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ADVANCED MATERIALS

Market, Producers of Electrically-Conducting Polymers Viewed

93WS0090B Duesseldorf *HANDELSBLATT* in German
3 Nov 92 p 28

[Article by Wolfgang Asche: "Electrically-Conducting Synthetic Materials Remain Preserve of Small and Mid-Sized Firms"]

[Text] Market researchers from Frost & Sullivan predict a consumption of about 180,000 tons in 1996 for electrically-conducting polymers. The main area of application is the shielding of microelectronic components and cables. Once it has been made conductive, the synthetic material acts as a Faraday cage and hinders electromagnetic fields from penetrating or escaping. Frost & Sullivan see little chance for new concepts like intrinsically conducting polymers.

In spite of the predicted rise in volume (in 1991 only 75,000 tons were used worldwide) the market for "organic metals" will remain small compared to that of mass-produced synthetic materials, and it is mostly small and mid-sized firms which deal with it.

The A. Westensee und Partner Rohstoffe GmbH in Winsen an der Luhe, for example, offer the usual synthetics like polyethylene, polystyrol and polypropylene with an electrically-conducting filling. Mostly soot is used, but aluminum powder or carbon fibers are possible. Compounds from Westensee can be used for permanently antistatic application, as for example in the lining of vessels to prevent electrical discharges and dust adhesion to the surface. In addition, EMI shielding against electromagnetic interference and heating elements made out of these synthetic materials which have been made conductive are available.

Westensee and its Finnish partner Premix Oy also offer "semiconducting" synthetic materials. A polyethylene modified with silane is filled with a special soot which lowers its electrical conductivity with rising temperatures, that is, with rising self-heating and loses it entirely at a limiting value. Semiconductors like silicon behave exactly the same way. Thus a thermostatic effect can be obtained without expensive automatic control technology; for example, a water pipe could be kept a few degrees above zero during a frost.

The telecommunications division of the "material" company Raychem has built electrically-conducting polymers into a protective system for cable. A "bandage" of adhesive, conductive synthetic material and a foil is wrapped around repaired spots on the cable. The passage of current induces heat, which causes the foil to shrink. At the same time the adhesive is activated, so that in the end the wrapping is tight against the cable. Raychem can change the structure of thermoplastic synthetic materials by irradiation and make them liable to shrink when heated. In the process they acquire an "elastic form

memory." A rise in temperature restores the denser structure of the original thermoplasts.

Large companies are also marginally involved with this topic, but usually go for the big picture and work with unfilled, intrinsically conductive polymers. Thus Gerhard Heywang and Friedrich Jonas from the central research division of Bayer AG recently reported on poly(ethylene dioxythiophene), a new, electrochemically produced material which retains its conductivity unchanged even after 1,000 hours at 120°C. Polymerization from the monomer ethylene dioxythiophene is achieved in an aqueous solution at the surface of an electrode. According to the inquiring minds at Leverkusen, this procedure can be used for the in situ production of new types of capacitors. One side of the capacitor together with the dielectric layer (aluminum plus aluminum oxide) functions as an electrode, and when current passes through the polymer forms on the aluminum oxide as an antipole. The usual tantalum capacitors for high frequencies are much more complicated to produce.

A few years ago a great future was prophesied for intrinsically conducting polymers in rechargeable batteries. Low weight and custom shaping are characteristic of polymer electrodes. But the only product on the market at the moment is a button-sized battery with a cathode of polyaniline and a lithium-aluminum anode. Bridgestone and Seiko, companies from Japan, cooperated in its production.

The cause of Frost & Sullivan's pessimistic prognosis for intrinsically conducting polymers is concern about their mechanical stability and about the constancy of conductivity. Even Prof. Gerhard Wegner, who as head of the Max Planck Institute for Polymer Research in Mainz is an expert on the material, sees the future as black. If damage mechanisms in the polymer molecules of the "intrinsic" are not thoroughly studied and if no one discovers how effective protection against light, air and heat is possible, then, according to Wegner, "this promising field will sink into stagnation."

CNET Develops Aluminum Nitride Synthesis Method

93WS0116C Paris *COMPOSITES ET NOUVEAUX MATERIAUX* in French 28 Oct 92 p 6

[Text] The National Center for Technical Studies (CNET) has just developed a new process for synthesizing aluminum nitride as part of its research into materials and ceramic composites. The process is based on the principle of direct nitriding of aluminum powders, to which an activating agent such as a lithium salt has been added. The method makes it possible to treat powders more cheaply than with the usual techniques, and in a relatively low-temperature (1000 and 1200°C) nitrogen atmosphere.

The technique has been patented, in a patent document that describes the synthesis of other nitrides such as boron, silicon, titanium, chromium, or zirconium nitrides.

The process produces aluminum nitride that is reproducible in batches of several hundred grams. The powder will be worked and sintered to make substrates with highly specific characteristics.

CNET, 38-40 rue du General Leclerc, 92131 Issy-les-Moulineaux, Phone: (1) 45 29 44 44.

Second BRITE/EURAM Call for Materials R&D
93WS0116D Paris COMPOSITES ET NOUVEAUX MATERIAUX in French 28 Oct 92 pp 7, 8

[Article entitled: "150 Million Ecus for the Second Call for BRITE/EURAM II Proposals"]

[Text] The European Commission has just published its second call for proposals for the industrial technologies and materials R&D program. In other words, it is inviting member countries to present projects for BRITE/EURAM II. Funding of ECU150 million will be allocated to this second call for proposals. Note that in response to the first call, which ended 3 April 1992, the Commission received 1,158 proposals, from which it selected 251 projects.

The program encompasses the following areas of research:

Area I: Materials and Raw Materials

- Raw Materials: Exploration and mining technology; mineral processing;
- Recycling: Recycling and recovery of industrial waste; recycling, recovery, and reuse of advanced materials;
- Structural Materials: Metal materials and metal-matrix composites; ceramic materials; ceramic-matrix composites and advanced glass materials; polymers and polymer-matrix composites;
- Functional Materials for Magnetic, Optical, Electrical, Biotechnological, and Superconducting Applications: Magnetic materials; high-temperature superconductors; materials that conduct electricity and ions; optical materials; biotechnological materials;
- Consumer Materials: Packaging materials; new construction materials.

Area II: Design and Manufacture

- Product and Process Design: Design tools and innovative techniques; methodology for the design of complex components; maintainability and reliability;
- Manufacture: High-quality manufacturing tools, techniques, and systems; manufacturing techniques that make industrial use of advanced materials; an integrated approach to chemical and process engineering;

- Engineering and Management Strategies for the Whole Product Life Cycle: Strategies that integrate design, engineering, and human factors into engineering and manufacturing management.

Call for proposals, ECC, DGXII, Department C, rue Montoyer 75, B-1040 Brussels, Phone: (32-2) 295 23 45, Fax: (32-2) 295 80 46

AEROSPACE

German Telecommunications Satellite Industry Viewed
93WS0083A Duesseldorf HANDELSBLATT in German 28 Oct 92 p 21

[Article by Anatol Johansen: "Space Industry Complains About Being Forced Out by International Competition"—first paragraph is HANDELSBLATT introduction]

[Text] Bonn, HANDELSBLATT, 27 Oct—Communications satellites: The program worth billions is over—no more orders for German manufacturers.

With "mixed feelings" the German space industry followed the launch of the last national "German communications satellite, Kopernikus 3" (DFS-3), which was orbited into a geostationary position with an American Delta-2 rocket on 12 October. This is what Wolf-Peter Denker, who is responsible for commercial satellites at German Aerospace (DASA), recently said.

The DFS-3, which has up to now successfully passed all the checkout tests, is expected to begin its mission in space in December. It will, in particular, help to improve communications with the new federal states and Eastern Europe, whereupon it will be possible to connect telephone channels via the satellite. The Telecommunications Office has reserved the DFS-1, which was launched in 1989, for 14 television programs and telephone calls, data, and fax in particular are being transmitted via the DSF-2, which was launched in 1990.

The setting-up of the satellite system was a boon for the German industry: The order was intentionally issued without a call for bids in order to strengthen German satellite manufacturers' international position. Including ground stations and all additional costs, it amounted to more than DM1 billion.

No More National German Communications Satellites

Wolf-Peter Denker said that additional orders for the DFS system are not to be anticipated. For political reasons alone, there will be no more national German communications satellites as of 1993.

Added to this there is something else. According to Gerd Tenzer, a member of the Telecommunications Office board of directors, that office operates on a commercial basis and, consequently, cannot pursue any national policy in support of the German industry, which the Post

Office was still able to do in connection with the procurement of the DFS system. At any rate, no less than 24 providers of satellite services today operate in the federal republic, providers which in part compete with one another and in part with the Telecommunications Office as well. "Costs and quality are of prime importance for us," Tenzer said.

That this is obviously no meaningless assertion was shown right from the start when, contrary to expectations, the choice fell not on a European Ariane rocket—in the production of which the Federal Republic of Germany participates—but on an American Delta-2, made by McDonnell-Douglas, which was about DM20 million cheaper for the Telecommunications Office than its European counterpart. The international situation is also at present extremely unfavorable for German satellite manufacturers. According to Wolf-Peter Denker, "a tough situation in which we are being forced out by the competition" prevails. Thus, the American company, Hughes, has cornered a world market share of communications satellite sales of about 60 percent. According to Dietrich Davidts of ANT Bosch Telecommunications (Backnang), we produce "handcrafted technical marvels," but Hughes, which also manufactures military satellites, mass produces them and in the process comes up with extremely attractive prices due to a very great reduction in per-item cost.

In addition to this, there is the fact that Hughes not only produces satellites, but also itself operates communications systems with them. So the Americans can in certain cases not only offer a customer a satellite system, but also assure him that they will later themselves lease some of the transmission capacity.

As if that were not enough, the Americans are also prepared to sell a satellite in orbit. This means that the customer is spared the risk of an aborted launch or an insurance premium in the two-figure millions. If the launch fails, one of the firm's own satellites circling in a geostationary orbit over the equator is simply pushed into the position the customer wants it in and begins to operate there.

But, naturally, German satellite manufacturers cannot provide this kind of service. On the contrary, they are even at a political disadvantage to boot. Thus, the German industry had designed a technically demanding and cost-effective satellite system at a cost of about DM10 million for the Arab states and offered it to them. But then, according to Dieter Davidts, the Americans offered them a more expensive system, one for which there were not yet any technical specifications either, and their bid was nonetheless accepted (the Gulf War may well have provided this as a bonus).

Americans Relieve Customer of Risk of Aborted Launch

So the German space industry's hopes are now directed toward the East. But at the same time they are now no longer thinking—as they still were only recently—of putting together a system composed of "Romantis"

satellites. Evidently, both sides lack the money for this. According to Gerd Tenzer, this satellite system was in its time still being negotiated with the former Soviet Union and is now "too risky." Instead of it, they want to set up a communication network in Ukraine along with the American AT&T and the Dutch Post Office. There are other initiatives in Russia and Kazakhstan. But no additional new satellite systems are required.

On the other hand, they are still hoping for a western European system of direct-transmission satellites that would, if necessary, be implemented and operated with France and Switzerland as of 1994. Three or four "Europesats" could transmit up to 40 television programs—with which they would have to compete with the now well-established "Astra" satellites. Which is why the planned satellites would, if necessary, be provided with higher transmitter power to allow for smaller receiving antennas or a better picture quality in keeping with the new HDTV [high density television] standard.

So far, however, the Europesats too are merely a project, the realization of which is by no means certain. Exactly 30 years after the beginning of state-supported space technology in the federal republic, German satellite manufacturers today find themselves facing the most difficult situation they have had to deal with up to now.

EUTELSAT-2-F5 Launch Date Moved Up

93WS0162C Paris AFP SCIENCES in French
26 Nov 92 p 8

[Unattributed article: "Fifth EUTELSAT-II Launched 'As Soon As Possible'"]

[Text] Paris—To meet increasing needs for telecommunication services, both in Western and Eastern Europe, Eutelsat [European Telecommunication Satellite] has decided to proceed "as soon as possible in 1993 with the launching of its fifth second-generation satellite, Eutelsat-2-F5," a communique announced.

The satellite will be ready by next April, and Eutelsat intends to set a launching date at its next signatories meeting, in January. The European Ariane rocket (ArianeSpace) and the U.S. Atlas rocket (General Dynamics) might normally compete for the launch, as both have already launched Eutelsat satellites. In this context, however, people recall that the last Atlas launch, one month ago, ended in failure.

