they bounce back better on walls and are not absorbed as much by construction materials. In addition, they allow for higher radio component integration. As a result, portable telephone sets keep getting smaller. Motorola is already offering a set approved by France Telecom, which is no bigger than a small flashlight.

European Agreement

The GSM dates back to the early eighties. In December 1982, the CNET [National Center for Telecommunications Studies] officially launched its Marathon project [Mobile Systems With Access to the Digital Radio-Relay Subscribers Network]. The objective of the project was to draft specifications for a new generation of cellular systems designed to communicate with land mobile systems operating in the 900-MHz frequency band. The same year, the CEPT [European Conference of Post and Telecommunication Administrations] adopted a recommendation defining the corresponding sub-bands (890-915 MHz for mobile station transmission; 935-960 MHz for fixed station transmission). Immediately after that, all European countries "took off" in the same direction in order to develop a common product. At the same time, the CEPT created the GSM—which, at the time, stood for Special Mobile Group; its mission was to draft all technical specifications.

At the beginning of 1987, the GSM chose to use digital technology, a choice that was approved in Brussels a few months later. In September 1987, the network operators of 13 European countries signed an agreement for the joint implementation of the European digital cellular system. The GSM acronym then took on another meaning; it now means "Global System for Mobile Communications." In 1992, no fewer than 26 operators in 18 European countries signed a memorandum of understanding (MoU) under which they all agreed to implement a network based on GSM standards. Other operators throughout the world also adopted the GSM standard. The GSM used concepts very similar to ISDN [integrated services digital network] concepts to define the services to which mobile subscribers to the European cellular system would have easy access. In addition, a distinction was made between support services, allowing for the transmission of appropriate signals between user/network interfaces, and remote services, which provide for data transmission between users under a specific application defined by the CCITT [International Consultative Committee on Telephone and Telegraphy]. The GSM also provided for additional services to complement these basic services.

A Broad Range of Services

For instance, the standard provides for basic services such as telephone service, emergency calls, 300- and 1200-baud messaging, the transmission of short alphanumeric messages, and group-3 facsimile transmission. It will thus be possible to access the switched public telephone network through a modem, at baud rates ranging from 1200 to 9600 bauds, in synchronous and asynchronous mode. The standard also provides for connection to the Numeris network through throughput adapters very similar to those already used by Numeris. In this particular case, interconnection is achieved at speeds of up to 9600 bauds in fully digital mode, without using traditional audio modems. Finally, any GSM subscriber will have easy access to videotex on all asynchronous services.

Specifications for this full range of services already exist, although most infrastructures do not implement them. The basic mechanisms making it possible to offer these services on radio frequencies require specific coding. In particular, they require interconnection functions between the GSM and fixed networks, using gateway nodes to convert protocols and match throughput rates. To date, these gateway nodes are still being developed. However, France Telecom intends to offer all these data transmission services by 1994, in particular facsimile transmission, 1200- and 2400-baud modem links, access to videotex, as well as Transpac connection capability from X25 terminals.

The GSM network specifications are such that it is possible to connect a standard terminal to a mobile cellular station through an adaptation function. Therefore, in the future, three cases may occur:

- the mobile station will include the adaptation function, allowing for connection to a standard terminal such as a portable PC;
- specific terminals will include the GSM cellular telephone part;
- specific terminals will include only the adaptation part and will be connected to the GSM mobile station.

Obviously, it will all depend on the market and on whether manufacturers want to invest in this field.

With the GSM, each subscriber will have only one telephone number, irrespective of where he finds himself in France or any other European country. This feature, called "roaming," is a service offered by the GSM; it enables subscribers to use their own mobile equipment in all countries where the service is available. However, all billing and connection operations will require bilateral agreements between operators. In fact, "roaming" requires interfaces between operators in order to transmit mobile-system localization data. France Telecom is planning to offer this function for a number of priority countries—Germany, Switzerland, England, Italy, and Sweden—sometime during 1993, and later on for all countries.