Eutelsat-2-F5 was ordered in 1989 from Aerospatiale, the leader of the consortium that builds this series of satellites. Like Eutelsat-2-F4, it will be specially equipped with an antenna covering Europe all the way to Moscow and beyond.

Of the 64 repeaters currently provided by the four Eutelsat satellites in orbit, 62 are in service or reserved. Eutelsat-2-F5 would be added to take care of business

communications between the East and the West and to meet the demand for television channels recently created in Europe.

By the end of 1994, the Eutelsat system should include six satellites, adding up to 96 repeaters. The sixth Eutelsat-2, to be launched during the second half of 1994, will be positioned with Eutelsat-2-F3 at 13 degrees longitude east, in order to provide 32 repeaters at this location on the geostationary orbit. The Eutelsat organization currently includes the public and private telecommunication operators of 32 countries.

AUTOMOTIVE INDUSTRY

German Auto Companies' Research on Lower Fuel Consumption

93WS0090C Munich SUEDEDEUTSCHE ZEITUNG
in German 29 Oct 92 Supplement p V

[Article by Rainer Kluetting: "The High-Tech Way to the Economy Car"]

[Text] The engineers at Volkswagen had thought up a little challenge for the car driver—only experimentally, of course: he was to play a part in energy savings. Since many, if not all, vehicle drivers let the motor turn over too often too high and in the process use fuel unnecessarily and produce pollutants, the engineers built a yellow light into the instrument panel. If it went on, that meant: "This would be a good time to shift to the next highest gear." The result of the experiment was that the light was "not accepted." The test drivers remained in low gear, too lazy to shift, with the consoling knowledge about the reserve of power in the right foot.

This is a small example of a large problem which is formulated this way by Ulrich Seiffert, VW chief executive for research and development: "Real customer behavior and publicly proclaimed opinions often differ widely." In other words, people are asking for the "eco-car" or "three-liter car," but that does not mean that it will also be purchased.

Nevertheless all car manufacturers are working on more economical vehicles, not least because they promised the federal government to do so. By the year 2005, in spite of rising numbers of car registrations, the carbon dioxide emission from street traffic is to fall by one quarter; as much as three-quarters of other waste gases are to be eliminated.

On the way to this goal very different concepts are being pursued, not all of them ready to be implemented by any means. But all the producers are agreed about one thing: technical optimization is possible. However, there will not be a "three-liter car" without sacrifice of comfort. At the same time safety must not be compromised.

It is said at BMW in Munich that "the five-liter car almost exists," and without circumlocutions, "it is not a BMW." The economical car will be a compact with

minimal comfort and safety and with a diesel engine. But, they say, cars should satisfy various requirements, and the requirements for a BMW are different. Nevertheless, the newest six-cylinder models from Munich have had their engines powerfully optimized and, depending on driving style, at least 7 percent savings in running costs have been realized. Precisely because a large and costly car is being dealt with, it was possible to use expensive technologies. New materials reduce the weight of the valves, flatter pistons and longer piston rods reduce harmful friction in the engine, and sophisticated electronics regulate compression in such a way that the engine does not ping at high revolution numbers and at low revolution numbers still uses fuel optimally at high compression.

The competition at Mercedes-Benz also relies on high tech, in the automobile as well as in the laboratory. "Nowadays nothing can be done just by trying it out, as used to be the case," says Michael Kraemer, head of the research institute of Mercedes-Benz. He says that it was thought for a long time that combustion in the Otto engine could not be improved upon. But in the last couple of years he has seen matters differently. Today it is possible to watch combustion while the engine is running with the help of laser measurement techniques, which has resulted in one or two surprises. An example is direct fuel injection: the closer the injection pump is placed, the more precisely the course of the gas or diesel stream and how it spreads out can be adjusted. Older models, according to Kraemer, had injected the fuel onto the cold cylinder wall when starting—not a good precondition for optimal combustion. Today he hopes to achieve an additional 5 to 15 percent savings from direct injection, even in the Otto engine.

Still, technology is not advanced enough to produce an optimal mixture of air and fuel in the combustion chamber. The direct injector has the advantage of always pumping the precise amount of fuel into the combustion chamber that is needed at the moment. In diesel engines this is already done now. But for consumption not to rise unacceptably, you need an air surplus in the combustion chamber. But then the catalyzer of the Otto engine can no longer filter the nitrogen oxides out of the waste gas properly. So the choice is still between catalyzer and direct injector.

Everywhere new materials are being experimented with. An example is ceramics: the relatives of simple clay are poor conductors of heat, and therefore good insulators. Why not line the combustion chamber of the engine with ceramics and thus burn more effectively? The euphoria was short-lived. "Ceramics still conduct too well," as Gerhard Woschni of the Technical University of Munich found out more than half a decade ago. Automobile manufacturers gave it up by that time at the latest. The combustion chamber did become hotter, but the hot walls prevented the combustion chamber from being filled with air to the necessary extent, and the heat gained heated up the exhaust. Otto engines knocked,

diesels produced soot, and the final effect was that fuel usage increased instead of decreasing.

But that did not mean the end for ceramics in engine construction. Wherever low weight and low friction are at a premium, ceramic materials are being tested or are already in use. This includes the valve drives and piston heads as well as the exhaust-driven turbosupercharger, a tiny turbine which must revolve very quickly in the hot exhaust stream. There are still problems where ceramics meet ceramics; friction is high. Many components must be redesigned if ceramics are to be used, since this material is brittle and is often subject to cracks which then become gaps, and since it can withstand pressure but not much tensile load. On the other hand, there is no problem in using ceramics in catalytic converters, where they function as a carrier material. And soot filters for diesel engines are also made from ceramic materials.

Experiments are also being done with other materials which are lighter and ought to produce fewer losses due to friction. New alloys from titanium and aluminum are being tested at Mercedes, but so far they are too brittle. The engineers are also fiddling with variable compression and other modern automatic control procedures. It may sound baffling that it is the man from Mercedes, Kraemer, who places great hope in the two-stroke engine. He can become quite enthusiastic about it: he says that it runs more quietly, could be 30 to 40 percent smaller and lighter than it is today if technically optimized, and produces fewer nitrogen oxides.

For since the two-stroke engine does not run all waste gases through the exhaust, the fuel is ignited in an atmosphere of hot waste gases and thus burns better, i.e. with less nitrogen oxide. In the case of the notorious Trabant, however, for this very reason unburned fuel also came out of the exhaust and released that unmistakable stench. Kraemer hopes that he can get a grasp on this problem with direct fuel injection.

Volkswagen is following a different path. The Wolfsburgers have not yet given up the idea of asking a little cooperation from the driver, in spite of their experience with the yellow light. Starting next year, they want to offer their "eco-Golf" as a line which has been tried out by the police of Lower Saxony since December 1989. The price increase, according to the press release, should lie "in the range of a good car radio." The diesel with catalytic converter lowers fuel consumption in the standard ECE test by 12.7 percent, to 5.5 liters; a driver who makes use of its features will get 100 km even with four liters.

At the heart of the eco-Golf is "automatic momentum utilization" (SNA). It simply turns the engine off at a stop light or when stuck in traffic and turns it on again at the touch of the gas pedal. The engine also cuts out during prolonged coasting on a level street or downhill and is started up again by the car's momentum. Even seasoned drivers first have to get used to the fact that

they do not have an engine brake any longer unless they deliberately switch it on again, which would switch off the "eco" part of the Golf.

France: Auto Part Recycling Effort Described

93WS0116B Paris COMPOSITES ET NOUVEAUX MATERIAUX in French 28 Oct 92 pp 4-6

[Article entitled: "Automakers Concerned With Recycling Wrecks"]

[Text] With the auto show in progress, the Union of Automotive Engineers is taking stock of the latest efforts to recycle wrecks. Although cars generate waste throughout their lives, including production waste, used parts and components, and worn-out vehicles, 75 percent of those components are now recycled. Twenty-five percent (Auto-Crushing Residue, ACR) are sent to the dump. About 10 million vehicles are taken out of circulation and destroyed each year in the EC; the figure for France is 2 million. When crushers appeared in the 1980s, they brought three types of waste with them: iron scrap (70 percent, very well recycled), non-iron metals (5 percent of the vehicle's weight, also well-recycled), and crushing residues, or plastics, rubber, glass, fabrics, etc.

The EC has proposed three lines of research to reduce the volume of ACRs, which is expected to grow steadily. One would look into introducing recyclability criteria for materials at the vehicle design stage and making more widespread use of marking systems for plastic parts. Another would study stepping up the reuse of automobile components, and a third would look for ways to recycle crushing residues. The EC's proposals have prompted France's two automakers to work on a joint project to treat their end-of-lifespan manufactures. Located in Athis-Mons in greater Paris, the concept is based on two pilot ventures that are being conducted by each of the manufacturers: PSA's at St-Pierre de Chandieu (Lyon), where 3,600 vehicles have been treated since June of 1991; and Renault's at Flins, where the polypropylene bumpers and polyamide hub caps of 4,000 vehicles have been recycled. It should be pointed out that since the new '91 Espace, Renault has been marking all its plastic parts weighing over 100 grams, and all those under 100 grams that are easily accessible. PSA began marking in 1991 on the new Peugeot 106 and Citroen ZX models.

Like thermoplastics, thermoset composites are recyclable. Producers of thermoset plastics, especially those who make SMC/BMC, have organized themselves into groups: Valcor in France and Ercom in Germany. Eleven companies have so far joined the Valcor group, which is working on two main lines of research: recycling materials for use in the type of part they originally came from, and putting them to use in other applications. Examples include reinforcing fillers in thermoplastic compounds, cohesive loads in cements and asphalts, and reinforcing fillers for construction and other purposes.

An Example of Plastic Reuse: Polypropylene Bumpers

The study undertaken nearly two years ago by Renault and its partners (Appryl, C2P, Plastic Omnium) aims to establish a complete recycling loop for polypropylene bumpers. Tests have shown that a mound of deformable safety bumpers can produce a second-melt material whose characteristics are close enough to those of the original to allow its reuse in bumpers (only the bumpers' paint degrades the material's cold-impact properties). Plastic Omnium formed bumpers from the used material and tested them against the specifications sheet. Molding is easy. The material's fluidity is greater than that of the reference material, its temperature drops 20°C, and the part's shape is very close to that of the mass-manufactured parts. Color is homogenous although not in accordance with Renault's standards, and aging strength is good. By 1993, Renault vehicles should be on the road with recycled parts.

According to ACEA "Recycling Companies Can Set Prices Freely"

There are several steps in dismantling a wreck. One involves pretreatment to "depollute" the vehicle (removing the battery, emptying the fuel, separating fluids such as oil and coolant). Certain components such as engines, transmission cases, and alternators are stripped and, depending on the condition of the vehicle and the prevailing market, reintroduced into the economy as verified spare parts. The vehicles are disassembled to remove aluminum components and electrical wires.

In this way, old cars will move directly from their last owner to recycling channels. The Association of European Automakers (ACEA), which represents 14 European manufacturers, stresses in the words of Jean Hollis that "We consider it extremely important for the last owner of the decommissioned vehicle to set prices freely with the recycling firm. Prices must be determined based on the principles of market economics. This has many advantages. It creates competition among different recycling companies, putting pressure on them to lower their costs; it depresses the price of vehicles whose disassembly costs are higher; and it lowers the value of vehicles when their drivers remove recyclable parts."

France: PSA Introduces 'Cold Box' Crankshaft Manufacturing

93WS0143C Paris INDUSTRIES ET TECHNIQUES
in French 6 Nov 92 pp 60, 61

[Article by Michel Le Toullec: "PSA Chooses 'Cold Box' Casting To Manufacture Crankshafts its Diesel Automobiles"]

[Text] Installed at the Charleville-Mezieres site at a cost of 104 million French francs [Fr], this line will produce 6,000 pieces a day at full capacity.

For its new crankshaft production workshop at Charleville-Mezieres, PSA [Peugeot Corporation] chose

the innovative so-called top-pouring "cold box" technique. Peugeot's objective was to obtain dimensionally more precise and at the same time more homogeneous spheroidal graphite [SG] cast iron pieces. The workshop, representing an investment of Fr104 million, is designed to produce 6,000 crankshafts at full capacity, with three shifts totaling 64 persons. It has been operational since September and is currently producing 1,500 pieces a day with one shift.

This investment is in line with PSA's policy of generalizing the use of SG cast iron crankshafts, as an alternative to forged steel crankshafts, in all of its passenger cars. The Charleville site thus combines in this unit, in a single building, the melting, casting, and finishing operations. PSA justifies its choice of the "cold box" technique—its first use of this technique—by comparing it with the other methods of molding in hard sand, such as the croning [shell-molding] process and the croning metallic-shell molding process. The new method produces, first of all, a crankshaft without a casting sprue, that is, without the excess of metal that generally adheres to the piece. "Cold box" casting moreover, unlike the other methods, enables recovery of up to 80 percent of the sand used. The sand regeneration rate is 20 percent.

The method also avoids shortcomings of the other techniques, such as a sizable heating factor and the risk of pollution. And it guarantees PSA a better quality product: a high degree of surface hardness, a good appearance, and very few shrink-hole problems (surface defects owing to shrinkage of the metal during cooling). The rejection rate meets PSA's goal of less than 3 percent at maximum.

The process is being used today for the manufacture of PSA's diesel vehicle crankshafts, but its use would be advantageous for the manufacture of other massive parts as well, such as camshafts in particular.

[Box p 60]:

The Top-Pouring 'Cold Box' Method

This method of molding is one of the so-called hard-sand techniques. After the molten metal has been poured, the portion of the sand in contact with the piece—approximately 20 percent of the total—becomes a coolant. This part of the sand loses its hardness and can be removed without mechanical tools. It can then be regenerated and reused to fill the mold. The remaining 80 percent is not subjected to any thermal shock, and can be reused as is, as filler and support for a new pouring.

France To Test Natural-Gas-Fueled Bus

93WS0163D Paris AFP SCIENCES in French
26 Nov 92 p 47

[Article entitled: "The First Natural-Gas Bus Prototype Readied in Marseille"]

[Text] Marseille—Marseille will be home to the first prototype for a bus fueled by natural gas. The Marseille Public Transport Co. (RTM) mass transit system plans to experiment with the bus for a year, says the RTM, starting in March 1993.

The RTM's goal is to contribute to urban ecology by reducing polluting emissions and roughly 30 percent of irritating noises, and to use a substitute fuel that is "widely distributed throughout the world," says Pascal Maguet, an engineer with the RTM's vehicle technical department. The prototype contains six tanks of 150 liters each, placed in the roof "for safety reasons." The bus can travel 200 to 300 km before filling up again.

The tanks were subjected to numerous tests to insure the vehicle's optimal safety. They withstood violent impacts, pressure of 600 bars, a thrown grenade, and fire from an automatic weapon and penetrating bullet gun.

Renault Vehicules Industriels (RVI), which has designed an engine adapted for natural gas, Gaz de France, RTM, the Regional Industry, Research and Environmental Directorate (DRIRE), and the ministries of Transport and Industry all teamed up on the project. Adapting the vehicle to run on natural gas should raise its purchase price by about 10 percent, according to Mr. Maguet. Natural-gas buses are already operating in Holland, Germany, Belgium, Australia, Canada, and the United States.

BIOTECHNOLOGY

CIBA-GEIGY AG's Lippuner on Genetic Engineering Laws, Research

93WS0124B Duesseldorf *HANDELSBLATT* in German
17 Nov 92 p 27

[Report on interview with Heini Lippuner, chairman of the board of directors of CIBA-GEIGY, Inc., by Waldemar Schaefer: "Many People Do Not Trust Chemical Industry To Deal With Genetic Engineering in a Responsible Way"]

[Excerpt] *HANDELSBLATT*, Monday, 16 Nov— [Passage omitted] A mood in some countries that Lippuner says is opposed to the chemical industry, critical of it even to the point of being hostile, particularly in connection with genetic engineering, is causing him concern. According to him, many people do not trust chemical companies "to deal with technologies in a morally and ethically responsible way. They hear what we say (for example, the Swiss chemical industry's statement that it will not touch human genotypes), but apparently they don't quite believe us."

According to Lippuner, there is no doubt that genetic engineering has its risks. Therefore, it must be applied in a very responsible manner. "In the hands of irresponsible scientists or industrialists, genetic engineering could without a doubt cause damage. But inversely,

responsibly applied, it can be of enormous benefit to mankind and individual human beings."

Lippuner takes a calm view of the legal regulations governing it, insofar as they exist at all. In Germany the problems probably lie less in the law governing genetic engineering than in the bureaucratic translation of the law into ordinances.

In Switzerland there is no genetic engineering law, but there is supervision by the "Swiss Commission for Biological Safety." All genetic engineering experiments must be registered with it. Perhaps, the head of CIBA [originally: Basel Chemical Industry Company] conjectured, a genetic engineering law would even be helpful, "since people place greater trust in a federal agency."

But regulations alone are not what is crucial, rather the adjustment to a new technology. Research and development in the field of genetic engineering are easiest in the United States. Not because they are negligent there, Lippuner emphasized. "The Americans see to it that the risks involved in genetic engineering are reduced to a minimum. But they do so with 'common sense,' not with a bureaucracy that is hostile to genetic engineering."

The basic attitude toward genetic engineering is positive in the United States, "since they say that it is a key technology of the future. We must now see to it that we do not assume any irresponsible risks. The safety standards of the National Institute for Health (NIH) are based on this premise. Here in Switzerland one gets the impression that genetic engineering is viewed as a bad thing. This is why we must do everything we can to prevent ourselves from assuming any risk whatsoever. We have to attain zero risk here."

He said that there are nuances inside Europe. France has recognized that genetic engineering will be a key technology of the future. And France is determined not to miss out on this technology of the future, but "to be in on it."

Research in genetic engineering in the United States is of great importance to CIBA-GEIGY because the status of this science is very high, at any rate higher than in most other countries. Alongside the science's own activities [i.e., basic research], in particular involving useful plants, there is a whole series of cooperative ventures with "high-tech boutiques," in part with capital investments. But genetically engineered seed types are hardly to be expected before five years from now since they are proceeding step by step to minimize the risk.

Unlike the case with genetic engineering, a field dominated by the United States, there are no appreciable differences in levels between countries in the other organic chemistry fields. This is also true of research on AIDS, in which all firms and scientists are naturally very interested since every success has a positive effect on one's image.

As Lippuner reports, CIBA-GEIGY has different focal points for research and development in the United States, Great Britain, and also Japan. "Productive research and development require a critical mass in every field." Despite modern means of communication, this cannot be geographically distributed just anywhere.

As regards the cost of research, the general manager of the CIBA combine believes that the billion francs that are spent every year in the pharmaceuticals sector, for example, will be quite sufficient: "We don't need 1.5 or 2 billion because with the state involved the losses due to friction also increase."

Because of its size alone, CIBA will not enter into any investments or company takeovers either, even though its "war chest" is well filled with Fr4 billion in liquid assets. "However, [our situation] is not as good as Siemens or Hoffmann-La Roche's," Lippuner said, qualifying it. It is hard to find investments that will yield more money than bank investments in the short to medium term. Furthermore, CIBA-GEIGY can continue to grow on the basis of its own strength. Large investments in Asia, Taiwan, South Korea, and China—it has been involved in Japan for some time—will now begin to mount up. This is already manifest in the company's sales volume for 1992.

CIBA realizes only 2 percent of its business turnover in Switzerland and that is why it has for a long time now thought of itself as a global combine. Worldwide cooperation and worldwide involvement are part of its strategy. At the same time Lippuner regards its investment portfolio "as a living organism that first gets rid of something, then once again takes on something." The latter may already be the case during the next few weeks. [passage omitted]

Hamburg University Plans Field Trial With Genetically Manipulated Potatoes

93MI0144 Bonn DIE WELT in German 14 Nov 92 p 9

[Text] The Institute of General Botany at Hamburg University has applied to the Federal Health Office for permission to carry out an open field trial with genetically manipulated potatoes. The scientists have already performed detailed laboratory and greenhouse tests on the genetically manipulated potatoes. Project leader Klaus Duering did not think the transgenic plants were likely to pose any hazards. The university's field trial will begin in the spring of 1993.

It plans to carry out a two-year trial for resistance to a bacterial pest, the pathogen of the potato diseases blackleg and blight, under natural weather conditions. According to the university, the project will be funded jointly by the Federal Ministry of Agriculture and the Association for the Promotion of Private German Plant Breeding.

To date, there have only been two such open fields trials, involving color-modified petunias, with transgenic

plants in the Federal Republic; these took place at the Max Planck Institute of Breeding Research in Cologne.

Hamburg University announced that the Institute of Genetic Research in Berlin also intends to cultivate two manipulated varieties of potato at Einbek (Lower Saxony).

A private plant breeder is reportedly planning to release virus-resistant sugar beet, both at the same place and in the Bavarian district of Deggendorf.

COMPUTERS

State of German Neuron Network Research Viewed

93WS0124A Frankfurt/Main FRANKFURTER
ALLGEMEINE in German 19 Nov 92 p N4

[Article by Klaus-Dieter Linsmeier: "Robots Learn From Toads; Complex Tasks Solved With Neuron Networks, "Parallel" Data Processing"]

[Text] Neural computer scientists' goal is to learn from nature. No mainframe computer is yet capable of simulating the complicated flight movements of a housefly. Neuron networks, with which they are trying to reproduce the way synapses function in organisms, have been increasingly attracting attention for about 10 years now. In Germany research is being conducted in 11 integrated Ministry for Research and Technology (BMFT) projects, among others, on neuron networks and their applications. It became clear at an initial status seminar at the end of October that neuron networks are still far from having arrived at the stage of development of a horsefly, to say nothing of being capable of understanding how human beings think. But they are often superior to the classical processes of data processing. Industry was unanimously asked to display more courage in applying them.

With the neuron networks computer science has finally entered the field of parallel data processing. The superiority of biological systems over a computer in controlling the processing of images lies in this parallelism. Information processing units are in part organized into larger units that are linked with one another in various ways. In a neuron network the processors are arranged in layers and are linked with one another within each layer as well as throughout the entire network. The processed information is passed on from neuron to neuron and from layer to layer, but it is also fed back again in various ways. There is a bit of learning capability inherent in this processing: Parameters can be changed so that, after a training phase, a neuron network is capable of selecting patterns out of different data records, classifying data, or compensating for deviations in, for example, position adjustments.

The Way Insects Crawl

Different approaches are apparent in the research activities of the integrated projects. For one thing, biologists are trying to find clues to nature's learning mechanisms through behavioral research and physiological measurements in order to transfer them to the artificial networks. For another, mathematicians are integrating the networks into theories in order to better understand and make optimal use of them. Further approaches are the development of appropriate software and hardware as well as applied research, through which they try to find the optimal network for a given task.

A good example of the kind of research being conducted by biologists is the walking machine. Not long ago a "robot beetle" caused a sensation at the Massachusetts Institute of Technology. There, too, control was exercised with neuron networks, but they did not have enough understanding of the cybernetics of these movements. Scientists at the University of Bielefeld first made extensive observations of the stick insect to determine how to control one of the legs and coordinate all six of them. How does one leg react to obstacles, changes in level height? What do the remaining five do? These rules are transferred to neuron networks. Initially, there is a mechanical leg that can not only support itself, but also helps to stabilize the entire "organism."

Copying Nature

The learning phase does not always lead to an optimally structured network. The often-employed, so-called back propagation learning method, in which an error between the desired and actual results corrects the parameters of all the neurons, is equivalent to trying to reach the lowest valley in hilly country. The algorithm does not always attain this goal and the search ends prematurely.

But optimization strategies were presented at the seminar that are still more to be viewed as starting points than anything else. The firm, Expert Systems, has come up with a pragmatic approach. Instead of mapping networks on mathematical space and looking for the optimal network there, the scientists represent them through mathematical functions. The functional space is smaller, the search is narrowed down, and is therefore faster. Another big advantage: Like any other function, the mathematical description can be studied in terms of its behavior. With neuron networks this is hardly possible in any other way. Participants in the seminar demanded the development of methods that would enable them to observe the behavior of the networks during operation. Industry customers' mistrust is connected with the question as to how reliability can be guaranteed if the internal processes in the network remain hidden. Software to make them visible could provide a solution: Integrated processes are in the nature of things and they cannot be linearly represented and analyzed, but humans can visually grasp even complex processes.

The University of Stuttgart offers the transfer of networks to a "massive parallel" computer system, MasPar, with 16,000 processors. Their experiences so far show that this way of portraying processes requires quite a large expenditure for planning. If the neurons and the actual processor are poorly coordinated, it can happen that unnecessarily long communication paths are produced and computing time is prolonged.

The goal of one application of neuron networks to automation technology is to teach a robot to recognize different objects on a conveyor belt, grasp, and assemble them. The toad, for example, provides the biological model for the image processing. It only recognizes a linear object as a worm if the object is moving lengthwise. Widthwise movements produce no reaction from the animal. Behavioral studies and physiological measurements convey the nervous system processes involved in processing. This is how the biologists at Kassel Polytechnic discovered the learning mechanism and transferred it to a neuron network. Controlled by it, an industrial robot only takes objects from the conveyor belt if its image-processing system triggers the appropriate "feeding reaction."