The GSM maximum transmission speed via current channels is 9600 bauds, and no baud rate increase is expected. The system, designed for at least 80 percent of voice communications, offers maximum spectral efficiency. The basic problem is mostly to increase the GSM capacity, which is soon saturated in urban areas, in spite of the limited number of frequencies available to each operator. As we just saw, the GSM transmission frequency band lies between 890 and 960 MHz, [with 890-915 MHz for mobile stations] and 935-960 MHz for fixed stations, i.e. two 25-MHz bands. Only part of this range is available to each operator. In France, the two existing operators, France Telecom and SFR, can use only 7 MHz, a range that will gradually be increased to 12.5 MHz.

As these frequencies are limited, it became necessary to use specific voice coding techniques. Voice requires a throughput of 13 kilobits per second [Kbits/s], plus an error-correcting code to improve transmission quality. In fact, this is a tradeoff between good voice quality and good frequency spectrum efficiency. Under the GSM standard, it is quite possible to multiplex eight communications in a 200-MHz frequency range while retaining good audio quality. In 1994-1995, the number of multiplexed communications will increase to 16, as a result of the development of voice coding at half the throughput rate, i.e. 6.3 Kbits/s. For computer data transmissions, several such channels might be regrouped. The resulting complexity, however, is no longer compatible with the demand.

Many operators view the GSM as a cure-all. The countries which signed the agreement had only analog systems totally incompatible with one another and controlled by operators in a monopoly situation. Therefore, they had to start from scratch. In the United States, the situation was entirely different. There, operators were more numerous and tried mostly to achieve compatibility between the two systems, analog and digital.

AMPS, the U.S. Rival of the GSM

The result is called Digital AMPS [Advanced Mobile Phone System]. It enables the U.S. infrastructure to evolve slowly toward a fully digital system without having to adopt the GSM standard. GSM-standard equipment will be useless in the United States. Nevertheless, there exists an extension of the GSM standard on which all countries on the planet might eventually agree. By the end of the century—which is only seven small years away—mobile cellular telephone frequencies will rise to around 1800 MHz, instead of today's 900 MHz. The goal is to develop personal communication networks geared to small power outputs for urban coverage. Quite possibly, all countries could adopt such a standard in order to design universal equipment, similar to what is being considered in Europe for the GSM.

Miniaturization

With the three-way computer-telecom-multimedia alliance, plus component miniaturization, we can certainly

expect to see microcomputers within two or three years. It is most likely, and people working for the company have confirmed, that Apple will launch its Newton system in the United States in March 1993, and in France next fall. Designed to be connected to any kind of telecommunication equipment, it will be quite capable of transmitting data via the GSM, as long as adaptation interfaces are available. As for telephone manufacturers, although the first sets are relatively bulky, they will soon fit in a pocket like the French Be-Bop which is hardly bigger than a calculator. In addition, when the Minitel Photo service is available, it will no doubt be quite possible, within one year or two, to use a portable PC connected to the GSM to view images, or even to transmit them, in spite of the "slowness" of the digital network. Still in the field of cellular telephony and computer data transmission equipment, large computer companies are currently working to develop various means to exchange data. Apple offers the OCE, i.e. an Open Collaborative Environment. In fact the goal is to simplify as much as possible data exchange via messaging systems. With the OCE, the user will be able to send an open document from a word processor or a spreadsheet, without leaving the application and without having to worry about the many "twists and turns" the document will have to go through in order to reach the addressee. He will also be able to move a document icon to the addressee's icon to perform the same file transfer. The OCE uses an entire structure of directories, protection and identification, digital signature, storage, and retransmission, which is currently being developed. In the future, users will use a single interface to access multiple messaging services (QuickMail, MS Mail, CC:Mail, Voice Mail, etc.) via satellite communications, X25, ISDN, GSM, etc. Next spring, a first package will be offered. To succeed in this field, therefore, Apple has concluded several partnership agreements with Lotus, Borland, Novell, IBM, and WordPerfect. In addition, OCE technology will be ported to other platforms. Note that version 1 of the specifications has reached its final development stage.