Hesitant Industry

Neuron networks seem to be predestined to control industrial robots. Most of the projects supported by the BMFT deal with this subject. Even in the field of speech processing they have set themselves the goal of making it acoustically clear to a robot what they want of it. Behind all this is the ministry's effort to convert [the results of] state-supported science to practical applications as quickly as possible. However, as could be heard at the conference of industry representatives, with this too the difficult economic situation is making industry shy away from investments as long as their usefulness cannot be clearly verified. On the other hand, projects that combine expert systems with neuron networks serve this goal. They are expected to make the behavior of these networks clearer and therefore more reliable as well.

DEFENSE R&D

Germany: Price-Competitive Version of Eurofighter Planned

Costs Drastically Reduced

93MI0109A Bonn DIE WELT in German 3 Nov 92 p 2

[Article by Ruediger Moniac: "EFA-90 Back on the Test Bench—Cost-Saving Version Will Be 30 Percent Cheaper"]

[Text] A few weeks ago, on 21 September, Volker Ruehe again confirmed his position on the EFA [European Fighter Aircraft]-90 quite clearly before the Bundestag Defense Committee. Firstly, he said, "we need a different aircraft for a different age," adding, "we want a

European solution using as many of the previous technological developments as possible."

This solution has been on the table for only a few days—since 16 October to be exact. The proposal for an aircraft other than the EFA-90, which Ruehe has been describing as "dead" for some months now, comes from the industrial consortium of the four countries participating in the development of the aircraft. In addition to Germany, these are Great Britain, Italy, and Spain. They belong to the "Eurofighter" (aircraft development) and "Eurojet" (engine turbine development) consortia. For three months they have been examining the question of what a modified European fighter aircraft, cheaper than the previous development yet with a performance level acceptable to the four air forces, might look like.

The proposal from industry is based on the airframe that was designed for the EFA-90, and the EJ-200 engine developed for it at the same time. The industry calculates that it will be possible to produce this basic model of a New European Fighter Aircraft (NEFA) for about 30 percent less than the original design for the EFA.

Minister Ruehe's advisers are not yet sure whether he will accept this proposal. A meeting to discuss this matter will be held with those immediately concerned when he arrives back in Bonn today from his trip to Ankara. In April 1992, the cost of the original EFA design was put at 111.5 million German marks [DM] (excluding VAT). The industry expects the EFA-90 design to cost DM97.9 million, while the NEFA, the modified version, will cost DM90.2 million.

Changes in Defense Strategy

92MI0109B Bonn DIE WELT in German 3 Nov 92 p 2

[Article by Cay Graf Brockdorff: "The Strategy: Air Superiority"]

[Text] A modern fighter aircraft must be a match for the enemy in air combat. If it is not, it may quickly be shot down. The quality of the fighter aircraft means that the country that purchases it gives a well-trained pilot a chance of surviving an air battle. The pilot's task is to defend his own air space and prevent the enemy from gaining air superiority.

Air superiority is a prerequisite for the operational capability of a country's land forces. If it is acquired by the enemy, the land forces are doomed. Consequently, the question of whether to acquire a new fighter is a matter of life and death for the entire German armed forces, not just ambition on the part of one of the forces to be in possession of a piece of prestige hardware.

The welcome reduction in the risk of war reflects the change in the political situation following the end of the Cold War. Nevertheless, public opinion is overwhelmingly in favor of retaining the German armed forces. Accordingly, the quality of a new fighter is crucial to its combat capability. Never before has it been suggested

that cheaper tanks with weaker armor and smaller guns should be built because of political change.

Ultramodern fighter aircraft are being produced all over the world. Even Taiwan is producing and testing its own new fighter aircraft with digital control. In September, a further development of the most powerful Soviet fighter aircraft, the SU-27 (NATO name "Flanker") was presented at the British air show. The new plane is known as the SU-35 ("Super-flanker") and is currently superior to all other fighter aircraft. Russia is pursuing an aggressive export policy for conventional arms.

The procurement costs in the partner states of Italy, Spain, and Great Britain are 14-percent lower than in Germany. In Germany, the Ministry of Defense is allowing for the value added tax collected by the Ministry of Finance.

The EFA-90 Consortium

Country	Company	Share
Germany	Daimler Benz AG	33%
Great Britain	British Aerospace plc	33%
Spain	Construcciones Aeronauticas SA	13%
Italy	Aeritalia	21%

EFA Technology Assessed

92MI0109C Bonn DIE WELT in German 3 Nov 92 p 2

[Article by Lothar Ruehl: "The Technology: Cruising Height Reached in 90 Seconds"]

[Text] The military requirements to be met by the European fighter aircraft (EFA) in order to repel "foreseeable" air threats to the NATO area in Europe can be deduced from the capabilities of the most advanced ex-Soviet MIG-29 fighter aircraft, the newly developed MIG-31, and the SU-27 heavy fighter bomber.

The specification drawn by the four NATO partners involved required that the EFA have the operational capability to lock onto and engage several flying targets beyond the sensible horizon and low-flying aerial targets, both from above and in flight configurations exceeding the normal, still stable configuration of an aircraft in the crash risk range.

The latest ex-Soviet fighter aircraft of the types mentioned are capable of operating with such an inherently unstable configuration. The EFA would have to be sufficiently maneuverable in this borderline flight configuration to survive an air battle. Moreover, the ability to engage flying targets beyond the range of visibility was and is provided by means of radar-controlled active all-weather guided short-range missiles, and, at close range, the aircraft's guns.

The radar range for detecting targets was previously to have been designed for up to 100 kilometers, depending

on altitude. Moreover, the fighter's silhouette had to have the smallest possible radar reflection surface so as to offer the enemy only a small target. After the Warsaw Pact broke up the military threat receded, the Luftwaffe did not reduce the operational requirements that it made of the EFA-90, but reduced its numerical requirement from 250 to 140 aircraft, taking advantage of the extended warning time that made this possible without jeopardizing air defense.

The Allies are abiding by the assumption generally held within NATO that, even though the USSR is no more, Russian MIG and SU fighter aircraft could threaten European NATO air space, particularly because Russia is exporting them all over the world and other countries are expressing interest in acquiring such aircraft, in the Middle East, for example, and the Mediterranean area.

Franco-German Project To Develop Military Reconnaissance Drone

93MI0147 Bonn DIE WELT in German 19 Nov 92 p 9

[Text] Germany and France have decided to develop together a high-tech drone capable of operating over enemy territory as an unmanned reconnaissance aircraft for up to three hours. The system is to be developed by the French Matra group and the German firm Systemtech Nord GmbH, at an estimated cost of over 400 million German marks [DM]. The drone will weigh 150 kilograms, will be driven by a rear propeller, and will have a wingspan of 3.4 meters; its range will be in the region of 150 kilometers. A sensitive infrared camera will be mounted on the nose, transmitting images directly to the control center via a radio link, which will have a special electronic system to prevent jamming.

EFA Partners Considering Cheaper Version

93WS0148B Paris AFP SCIENCES in French 19 Nov 92 p 19

[Unsigned article: "EFA To Be Replaced By Less Expensive Airplane"]

[Text] Bonn—On 15 November, the German defense minister, Volker Ruhe, announced that in December, the chiefs-of-staff of the four countries involved in the European Fighter Airplane (EFA) will present a design for a plane that is less expensive and better adapted to geostrategic demands.

In an interview with the daily BILD ZEITUNG, Mr. Ruhe explained that "the question (is to know) how we can reorient EFA development toward a new fighter plane for a new era." Given the high security level (which currently prevails in Europe), the plane's military requirements must be reduced. The Italian, Spanish, British, and German chiefs-of-staff are now working on it, and they intend to present their report in December. "People have other worries than to knock their brains

out over a fighter plane," pointed out Mr. Ruhe, who for a long time has urged that the EFA program be dropped as too costly.

According to the Ministry of Defense spokesman, the four countries agree that "it will not be possible to give an exact direction to the development of a new fighter plane until after the chiefs-of-staff report."

Until now, Great Britain has always argued against Germany's advice, that the program be continued. At the end of September, Germany had begun to withdraw from the program after first announcing that it would not participate in its production. On 15 October, Spain announced that it had decided to spread its investments in the program for financial, strategic, and political reasons. Lastly, Italy indicated on 19 October that it wanted to pursue the project as a foursome, under condition that the costs would be lowered.

EFA's cost is estimated by some experts to be as high as 200 million German marks [DM]. According to DASA's (Deutsche Aerospace) president, Jurgen Schrempp, who is directly involved in the program, a new plane should not cost more than DM90 million.

Rafale Two-Seater Prototype Ready for Testing

93WS0162D Paris AFP SCIENCES in French 26 Nov 92 p 16

[Unattributed article: "Rafale Two-Seater Prototype Ready for Its First Tests"]

[Text] Paris—The prototype two-seater Rafale, the B01, has arrived at Istres (Bouches-du-Rhone) where it will undergo its first tests, Dassault Aviation announced on 20 November.

After being reassembled at the Istres flight test center, the B01 will be submitted to a series of tests (fuel, vibrations, systems), after which "power tests and taxi tests" will precede its first flight, scheduled for the spring of 1993. The two-seater Rafale will then take part in the program tests, together with the three single-seaters already completed, the Rafale A demonstration unit, the C01 prototype designed for the air force, and the M01 prototype designed for the navy, pending completion of the second marine Rafale, the M02 which will fly around mid-1993.

The first order for a series Rafale, to be placed in 1993 by the Ministry of Defense, will cover two marine-version and two air-version units, Dassault Aviation indicated. Manufacturers participating in the Rafale program finance 25 percent of the development (which includes construction of the prototypes) and of the program industrialization (series manufacturing). Development and industrialization costs are estimated to add up to 50 billion French francs [Fr].

Around the year 2000, the air force is expected to acquire 235 Rafale (95 single-seaters and 140 two-seaters) and

the navy 86 single-seaters. In 1991, the total cost of the Rafale program was officially estimated at Fr155 billion (Fr250 million per unit) for a series of 350 units, air and marine versions together.

ENERGY, ENVIRONMENT

Cold, Hot Industrial Waste Disposal Methods

93WS0117D Paris L'USINE NOUVELLE in French
5 Nov 92 pp 80, 81

[Article by Jean-Michel Meyer: "Vitrification Becomes More Widely Used for Toxic Industrial Waste"; first paragraph is L'USINE NOUVELLE introduction]

[Text] Two processes are vying with one another in the field of toxic waste treatment: a cold method using binders, and a hot process, or true vitrification. Nearly a million tons of waste will have to be treated by one method or another over the next three to five years.

In his day Lavoisier declared that "Nothing is lost and nothing is created, everything is transformed." Two centuries later, the father of modern chemistry's precept is a great inspiration to manufacturers responsible for treating toxic waste. To stem the tide of waste that will have saturated Class I dumping grounds five years from now, the law of 30 June 1992 stipulates that only final, non-recyclable waste products will be able to be stored there by century's end. Moreover, to avoid contaminating the groundsoil, a ministerial decree that will be issued within the next few weeks will require that final waste products be neutralized using stabilization-solidification processes before being stored.

"The application of these new regulations means that 600,000 to 700,000 metric tons of waste, plus about 250,000 tons of residues from the purification of household-garbage incinerator smoke, will have to be stabilized over the next three to five years," says Patrice Philippe, a specialist in industrial waste treatment at ADEME [Environmental and Energy Control Agency].

Two techniques are facing off in the nascent market of toxic waste treatment. The giants of the environmental industry, Lyon Water and the General Water Company, defend the cold method. The process consists of using binders (cements) that contain specific additives such as quickening or retarding agents or admixtures; these react with water to capture the liquid, mudlike, or pulverulent waste through malaxation. The method petrifies the waste into solid, compact blocks. But, stresses Patrice Philippe, "binders do not truly stabilize the waste." And this raises the problem of toxic substances redispersing themselves over time.

Nonetheless, Solicendre, a subsidiary of Sarp Industries (CGE group) started up a stabilization-solidification plant in Calvados this year with a capacity to treat 5 metric tons/hour. The facility treats purification residues from the smoke of household garbage incinerators

(SPR). In 1993, Sarp Industries is going to build a plant to treat liquid and mudlike industrial waste mixed with SPR in Yvelines. It will have a capacity of 50 metric tons/hour. "In three years," explains Jean-Louis Biros, a technical director at Sarp Industries, "there will be 10 centers in France."

France Dechets, backed by Inertec, another subsidiary of Sita (Lyon Water-Dumez group), has also applied to operate a crushing/malaxation module capable of deactivating 20,000 metric tons/hour of waste in Meurthe-et-Moselle. As soon as the decree is published, France Dechets will file similar requests to equip its six other burial sites.

Deactivation in the Lead

For the time being, cold deactivation has pulled ahead of the second process, which is vitrification. Vitrification involves bringing the product to a very high temperature, between 1,200 and 1,700°C, until it reaches its melting point. Electricity of France (EDF) uses it to treat floating ash at its Renaudieres research center. But vitrification is still reserved primarily for products of fission, that is, long-lived radioactive waste produced by the retreatment of nuclear fuel.

Radioactive waste is converted by calcination into a mixture of powdered oxides, and placed in a melting furnace, which is a metal pot that does not allow the melting temperature to exceed 1,150°C. Glass frit is added to the furnace. The borosilicated glass that is produced is poured into stainless steel containers and stored. Cogema has three vitrification facilities with a capacity of 1,600 metric tons/year. The latest one cost Fr2 billion and has been active since July. This technique, stresses Jacques Couture, director and adviser to Cogema's president, "can reduce 10 years' worth of French radioactive waste to a quantity that would fit into an Olympic-sized swimming pool."

Cogema is counting on its subsidiary SGN (General New Techniques Company) to handle the technological transfer to treatment of more common types of waste. But problems remain. "We still run into snags for waste that is highly saline-soluble and has high concentrations of heavy metals," says Patrice Philippe of ADEME. There is also a cost problem. Nevertheless, announces Sylvain Fournier, SGN's assistant director of communications, "the first contracts will be signed within the next few months."

Trepaud company, which specializes in high-temperature techniques, claims to have solved these problems with an electroburner it is operating under license to EDF. The device is a classic natural-gas burner that heats up to 1,500°C. Two water-cooled electrodes electrically boost the flame's temperature to as high as 2,700°C. The melted residues of household or industrial waste are then steeped in water, which transforms them into glass balls. "The process requires a very high temperature," says Vincent Paolozzi, director general. "For melting is partial up to 1,200°C. There is no vitrification

and the heavy metals are not trapped." The first electroburner will be built in Spain. Trepaud has teamed up with the Spanish firm Gamessa, a subsidiary of a Spanish power company, to construct a 3,000 ton/year vitrification factory in Castille in two years.

Taking a cue from glass techniques, as Cogema did with its process, the Corning group is kicking off a project to trap incinerator ash from the burning of household garbage in a glass composition. The ash will be trapped in such a way as to fix the heavy metals. "We get a single-phase glass that is chemically resistant over time," comments Jean-Paul Netter, the company's technical manager for France.

The Last Technique: Plasma Torches

Stein Industrie has just announced plans to develop a semi-industrial pilot plant with a melting capacity of 100 kilos/hour at Lys-lez-Lannoy, near Roubaix. The plant will vitrify the incineration residues of hospital, industrial, or household waste. The process developed by the GEC-Alsthom subsidiary consists of melting the residues in a furnace heated to over 1,300°C. The magma is abruptly plunged into water at room temperature, and the heat shock transforms the lava into glass balls. "The method produces a vitreous structure that cannot be dissolved in water," claims Jean-Pierre Peyrelongue, head of the company's nuclear and industry department.

The final technique involves plasma torches. The waste is vitrified by the high temperature—over 1,500°C—of an electric arc and the addition of additives. For now, cost constraints limit the use of plasma deactivation to the highly toxic waste of the chemical industry. Those involved in both hot and cold deactivation are working toward the same end. "We are trying to fabricate a synthetic rock," observes Michel Botrel, of France Dechets. "In 50 years, storage sites will hold deposits of materials comparable to raw materials, which we will have to find a way to use." So as not to make a liar out of Lavoisier.

Deutsche Aerospace, Danish Firms To Develop Molten-Carbonate Fuel Cells

93MI0143 Bonn DIE WELT in German 12 Nov 92 p 9

[Text] A new energy technology will help reduce carbon dioxide emissions in the future: Molten-carbonate fuel cells are capable of converting energy from combustible gases (natural gas or biogas, refinery gas or coal gas) directly and efficiently into power and heat without involving combustion; the process is also quiet and non-polluting. They are therefore superior to conventional combined power and heat generation technology. The American Company Energy Research has already done major basic development work on this technology. Deutsche Aerospace (DASA), RWE [Rhine-Westphalian Electricity Works], Ruhr Gas, and the Danish companies Elkraft and Haldor Topose have now set up a consortium to develop molten-carbonate fuel cell technology to market readiness. It could then be used, primarily in

block-type thermal power stations or solely to generate electricity in power stations.

The project is being funded by the EC Commission, the Federal Ministry of Research and Technology, and by Danish institutions. It will cost about 130 million German marks and will run until 1999. Three pilot plants with an output of 100 kilowatts each will come on stream by 1996. They will run on natural gas and coal gas.

EUREKA Programs To Stress Waste Processing Technology Research

93WS0144A Paris INDUSTRIES ET TECHNIQUES in French 6 Nov 92 p 76

[Article by A. L.: "A New EUREKA Programs Priority 110 Million ECUs for Waste-Processing Research"]

[Text] EUREKA will impart a decisive boost to waste processing research, still in its infancy. Industrialists and researchers must coordinate their efforts. Public-sector research still suffers from a lack of money. In a nutshell:

- Integrated Technologies alone, one of the nine approved waste-processing research programs under EUREKA, represents an expenditure of ECU70 million over a period of four years, almost half of which is to be coordinated by Generale des Eaux [General Waters Company].
- RECORD [Waste Research Cooperative Network], an association of 12 industrial enterprises concerned with the waste problem, is cooperating with public-sector laboratories on predevelopmental research programs.

Since 1985, the EUREKA program has emerged as one of Europe's main precompetitive-research tools. Today, its environmental portfolio is the one showing the strongest growth. It is comprised of 117 projects totaling ECU881 million (5.4 billion French francs [Fr]).

To date, a large part has been devoted to water treatment and the recycling of materials in the automotive industry, as for example, the Step 2000, Membrane, and Recap programs. Among the research topics launched during the last ministerial conference, waste-product and household-garbage processing occupied first place. Of the nine most recently approved waste-processing projects, totaling ECU110 million, the INTEC [Integrated Technologies] project alone calls for an expenditure of ECU70 million (Fr450 million) over a period of four years. It is without a doubt the largest-scale research program ever undertaken on the overall management of waste, and includes topics such as: collection, pre-recycling, and enhancement of value; thermal processing and enhancement of value; solidification, stabilization, and storage of waste products; waste products released from water purification plants. INTEC brings together 15 partners, including Solvay for the treatment of fumes, and the German firm Bezner for sorting techniques. Slightly less than half of the budget is allocated to the Generale des Eaux [French Water Company]

group. Generale des Eaux coordinates INTEC's research teams around a GIE [economic interest group]: the CREED [Research and Testing Center for the Environment and Waste Processing], directed by Georges Valentis.

Public-sector laboratories in France still lack the means to enable them to take maximum possible advantage of the EUREKA gold mine. Research on waste processing is represented mainly by three laboratories: Nancy's IRH [Hydrologic Research Institute], the Ales School of Mining Engineering's Center for Industrial Environment, and Insa-Lyon's LCPAE [Laboratory of Applied Physical Chemistry and Environment] whose director is Alain Navarro. The CNRS [National Center for Scientific Research], for its part, through an Environmental Program, has been trying to coordinate the numerous teams working to a greater or lesser extent on water, air and waste problems.

At Ales, Professor Christian Roulph's team consists of 40 persons, including the equivalent of 20 full-time researchers. The team works on the nature and treatment of industrial effluents, that is, of everything discharged by a factory—water, air, waste products—into the environment. "We have become specialized in the identification of a species in a sample," says Christian Roulph. "Our methods enable us, for example, to differentiate between hexavalent chromium, the most toxic, and trivalent chromium." The Ales Center also manages Geode, the small group of researchers in France engaged in odors research. In the field of waste-water treatment, Christian Roulph believes in the future of biopolymers for the fixation of metallic ions. The Center for Industrial Environment receives approximately Fr2 million yearly in the form of contracts with industry and public-sector agencies.

The LCPAE, with a staff of 85 persons, devotes the entirety of its work to industrial and urban waste. Its Polden (Pollution, Waste, and Environment) Division is linked administratively to Insavalor SA, a company for developing the applicability of the research done by INSA's [National Institute of Applied Sciences] 42 laboratories. Through this link, the team can conclude contracts with outside entities, such as ADEME [Agency for Environment and Energy Control], regional and local communities, international agencies, waste-producing industries, and environment-benign industries. With about 12 people dedicated exclusively to outside contracts, Polden has an annual revenue of Fr4.5 million in four major niches: waste characterization and behavior, solidification and pre-treatment of waste, expertise in the evaluation of contaminated sites and feasibility of their rehabilitation, and organization of waste-management. Work is proceeding under several contracts with the RECORD [Waste Research Cooperative Network] association.

[Box 1, p 76]:

Waste Research Cooperative Network

Cooperation between industries and laboratories is organized around an original structure—the RECORD network—comprising approximately 12 industries. RECORD is energized, with verve, by Professor Alain Navarro, one of the research sector's most likable figures. Its president, Darius Francois, is a former head of Ciments Lafarge, which is a member of RECORD together with the other cement industries (Ciments Francais, Ciments d'Obourg), and with Elf-Aquitaine, Solvay, Rhone-Poulenc, the Lyonnaise Company, Generale des Eaux, Tredi-EMC Services, Edf-Gdf [French Electric Power Company-French Gas Company] and the engineering firm SOCOTEC [Construction Inspection Company]. Together, they are conducting joint research that ends as such with the predevelopment stage. Since 1989, 15 contracts have been set in motion involving research on combustion, solidification, odors, etc. RECORD is twinned with an American center of the same kind—New Jersey's Hazardous Substance Management Research Center—and shares projects and researchers with it.

Box 2, p 76]:

Whom To Apply To

- RECORD (Reseau cooperatif de recherche sur les dechets [Waste Research Cooperative Network]), Professor Alain Navarro. Telephone: 72 43 81 88
- Programme Environnement (CNRS), Professor Alain Ruellan. Telephone: 67 61 33 02
- Centre de l'environnement industriel [Industrial Environment Center] (Ecole des Mines d'Ales [Ales School of Mining Engineering]), Christian Roulph, director. Telephone: 66 78 53 72
- CREED (Centre de recherche et d'essais pour l'environnement et le dechet [Research and Testing Center for the Environment and Waste Processing]), Georges Valentis, director. Telephone: (1) 30 92 98 98
- IRH (Institut de recherches hydrologiques [Hydrologic Research Institute]), Francois Colin, science director. Tel: 83 50 36 00
- Polden Insavalor, Jacques Mehu, Yves Perrodin. Telephone: 72 43 83 86

France: INRIA's Positive Impact on Industry Reviewed

93WS0144B Paris INDUSTRIES ET TECHNIQUES
in French 6 Nov 92 p 92

[Article by Thierry Mahe: "INRIA's Chicks - Industrial Dispersal of a Research Agency"; paragraphing varies from source text]

[Text] *The National Institute for Research on Data Processing and Automation [INRIA] is a good brooder, as attested to by some 20 enterprises, totaling 700 persons and 400 million French francs [Fr] in annual revenue.*

INRIA [National Institute for Research on Data Processing and Automation] celebrates its 25th anniversary in December. Praised to the skies by Minister of Research and Space Hubert Curien, INRIA is benefiting from its very strong growth in number of researchers: a 33 percent increase from 1989 to 1992. This increase has been warranted on two counts: its branching out (regional sub-branches and international cooperation), and the teaming up of the research sector with industry. With three centers outside of the Paris region (Sophia-Antipolis, Rennes, Nancy), and agreements with regional laboratories (Grenoble's IMAG [Institute for Applied Mathematics] and Toulouse's LAAS [Laboratory for Automation and Systems Analysis]), INRIA succeeded in delocalizing its operation early on. Internationally, it has also done rather well: Over 900 missions carried out by French researchers in some 30 countries, and a sound policy of alliances with the United States (National Science Foundation), Japan (ICOT), and Russia. INRIA also participates, together with seven other agencies, in what is to become the main European center of research in computerized information processing—the ERCIM [European Research Consortium for Informatics and Mathematics].