A Market of 20 Million Subscribers in Europe

All studies made by operators agree to estimate the GSM market at 20 million subscribers throughout Europe, and 4 million in France. Therefore, the Ministry of Telecommunications split the market down the middle and gave 2 million frequencies to each of the two operators it had approved, France Telecom and SFR. That does not mean that "older" cellular telephone networks are going to disappear, at any rate not in the near future. They can be expected to go on until after the year 2000. In addition, some cellular equipment can obviously evolve from analog to digital operation, e.g. Motorola's 4500, 4800, and 4900 models.

With the GSM, the future of cellular telecommunications has been set for some time. Moreover, thanks to digital technology, the alliance between microcomputers and telecommunications is further strengthened, on land with the ISDN, and on the air with the GSM. A book-size microcomputer with a micro-handset or a cellular connection cannot be far away. Certainly, we can expect major surprises toward the end of 1993 and the beginning of 1994.

Philips Develops Programmable Line Interface Chip

93BR0143 Paris ELECTRONIQUE INTERNATIONAL HEBDO in French 5 Nov 92 p 31

[Article by Elisabeth Feder: "Adaptable Transmission Circuit for Post and Telecommunications Authorities"]

[Text] The Philips programmable circuit will allow manufacturers to rapidly adapt their telecommunications terminals to specifications of the various post and telecommunications authorities [PTTs].

With the PCA1070 transmission circuit, samples of which will be available at the end of the year, Philips Semiconductors will offer a low-cost solution to manufacturers of telecommunications terminals. To date, specific requirements of PTTs in different countries regarding telephone line interfaces have necessitated dedicated circuits, often coupled with variable external components. Being totally programmable, the PCA1070 cuts the number of external components required by one-third, and can create a line interface for any country. Two years of development and the end users' cooperation were required to develop the various functions and integrate them into a multistandard transmission circuit. Optimized to operate in concert with a reduced number of external components, the PCA1070 can be programmed by implementing parameters regarding direct voltage, terminal impedance (with respect to the line), microphone and receiver amplification, and two- to four-wire transition. The component monitors the line current and adapts the parameters in accordance with the line's length. The country-specific parameters are saved in the EEPROM [electronically erasable programmable read-only memory] of a microcontroller and transferred via an I2C bus. The use of SACMOS [self-aligned contact metal-oxide semiconductor] technology developed by Faselec makes it feasible to place the microcontroller on the same chip as the transmission circuit. The telephone on a chip, thus, becomes a reality.

EC Criticizes Non-Official Harmonization of Analog Equipment Tests

93BR0157 Amsterdam COMPUTABLE in Dutch 30 Oct 92 pp 3, 4

[Article: "Technical Regulations Application Committee (TRAC) Lays Down Standard for Telecommunications Testing"]

[Text] The Hague—TRAC, the European Association of National "Regulations Offices" in the field of telecommunications, has decided to mutually recognize analog equipment testing results through bilateral agreements between the affiliated countries. As a result, equipment

will have to be tested by only one testing institute in order to conform to the standards imposed by several countries.

To this end, TRAC has adopted the NET4 [European Telecommunications Norm] standard, a decision which has been eagerly awaited by suppliers of peripheral telecommunications equipment. NET4 is based on a 1986 directive aimed at achieving mutual recognition of test results by introducing harmonized standards. As the analog networks of the European countries differ considerably, the requirements which are applicable to equipment connected to these networks (telephones, faxes, modems) also vary substantially. Only a very limited degree of standardization can therefore be achieved. Therefore, NET4 standards consist of a mutual part and a country-specific part.

Because of these deviations, the European Commisssion had already rejected NET4 in an earlier stage. In its opinion, it did not conform to the prime requirement of a NET norm, which is full harmonization. Nor is the European Commission enthusiastic about NET4. In addition to the fact that the standard does not meet the requirements of the 1986 directive, the Commission is also concerned about the question of liability if—perhaps due to the overwhelming number of country-specific specifications—an approved item of equipment does not function correctly when connected to a network. The Commission does not therefore wish to commit itself and it will not publish NET4 in its Official Journal.

The members of TRAC (the HDTPs of the EC/EFTA [European Free Trade Association] countries) have nevertheless decided to implement the standard so that a supplier no longer needs to have approval by an institute in the country where he wishes to sell his products. The supplier should now be able to manufacture equipment which, with the aid of dipswitches, can be suitably configured for connection to several infrastructures and which can be tested by one accredited approval laboratory acting for a number of institutes. Final approval (i.e., the granting of a "blue sticker") remains a matter which must be arranged by the domestic HDTP.

Following the EC Commission's decision not to publish NET4, the TRAC was not sure whether the 1986 directive would become effective and has therefore decided that the members themselves must draw up their own bilateral agreements to recognize the results of the tests.

The establishment of a standard as a NET norm has the advantage that the national requirements are difficult to change. Changes are only permitted if they will result in increased harmonization. According to a HDTP spokesman, laboratories which are already accredited (in the Netherlands these are KEMA [Electrotechnical Materials Testing], NKT [Dutch Telecommunications Equipment Testing Institute] and AKZO EMC [electromagnetic compatibility] Services) do not have to extend their testing capability in order to sanction equipment meeting foreign requirements.

Netherlands: Open Network Provision Increases Government 'Interference'

93BR0186 Amsterdam COMPUTABLE in Dutch 13 Nov 92 p 7

[Article by COMPUTABLE correspondent: "Greater Government Supervision of Telecommunications Sector—At Least One Year Still Needed To Prepare Tendering Procedure"]

[Text] Amsterdam—The government is again finding it necessary to supervise the telecommunications sector as a result of the principle that entry to basic services throughout Europe must be available to everyone.

The principle of general access to basic telecommunications services, which has been developed by the European Commission under the name Open Network Provision (ONP), signifies that new government interference is unavoidable. ONP stipulates that the same conditions will apply to everyone within the EC who wants to make use of telecommunications services.

Minister of Transport and Public Works H. Maij-Weggen announced this during the EuroComnet exhibition last week. A ministerial Round Table Conference formed part of this event, which took place in the RAI exhibition hall in Amsterdam.

Obsolete

The 1989 Law on Telecommunications Services is already out of date, although the regulations it replaced had been in force for at least 85 years. Minister Maij-Weggen has come to the conclusion that this still relatively new law must be completely revised. This necessity has arisen partly as a result of changes that have taken place within the EC, which is now going in a different direction from that first envisaged.

Greater supervision by national governments constitutes a turn-about in the trend of recent years toward less government interference in various economic and social sectors. According to Maij-Weggen, more direct government intervention will be needed in price levels for products offered under exclusive license. This conflicts with the present regulations, which intentionally provide for a great distance between the government and the telecommunications sector.

Mobile Communications

The present law is based on one operator who has overall responsibility for all parts of the mobile communications infrastructure. The Ministry of Transport and Public Works is, at the moment, adding the final touches to a change in the law that will allow several suppliers to set up mobile communications networks. If this change is accepted, a second operator can be allowed to operate the so-called GSM [Special Mobile Group] network in

addition to PTT Telecom. Maij-Weggen apologized that this would take at least one year to achieve. The year is necessary in order to specify licensing details and also to prepare the tendering procedure.

The Provisional Advisory Council for Posts and Telecommunications (RAPT) is very angry about the year's delay announced by Maij-Weggen. The advisory group is afraid that the second car phone network will be in place far too late, particularly when taking into account foreign competition.

Well Informed

Otherwise, EuroComnet '92 was directed this time toward Eastern Europe. According to the minister, a democratic state can only function with a telecommunications network that operates efficiently. "Implicit in the democratic theory is the fact that there is a a well-informed population that can choose for itself where to obtain its information," said the minister.