Extensive Regionalization of Research

With a 1992 research budget of Fr470 million, 20 percent of which consists of its own funds, INRIA employs 1,300 persons, of whom 300 are researchers, and 350 are college graduates-in-training. INRIA's research teams are divided up among four sites: Rocquencourt, Sophia-Antipolis, Lorraine region, and Rennes. These centers concentrate their activities equally around six main topics of research:

- Parallel architectures, data bases, networks, and systems.
- Symbolic computing, programming, and software engineering.
- Artificial intelligence and man-machine interfacing.
- Robotics, image, and vision.
- Signal processing, automation, and production engineering.
- Scientific computing, modeling, and digital software.

INRIA is authorized to acquire stakes in the capital of private firms, and it is by no means holding back in this respect! It owns majority stakes in four subsidiaries, as well as a stake in the Gipsi company. All of the following PME's [Small and Medium-Sized Businesses] were created by "renegades" from INRIA, and are marketing, among others, products under INRIA license. Of 50 INRIA licenses active in 1991, over half were granted to these firms.

Name and date of creation	Revenue*	Employees in 1991	Activity
INRIA Subsidiaries			
Simulog 1984	35	65	Simulation, modeling, optimizing of systems
Ilog 1987	44	74	Artificial intelligence and software engineering
O2 Technology 1990	10.5	29	Object-oriented data base system
Connexite 1992	3	5	Software engineering and structured computing
"INRIA Start-ups"			
Aleph Technologies 1989	12	28	Robotic cells, mobile robots
Chorus Systemes 1986	35	65	Chorus operating system, UNIX-compatible
Cose 1990	2	3	Electronic imaging
Ergomatic Consultants 1990	6	15	Ergonomics of man-machine interfaces
Euroclid 1989	2	3	Hypertext and multimedia systems
Finaki 1989	2.1	4	Unix and data-base advice and studies
Gipsi SA - Visual 1988	52	45	Design of X-Window terminals
Grif SA 199	18	15	Technical documentation (CALs, SGML)
Infosys 1986	13	28	Expert systems, relational data bases
Istar 1988	9.5	15	3D Digital cartography
Lorin 1989	18	18	Real-time computers

Name and date of creation	Revenue*	Employees in 1991	Activity
Noesis 1985	22	22	Computer vision and image processing
Robosoft 1985	10	14	Mobile robotics
Timeat 1989	1.7	4	Industrial vision
Verilog 1984	102	255	Software engineering workshops

* In millions of francs

INRIA's policy of industrial dispersal, which gathered momentum during the mid-1980s, is nothing less than remarkable. Every avenue of research identified by INRIA is swept up by at least one of these INRIA start-ups. Alain Bensoussan, president of INRIA, confirms this: "With INSERM [National Institute of Health and Medical Research] for medical research, INRIA is the agency that has done the most for the creation of industrial structures. These structures are ruled by two precepts: Cultivate a strong research potential and... become a leader in your domain." These "INRIA chicks" are leading contenders in the race for European programs, and they perform as virtuosos in the art of technology transfers. In the typical scenario, a project leader, anxious to have the results of his research developed for their industrial potential, picks up the ball and runs with it. This is how the Chorus company was founded, based on the Chorus-Mix operating system that was spawned by INRIA's Sol project. Thus also did the Connexite company emerge from the ESPRIT Gipe software engineering project, and Euroclid from the Chloe language and translation project.... A happy fact: Many of these "emergents" have struck it rich! This has been the case with Chorus, with Verilog, a European star performer in software engineering, and with Ilog in knowledge-based systems. Disgruntled critics may object that these companies confine themselves to the high-technology end of the spectrum, without regard for what constitutes the main body of the market: word processors, spreadsheets, data bases.... Alain Bensoussan retorts: "True, all the top-flight publishers of office automation software are American, and Europe has completely missed the boat on relational data bases. But in founding O2 Technology, we have set our sights on the next generation: object-oriented data bases."

France: CEA To Open Nuclear Waste R&D Center

93WS0163C Paris AFP SCIENCES in French
26 Nov 92 pp 25, 26

[Article entitled: "The CEA's Atalante Installation in Marcoule Receives Authorization for Gradual Startup"]

[Text] Paris—The CEA (Atomic Energy Commission) announced on 20 November that the Ministry of Industry's Nuclear Installation Safety Directorate (DSIN) had just authorized its Atalante plant to begin operation in stages. Atalante, which is located in Marcoule (Gard), houses all of the CEA's research and development resources on highly radioactive waste and advanced retreatment processes.

The Atalante facility aims to reduce both the volume and activity of radioactive waste through a whole series of chemical treatments. It will study, up to the industrial stage, the best way to burn nuclear waste—if possible in future reactors such as supergenerators.

The two ministries concerned, Environment and Industry, gave their go-ahead on 18 November. "Initially, however," says the communique, "only three laboratories and their associated premises have been authorized for active service. Operation of the other parts of the facility, which will begin during later phases, remains subject to the approval of the DSIN's management, and will coincide with the transfer of activities now being carried out in the CEA's Nuclear Studies Center at Fontenay-aux-Roses (Hauts-de-Seine)."

Atalante cost 900 million French francs [Fr] and consists of five buildings totaling 16,000 square meters. The facility is divided into three levels. The Alpha shop and the Laboratory for Transuranium Analyses and Retreatment Studies house 14 laboratories that will be working at the cutting edge of advanced retreatment, a technique at which France excels. The Atalante facility is also interested in the treatment of radioactive waste and the extraction of actinides, that is, the most dangerous nuclear waste.

In addition, the CEA will conduct studies there on plutonium, the chemistry of high activity, production of transuraniums, the fabrication of radiation sources, management of effluents and radioactive waste, and confinement of highly active waste.

Atalante has over 60 single or double-sided glove boxes, nine armour-plated lines with 60 work stations, and 47 units with remote handling equipment for its work on the development and use of processes. To insure researcher and environmental safety, the facility alone required over 3,000 metric tons of metal or concrete biological shielding and the installation of 150 continuous radioprotection gauges. Its ultra-advanced ventilation system can extract 180,000 cubic meters of air through a system of 23 km of galvanized- or stainless-steel conduits that end in a chimney 42 meters high.

The CEA spent Fr15 million on radioactive waste research in 1991. That is much less than the Japanese, who have invested Fr55 million in it through their Omega program, which was kicked off in 1988. According to the CEA, Japan plans to spend Fr10 billion over 20 years.

FACTORY AUTOMATION, ROBOTICS

France: AFNOR Evaluates Statistical Quality Control Methods

93WS0143A Paris INDUSTRIES ET TECHNIQUES
in French 6 Nov 92 p 23

[Article by Yves Ciantar: "Statistical Quality Control, a Misunderstood Tool"]

[Text] Its installation can sometimes take as long as two years, but the method can reduce a production line's rate of quality rejection by as much as 25 percent.

In 1989, it was the subject of much talk in France: A handful of French industrial groups were making their first use of statistical quality control [SQC], a method of improving production units that was introduced by Ford in its plants around the beginning of the 1980s. Three years after the start of these experiments, a symposium held by AFNOR [French Standardization Association] has evaluated the results.

Telemecanique installed SQC in 1989. "Our intent," says Gerard Delautre, an engineer at GEM—Editor's note: Work Methods Development Group, a Telemecanique in-house unit—"was to improve the quality of a complex thermoplastic piece that was to be integrated into one of our automaton product lines." From 1989 to 1992, the SQC procedure (see Box 1 at end of article) was followed to the letter. The machine parameters to be closely monitored were identified, and control charts put in place. The results speak for themselves: During the final phase of the procedure, from February to September 1992, the quality rejection rate dropped from 4 percent to 0.5 percent. Finer adjustment of the plastic injection machines has resulted in less frequent cleaning of the molds. Increased homogeneity of sizes of the pieces facilitates the work of the parts-handling robots that unload the machines. These improvements stemmed from the installation of the SQC "technical" tools. Installation of the log book and adherence to the same adjustment instructions by all watches produced finer adjustment of the injectors. Installation of the machine control charts resulted in increased homogeneity of the pieces.

In Gerard Delautre's view, the interest in SQC lies also in the change it has brought about in the organization of the workshop. "One day," he recalls, "we noticed that one of the control charts had not been filled out in real time." This almost anecdotal detail revealed that the operator was spending her time carrying cartons, because too many workers were on vacation and in training at the same time. The fault was corrected by reorganizing the shop. "Now," says Gerard Delautre, "the operator works solely at her machine, and a laborer has been assigned to the handling of all the pallets."

SQC is not the exclusive preserve of the big industrial groups. A PMI [Small and Medium-Sized Industry] like Vignal Artru (135 employees, and annual revenues of 77 million French francs [Fr]) can also apply it successfully.

As of 1989, it had been supplying IBM with cooling units for its mainframe computers. That year, IBM placed an order with Vignal for a new cooling unit that was difficult to produce. The precision of machining it demanded was far greater, and a new, complex surface treatment procedure had to be mastered. "To respond to this need," Vignal Artru's quality control engineer, Frederic Genthial, recalls, "we decided to use SQC." Use of this method reduced the rate of rejects from 20 percent in October 1990 to less than 5 percent in January 1992. "These results," says Frederic Genthial, "were the direct consequence of the use of the SQC tools: control charts, log book...." And what is more: Owing to the small size of the company, Vignal Artru's staff have also discovered that SQC must not be confined to the worker's station. "It is free-standing teamwork that embodies not only the factory hand but also the production engineer and the quality control engineer who must pilot the process," says Frederic Genthial.

[Box 1, p 23]:

SQC: Six Phases Over a Period of Two Years on Average

- Start-up (two months): All the indicators of the "quality" of the process in question, such as rejection rate, touch-up rate, and recalls under guarantee, are collected and analyzed; training begins.
- Analysis (two months): Causes of instability of the process are detected by means of FMEA [Failure Mode and Effect Analysis] and circles of quality.
- Stabilization (four months): Initial concrete corrective actions are applied to the process; a log book is introduced to track all actions.
- Aptitude (six months): All failures being related to parameters, a verification is made that the manufacturing process can be improved by acting on a limited number of these parameters.
- Placement under control (five months): Control charts are installed next to the machines, enabling the operators to take regular, periodic readings of the values of the parameters defined during the Aptitude phase.
- Improvement (five months): Parameters with long-term effects are identified; corrective actions are applied to these parameters.

(Source: Jacques Wenisch, Renault Industrial Vehicles)

[Box 2, p 23]:

For More Information:

The publication of the X 06-030 standard, encompassing the installation of SQC, provided the occasion for the holding of the AFNOR (French Standardization Association) symposium on which we have reported herein. For more information on this standard, the contact at AFNOR is Corinne Del Cerro (Tel: 42 91 55 55).

Bernard Murry (Tel: 76 41 88 88) is co-author of the book: "La MSP: demarche et outils" [SQC: Method and Tools] published by AFNOR Gestion. He is also the manager of XL Consultants, a group of SQC consultants.

France: Rapid Prototyping R&D Center Created
93WS0143B Paris *INDUSTRIES ET TECHNIQUES*
in French 6 Nov 92 p 41

[Article by Mirel Scherer: "A Rapid Prototyping Center for Lorraine - Equipped With an Original Stereolithographic Method"]

[Text] The Advanced School of Engineering Sciences and Technologies at Nancy [ESSTIN] is helping the PMIs [Small and Medium-Sized Industries] to design their products better.

Rapid prototyping techniques, which are very useful for speeding up the design and development of products, are now available to the industries in the Vosges region. The Advanced School of Engineering Sciences and Technologies at Nancy (ESSTIN) has created a Center of Engineering, of Research, and of CADAM and Rapid Prototyping Technology Transfer, at Saint-Die-des-Vosges (Meurthe-et-Moselle). The purpose of this Center is to provide technical assistance to the region's industries. ESSTIN has had the support of DATAR [Delegation for Territorial Development and Regional Action], ANVAR [National Agency for the Development and Commercialization of Research], the

Regional Directorate for Industry, Research, and the Environment, and the Lorraine Plastics Center.

"This simulation and new-product realization unit is accompanied by a projects cell whose primary objective is to reinforce cooperation between schools and industries through action in the field, especially as regards the PMIs," says Claude Barlier, head of the Esstin-Industrie program and of the new Center.

Technology-wise, the Center possesses an original rapid prototyping method, conceived and developed by ESSTIN's researchers. As is known, the maquette of a piece or a product in the design stage can be produced by stereolithography much more rapidly than by classical machining methods. Stereolithography makes use of the geometrical data supplied by a CAD software, and the piece is constructed section by section, by solidification of a resin under the action of a laser beam or of a heat source (ultraviolet lamp). ESSTIN has patented "stratoconception," a variant of this method. Its originality consists of breaking the prototype down, by computation, into elementary layers, then treating these layers as individualized pieces to be fabricated separately. The fabrication can then be effected by simple, rapid methods, such as laser or other cutting process, milling, machining, etc..., based throughout on the data provided by the CADAM system. The pieces then need only be stacked together to reconstruct the prototype.