Ireland: Strategy of Telecommunications Operator Analyzed

93BR0211 Ruisbroek BUSINESS & TELECOM in Dutch Oct 92 p 30

[Text] Ten years ago telecommunications in Ireland were almost nonexistent. There were: a waiting list of 63,000 for a telephone connection with an average wait of 14 months (sometimes up to five years); high rates; one local telephone call in 10 would go wrong, while for international calls this could rise to one in three; data transmission was at an extremely low level. Since the start of the 1980s, however, the Irish government has been working on an extremely ambitious modernization program. One hundred billion Belgian francs [BFr] have been invested, i.e., more than BFr30,000 per person. Today at least 91 percent of all telephone traffic is digital. The prime intention is to attract foreign companies and investors to the Emerald Isle. With a particularly young population—half of the total of 3.5 million Irish citizens are under the age of 20—there will be more than enough labor available.

Privatization

The Irish PTT [phone authority] was revamped in 1984 to become the commercial concern Telecom Eireann [TE], with the state taking a 100-percent stake. Last year TE recorded a turnover of about BFr47 billion with a profit of about BFr5 billion (19 percent higher than in 1990). Irish politicians still have quite a strong say in the area of telecommunications. Bernard McDonagh of the Department of Tourism, Transport, and Communications says that there no effective plans at the moment for the privatization of the Irish PTT "but it is a controversial political issue." Gerry Pahy, international business development manager for TE, is also very cautious but believes that privatization will take place within two to three years.

The Irish government has adapted the law in line with directives issued by the EC, but a genuine, independent regulatory organization does not yet exist; most things still fall under the jurisdiction of the Department of Communications. Just as in Belgium, TE is holding on to its monopoly position to a large extent. "Personally, I feel that competition provides the best guarantee for a good service," said Bernard McDonagh, "but we must be careful that we do not slip from a public to a private monopoly situation. Look at most of the other European countries. Enthusiasm there is not particularly high either." Competition is on the way for cellular services such as the GSM [Special Mobile Group] digital mobile telephone network (anticipated for the start of 1993) and the Personal Communications Network (PCN), although there are no concrete plans yet for this last service.

The analog TACS mobile telephone system, known as "Eircell," already has some 50,000 users (an increase of 1,000 per month). A joint venture with Motorola has been set up for the "Eirpage" semaphone service (in which TE has a 51 percent share). Since November, a videotex network has been in operation in cooperation with France Telecom. There are about 100 services available, which are aimed particularly at the professional user.

DASSNET [Data Services and Special Networks] offers companies solutions for integrated voice and data transmission. Eirpac, the X-25 network, is also expanding, but not quite as quickly. Nonetheless, there are both national and international Virtual Private Network (VPN) services offered.

Wait, See, and Jump

"We do not want to practice with every new technology," continued Bernard McDonagh. "It is all developing so fast that sometimes you need to be able to look into a crystal ball. It is not always clear what will become a success. Videoconferencing enjoyed a boom during the Gulf War, but there has not been much demand for it since then. No decision has yet been made on the introduction of Telepoint (CT2). You could express our philosophy as: "Wait, see, and jump."

One gets an entirely different point of view if talking to Ben O'Reilly, overseas business manager executive with TE. "One-third of TE's sales revenues comes from international business. Recently there have been conscientious examinations of the possibilities for a competitive mobile phone network in Brazil, Greece, the Netherlands, Spain, Italy, and also in Belgium." (Note by the author of the article: During the interview he was constantly asking me about the situation in Belgium.) "Network experience has been the sales argument in various African countries, in Czechoslovakia, Hungary, Poland, Uruguay, and Great Britain. For the last two years, 500 TE employees have been working on digital technology implementation in the British Telecom network. Last year a joint venture agreement was signed with the Hungarian national telecommunications operator, MATAV, and three Hungarian banks. Over the next 10 years, BFr150 billion will be invested in the Hungarian network. Telecom Eireann will also supply its experience in the areas of financial management and network planning and development.