Method/Criterion	5-Axis Machining	Stereolithography	Stratoconception
Types of pieces produced	Maquettes Molds Prototypes Solid-shaped mechanical pieces	Maquettes Molds	Maquettes Molds Prototypes Large-sized pieces Mechanical parts
Sizes of pieces	From 200 x 200 x 200 mm to 6000 x 2000 x 500 mm (machine-tool travel lengths)	800 x 1200 x 1980 mm (Quadrax)	Theoretically unlimited
Precision:			
Dimensional	0.01 mm	0.1 mm	0.05 and 0.1 mm on X and Y
Geometric	0.01 mm	unknown	0.05 mm
Surface state	Ra 0.8	Ra 2.5	Ra 2.5
Shape limitations	Homogenous solid-shaped pieces, limited by kinematics of the machine tool	Complex pieces	Complex pieces with closely-spaced recesses, inserts, reinforcements, and assemblages
Materials	Machinable materials	Acrylic resins, PVC, ABS, nylon, lost wax	All materials in sheet and foil forms (aluminum, paper, plastics...) or produced by founding
Time of completion of a medium piece	t (reference time)	8t	t/2
Installation cost	1 to 5 million francs	1 to 4 million francs	0.15 to 1 million francs
Principal advantages	Conventional means, machining of hard metals, new potentialities with high-speed machining	Production of pieces of complex shapes in resins. Production of pieces in wax for foundry	Quality/cost ratio, production of pieces of complex forms, possibilities of inserts. Adaptability of method to large-sized pieces
Principal drawbacks	5-axis programming. Volume of pieces limited by piece-handling systems	Limitations owing to resins. Need of a suitable environment (pollution)	Assembly of the parts involves a manual operation that has yet to be automated

Source: C. Barlier (ESSTIN)

LASERS, SENSORS, OPTICS

Market for Lasers in Materials Processing Viewed

93WS0114A Coburg MASCHINE & WERKZEUG
in German Oct 92 No. 22/23 pp 62-72

[Article by H. Behnisch: "Product Innovation with Laser Technology"]

[Excerpt] Today, there are CO₂ lasers with output powers of about 100 W to 25 kW. Because of this power, this thermal tool can do all metal-working tasks.

Statistical surveys such as that shown in Table 3 prove that Germany still has a privileged position in the production and use of laser systems in Europe.

Table 3. Shares of European countries, North America and Japan of world production and use of laser systems for material processing in 1989 (according to Prognos AG)

Countries/market region	Use	Production
Germany	9%	13%
Great Britain	4%	3%
France	4%	2%
Italy	4%	2%
Switzerland	2%	4%
Others, Western Europe	3%	1%
Western Europe	26%	25%
U.S.A. and Canada	31%	30%
Japan	43%	45%

Germany has a high production particularly for CO₂ lasers. German companies manufactured about 500 CO₂ laser sources valued at almost 110 million German marks [DM] in 1989. This corresponds to about 35 percent of the world production for lasers with power greater than 200 W. Of these lasers, 207 systems valued at DM44 million (> 40%) were exported. The most important purchasing countries are the industrial nations of Europe and the U.S. About 24 percent of the world market for CO₂ lasers is supplied to the German market. The statistics prove further that about a good half dozen machine makers are manufacturing laser systems of high quality and appropriate size. In 1989, Germany produced 213 CO₂ laser systems valued at almost DM200 million. Of these systems, 60 percent were exported, primarily to the industrial nations of

Europe. In past years, CO₂ laser technology experienced two-digit growth rates. This is also expected in the future.

According to Prognos AG of Switzerland, world sales of laser systems for material processing ran to almost DM2 billion in 1990. Actual laser oscillators made up about 25 percent of this amount. The German vendors—there are about six companies—were going strong. These companies have manufactured carbon dioxide and neodymium lasers—a total of 960 units—valued at about DM160 million. This is 29 percent more than the previous year. In terms of value, more than 43 percent of the lasers were exported. This increase of almost 50 percent over 1989 illustrates the dominant position, in terms of technology, in international competition that has been achieved in the meantime. Due to this, it can be said that the future will be highly dependent on increasing the acceptance of lasers for material processing in the domestic market. The greatest competitor on the world market is the Japanese industry. They manufacture laser sources valued at about DM290 million annually. This is followed by vendors from the United States at about DM130 million.

Growth of about 10 percent is to be expected for the coming year. The markets for laser systems are now found mainly in Japan, Europe and North America. Of these regions, Japanese industry is not only the largest manufacturer but also the chief user. European companies are in third and second place, respectively. Carbon-dioxide lasers made up about 58 percent of the world market in 1990. This was followed by solid-state lasers (mostly neodymium-YAG lasers) at about 40 percent. Thermal cutting is the chief application in material processing. Experts in the sector estimate that just the 25 Japanese manufacturers of cutting systems produce more than 4000 units annually. The industrial application of lasers is in a highly innovative area of a well developed manufacturing technology with a great degree of automation. This rapid continued development can only be maintained if government support remains and the industrial facilities can continue the constant research and development work.

Personnel qualification must and will go hand in hand with the rapid further development of laser technology. According to one estimate by users, it is to be expected that about 100,000 people will be entrusted with laser-specific tasks by the year 2000. These people must be qualified. About one-third of these will be engineers and natural scientists. The best qualifications are expected of them. Another assumption is that, in material processing, mainly lasers of the higher output power will be used. This results in increased demands on laser safety. This automatically includes qualifying representatives for laser protection and the employees who must use lasers.

The portion of German Association for Welding Technology (DVS) course participants who must be acquainted with laser technologies and systems will also grow considerably. It is to be expected that the number of course participants who want to be qualified according to the guidelines of DVS 1187 will increase noticeably. It goes without saying that the course material for technical workers, master craftsmen, technicians and engineers must be adapted to match the required quality level in industry and science.

German experts are distinguished by close technical-scientific cooperation and the readiness to embark on such cooperation. They know the significance of Europe-wide and worldwide standardization in the laser sector. The German Association for Welding Technology and the German Institute for Standardization (DIN) are working continuously and in conjunction with system manufacturers, research, and users of laser technology on the basic standards including the application standards founded on them.

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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 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 the attraction 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 their 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 mm³. 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.

France: CEGELEC To Launch Advanced Components

93WS0162A Paris *PRODUCTIQUE/AFFAIRES*
in French 26 Nov 92 pp 3-4

[Unattributed article: "Cegelec Will Offer a New Generation of Fullip Components in 1993"]

[Text] Cegelec, one of the most active promoters of the Fip field network was the first to introduce, in 1990, a

series of components making it possible to connect all kinds of products to the Fip network. Most "Fipes" products currently marketed or under development will use these components, which include the VLSI [very large scale integration] Fullfip integrated circuit and associated software tools. In view of this success, Cegelec decided to go one step further and to offer, already in 1993, a new generation of components fully compatible with the first one with respect to both hardware and software but based on the latest techniques. In particular, Fullfip 2 will be offered in 0.8-micron CMOS [complementary metal-oxide semiconductor] technology during the first quarter of 1993, in a "pin-to-pin" package compatible with the Fullfip package. It will come with a Fieldrive line driver developed in BI-CMOS technology. Together, they will make it possible to reduce Fip connection costs by a factor of nearly 10 compared with current costs. Compatibility with first-generation components guarantees the validity of all development work based on Fullfip and associated software developed by Cegelec. Eventually, under the Ficomp European project and with the same concern for continuity, Cegelec is preparing the transition to the future international standard now being drafted by the Isa, ISO [International Standardization Organization] and the CEI [International Electrotechnical Commission].

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NUCLEAR R&D

Franco-German Consortium Develops European Pressurized Water Reactor

93MI0124 Bonn DIE WELT in German 6 Nov 92 p 17

[Article by Lorenz Winter: "Nuclear Power for the Single European Market—French and German Electricity Corporations Developing New Type of Reactor"]

[Text] The strategic alliance to be forged at the start of 1993 between the French state electricity corporation EDF [Electricite de France] and its German partners PreussenElektra, RWE [Rhine-Westphalia Electricity Works], Badenwerk, and Bayernwerk (with which it has hitherto embarked on joint projects only in Eastern Europe), together with the NPI consortium of Siemens and Framatome, could play a major role in supplying nuclear power to European industry in the next century.

The five electricity corporations and NPI plan to pool their technical and financial resources to develop a new generation of reactors to be known as EDR [European pressurized water reactor]. "The first reactor in this series is likely to become operational in France during 1997-98, unless Germany requires an additional nuclear power supply before then," EDV [as published] director Remy Carle told the press in Paris.

The two NPI consortium members originally intended to sell their products only to other countries; however, when world recession ended any significant demand for nuclear power stations, Siemens and Framatome began to consider the potential offered by the single European market.

EDF's willingness to invest in Europe has continued undiminished: The first board meetings to take place after the appointment of its new chairman, Gilles Menage, agreed to accelerate the nuclear power station program, to the extent that, to quote one of those present, "it might be possible to commission a new unit every year." In 1997-98, two nuclear power stations at Civaux in the department of Vienne in western France, each with plants in the new series to be linked up to the grid: If possible, one, ordered early in 1991, will receive the first EDR.

EDF managers admit that a rapid expansion of capacity might at first sight seem illogical, in view of the excess capacity with which the company is saddled at least until 1995. The company does, however, regard its planned expansion after the year 2000 as sound, as the average 2.4-percent annual growth forecast for the French economy implies a 2.1-percent annual growth in demand for electricity.

Almost 80 percent of all thermally generated electricity west of the Rhine already comes from nuclear power stations. The Vienna-based International Energy Agency (IEA) considers that this figure implies a "lack of flexibility" in using different sources of energy, and its reports have repeatedly criticized by implication what the IEA sees as concealment of the true costs of generating French nuclear power.

German Nuclear Research Center Contributes to Advance in Nuclear Resonance Spectroscopy

93MI0139 Bonn WISSENSCHAFT WIRTSCHAFT POLITIK in German 4 Nov 92 p 2

[Text] As a joint venture with a well-known industrial partner, Karlsruhe Nuclear Research Center (KfK) has now developed a superconducting magnet, and the requisite cryostatic temperature regulator, that represents a technical advance for nuclear resonance spectroscopy. This opens up new horizons in structural research, from biology to materials development, for this method, which is also known for its use in medical nuclear spin tomography.

The principle of nuclear spin resonance spectroscopy is relatively simple: Atomic nuclei rotate like tops about a rotation axis. Their electrical charge creates a magnetic moment, i.e., they are also elementary magnets. If an external magnetic field is applied, it exerts a force on the atomic top via the magnetic moment. This force diverts the axis of rotation from its original direction and causes the spin axis to wobble around the direction of the magnetic field. The frequency of this precession motion is characteristic of the rotating atomic nucleus, and also

of its binding to the materials under investigation. It can be measured by resonance absorption: If an alternating magnetic field is superimposed, the racing atomic gyros can gradually continue to absorb energy via a phased change of direction of their rotation axes. In the case of resonance, if the frequency of the alternating magnetic field coincides with the precession frequency, this effect is electronically measurable. The great importance of this measurement procedure is also demonstrated by the award of the 1991 Nobel Prize for Chemistry to the Swiss Richard R. Ernst, whose brainchild this development is.

Magnetic Fingerprints

Conventional nuclear spin resonance spectrometers currently use superconducting magnets with field strengths of up to approximately 14 Tesla and resonance frequencies up to 600 MHz. This method makes it possible to obtain extremely detailed and precise information that is accessible only with difficulty, or not at all, by other means. Biological, chemical, and even in solid-state physical structures can now be investigated by means of the magnetic fingerprints thus determined for them.

German Physicists Use Diamond Crystal to Generate Channeling Radiation

93MI0146 Bonn DIE WELT in German 19 Nov 92 p 9

[Article by Klaus D. Linsmeyer: "A Slalom Through the Diamond Crystal—Frequency X-Ray Source"]

[Text] An X-ray source that can be tuned as easily as a radio, is easy to operate, and is not too expensive has long been the dream of doctors and chip manufacturers. Darmstadt College of Technology's Institute of Nuclear Physics has now achieved what has long been known to be theoretically possible, by generating channeling radiation.

Accelerated electrons emit electromagnetic radiation. This law of nature is the basis not only of radio wave transmission and reception, but also of X-ray technology. In an X-ray tube, electrons bombard an electrode and are abruptly decelerated, thus producing high-energy radiation. This X-radiation, however, basically has only one frequency which depends on the electrode material.

However, if a doctor needs to detect calcium deposits in vessels, but not in a differential image [Vergleichsbild], he requires two different X-ray frequencies: one that is absorbed by calcium, and one that is not. Microchip manufacturers would also welcome variable-frequency X-radiation facilities for exposing fine structures through the lacquer masks on semiconductor surfaces.

Channeling electrons can, however, be used to produce a variable-frequency X-ray emitter. If negatively charged high-energy electrons are shot into a crystal along one of its axes, they come under the influence of the positively charged crystal atoms. The electrons are then forced to oscillate in arcs around the atoms, performing, so to

speak a slalom through the crystal. Each curve accelerates them whereupon they emit channeling radiation: its frequency depends on the electrons' energy, which can readily be altered.

Professor Achim Richter's team of physicists has selected a diamond as the channeling crystal. Its regular lattice tolerates high energy and intensity of the electron beam: To maintain the variable X-ray radiation's high intensity and quality, electrons must be accelerated into the crystal at over 100 million volts.

Inadequate electron sources that allowed only pulse operation were the reason why the channeling effect could not previously be exploited. This changed with the commissioning last year of Darmstadt's new superconducting electron accelerator. S-Dalinac, which provides continuous generation.

UK Withdraws From EFR Project

93WS0163B Paris AFP SCIENCES in French
26 Nov 92 pp 23, 24

[Article entitled: "Great Britain Withdraws from the European Fast Neutron Reactor (EFR) Project"]

[Text] London/Paris—The British government announced on 19 November that it would withdraw from the European Fast Neutron Reactor project (EFR) effective March 1993. Germany, Great Britain, and France have been studying the EFR since 1989.

State commerce and industry secretary Tim Eggar told the House of Commons that the project "was not a priority" for the government, which had consulted with leaders of Britain's nuclear industry in advance.

The decision to scrap the project will result in the layoff of at least 270 people, and means that Great Britain—which has invested £4 billion in supergenerator research over the last 40 years—no longer believes in the viability of fast neutron reactors. The government estimates that the decision will save it £13 billion a year. The EFR, which was slated to produce a European supergenerator design in 1993, was expected to supply electricity at one third the cost of classic reactors.

Britain's withdrawal was reacted to strongly by the opposition labor party and by trade unions, who maintain that Great Britain must pursue fast reactor research to insure the future of its energy supply. Moreover, the move comes five months after the French government suspended plans to resume operation of the French Superphenix supergenerator under pressure from environmentalists. The Americans and the Japanese, meanwhile, are continuing their research in this area. Japan plans to put its Monju supergenerator into service at the end of the year or in early 1993.

The announcement certainly caught Britain's French and German partners by surprise. When all is said and

done, however, specialists believe that the two countries could expand international collaboration on fast neutron reactors.

Indeed, most experts were meeting at the same time in Chicago to consider future reactors at an event organized by the American Nuclear Society (ANS) to celebrate the 50th anniversary of Fermi's atomic battery.

Despite the technical setbacks the Superphenix has experienced in France, fast neutron reactors, or supergenerators, are still one of the most promising future technologies for producing electricity with nuclear power. But it is not the only one under study. Nonetheless, the French and the Germans regret the "unilateral decision" taken by London "without consultation or prior warning."

Launched in 1985, the 1,500-megawatt EFR had a unifying effect on the teams of French, German, and British specialists, which included some 250 engineers. On 16 February 1989, the project led to official recognition of the collaboration between the three European countries working in the field: France with Rapsodie, Phenix, and Superphenix; Germany with its now abandoned Kalkar reactor; and Great Britain and its Dounray reactor. Their cooperation was not limited to research; it was to extend to industrialization and to joint ownership of the patent rights likely to result.

The EFR is supported by EFRUG, or European Fast Reactor Utilities Group. The Group combines the three partners' six big power supply companies interested in a new type of reactor that is capable of using uranium more efficiently and burning the plutonium extracted from the irradiated fuel of nuclear plants. The idea is to use the experience they have gained to build a less complicated supergenerator than the Superphenix, and especially one that can supply electricity at 35 percent less cost than the power put out by classic light-water nuclear plants.

After an initial period of reflection starting next March, the partners were supposed to study technical proposals that might lead to a "concise project" that would then have had to be financed. The withdrawal of the British, who accounted for 20 percent of the total, is "therefore a heavy blow." This is especially so as certain studies done by the French Atomic Energy Commission (CEA) in Cadarache were halted and transferred to Great Britain.

"So we will have to see what can be done," Mr. Jacques Bouchard, director of nuclear reactors at the CEA, told the AFP from Chicago. He did not seem particularly worried. Other countries—Italy, Spain, Switzerland—have knocked on the EFR's door. Moreover, the Europeans and Japanese signed a general protocol agreement to collaborate on supergenerators on 28 October 1991 in Kyoto.

"Superphenix's problems have temporarily put the EFR project on hold, but international interest is still quite high everywhere, despite the pressure of environmentalists," added Mr. Bouchard. "We may have to study new

reactor designs. One thing is sure: the British decision is the result of an economic argument, and does not cast doubt on the overall value of supergenerators."

TELECOMMUNICATIONS

Status, Future of ISDN Services in Germany Viewed

93WS0072A Heidelberg NET—NACHRICHTEN ELEKTRONIK + TELEMATIK in German Sep 92
Special Issue 11 pp 6-7

[Article by Dipl.-Ing. Gerhard Wachholz, Director of the Section for ISDN at the Federal Bureau for Telecommunications in Darmstadt: "Domestic Digital Market"]

[Text]

Current Status of ISDN

The idea behind ISDN is simple. On account of the well-known advantages of digital technology, the telephone network is being equipped with digital central offices and digital trunk circuits between these offices. If the telecommunications user is offered access to this network core of not only analog but also digital connections—known as Universal or ISDN access interfaces—the user can take advantage of digital technology directly for his telecommunications needs.

Digital, transparent connections capable of duplex transmission at a rate of 64 kbits/s can be set up between two such ISDN access interfaces. These connections, in turn, may be used for a variety of telecommunications services and applications. These include both voice and non-voice services and applications.

Basically, ISDN is an advanced technology for connecting to the digital telephone network. For the user, ISDN access considerably expands the power of the telephone network. In this way, the user believes he is not just connected to the well-known telephone network by way of a new access method, but also to a completely new network, the integrated services digital telecommunications network of ISDN.

Accessing ISDN Officially

That is in performance specifications and tariff lists, an ISDN access interface is called a Universal access interface by the Telekom. There are two types of ISDN access interfaces:

- Basic rate access, and
- primary rate access

They differ in the number of 64 kbits/s connections that may be used at the same time over the corresponding ISDN access interface. With basic rate access, two 64 kbits/s connections may be at one time. They may be used to connect to different or even the same subscriber

for different or even the same telecommunications services. For example, two people may talk on the telephone at the same time to different destinations using basic rate access. However, one single person may also talk on the telephone to another person while at the same time both may exchange faxes with one another.

The user-network interface is where ISDN access ends at the ISDN customer and where the ISDN customer connects his terminal equipment. For basic rate access, this interface is known as the S^0 interface. As two 64 kbits/s connections are possible at the same time on one basic rate access, the S^0 interface has two 64 kbits/s speech/data channels (B channels).

One ISDN terminal or one private branch exchange can be connected at the S^0 interface. However, the S^0 interface can also be multiplied using a passive bus. In this way, up to 12 ISDN telecommunications jacks (ISDN access units IAE, also known as Western connectors) can be connected in parallel. Then, up to eight ISDN terminals can be connected at the same time to these jacks. Of these terminals, up to two can communicate at the same time. Thus, with basic rate access having a passive bus, small offices can do without a small private branch exchange. With a primary rate access, thirty 64 kbits/s connections can be used at the same time. This access has the same flexibility as provided by basic rate access. The user-network interface for primary rate access is known as the S^{2M} interface. The S^{2M} interface has thirty 64 kbits/s speech/data channels (B channels) because thirty 64 kbits/s connections are possible at the same time on one primary rate access interface. A private branch exchange may be connected to the S^{2M} interface.

Besides the speech/data channels (B channels), every Universal access interface has a D channel. While the B channels are routed through the network to a subscriber as 64 kbits/s connections, the D channel ends at the central office to which the Universal access interface is connected. This channel serves to exchange signaling information between the terminal equipment of the ISDN customer and the ISDN network. For example, the D channel indicates an incoming call even if all speech/data channels are occupied (call waiting). In this way, the transmission of speech and data over the B channels is completely undisturbed. The language used to transmit the signaling information in the D channel is the D-channel protocol.

Whether the user chooses one or more basic rate or primary rate access interfaces or a combination of both types depends on his communications needs. The monthly fees must also be considered:

- Basic rate access (2 speech/data channels): 74.00 German marks [DM]/month (DM37.00 per speech/data channel and month),
- primary rate access (30 speech/data channels): DM518.00/month (DM17.27 per speech/data channel and month).

ISDN Telecommunications Services

ISDN provides the following telecommunications services:

- Telephone service (3.1 kHz, fast connection setup, numerous facilities),
- facsimile (fax) service (Groups 3 and 4),
- circuit-switching data transmission service (64 kbits/s, favorable price/performance ratio; any application can be handled within the framework of this service),
- interactive videotex service (64 kbits/s, fast page setup),
- teletex service (64 kbits/s), and
- video telephone service.

Starting in mid 1993, a packet-switching data transmission service will also be offered within ISDN. This service will not only be available on the B channels, but also on the D channels. Thus, starting with the introduction of this service, the D channel will no longer be just a signaling channel. Rather, it will be able to transmit speech and data like the B channels (with certain limitations). The (packet-switching) Datex-P network will be used as the packet-switching core of ISDN for the packet-switching data transmission service. This is in contrast to the other services that use the (circuit-switching) digitized telephone network.

Numerous other facilities of the network support telecommunication via ISDN.

Status of the ISDN Introduction

The introduction of ISDN began in the former Lands at the start of 1989. ISDN will be available throughout the entire area by the end of 1993. At the end of May 1992, Telekom had orders for over 83,000 basic rate access interfaces and 7,200 primary rate access interfaces. Of these, 61,000 basic rate and 4,000 primary rate access interfaces were already in operation. Worldwide, Telekom has sold the most ISDN access interfaces.

In the new Lands, Universal access interfaces have also become available in the meantime. However, the scope of services for Universal access in the new Lands is still identical to that from a conventional telephone connection. The cause for this is that the central offices in the new Lands are not yet connected to one another to support ISDN. Because of this, the performance of ISDN is only available now between Universal access interfaces connected to the same central office. The central offices form ISDN islands to a certain extent.

Networking these islands to one another to support ISDN began in August 1992. Networking the former Lands with ISDN will commence at the start of 1993. It is projected to be completed by mid 1993. ISDN will be available throughout the new Lands by the end of 1995. Despite the stated limitation, the first Universal access interfaces are being already installed in the new Lands. For the most part, these are telecommunications users

who purchase a new private branch exchange and have this equipped immediately with an ISDN trunk port to avoid a later conversion.

On a worldwide level, the CCITT committee is concerned with standardizing ISDN. On a European level, this is the task of the ETSI. When Telekom began introducing its ISDN, the international standardization of ISDN was not as advanced as it is today. For this reason, national specifications were produced by Telekom with the German telecommunications industry even for areas currently covered by CCITT recommendations or by the European Telecommunication Standard ETS of the ETSI. The most important area was the D-channel protocol. This protocol was specified in the Technical Guideline FTZ 1 TR 6 (1-TR-6-ISDN).

As international standardization of ISDN progressed, the national peculiarities were replaced by internationally standardized technology. One example is the replacement of national connector technology for the S⁰ interface TAE by the internationally standardized connector technology IAE (ISDN access unit or the Western connector).

The last and most important step will be taken in mid 1993. This will be the introduction of the European D-channel protocol E-DSS 1 (European Digital Subscriber Signalling System No. 1). This will replace the national D-channel protocol of FTZ Guideline 1 TR 6. This step will complete the transition from the national ISDN version (1-TR-6-ISDN) to the European ISDN version (Euro-ISDN).

Existing terminal equipment that uses the 1-TR-6 protocol may either be converted or continued in operation without change until at least the end of 1999. Until that time, Telekom will continue to support the 1-TR-6 protocol in ISDN in addition to the new E-DSS-1 protocol.

Connections between terminal equipment still using the 1-TR-6 protocol and that already using the E-DSS-1 protocol will be possible without limitations. However, there may be restrictions for using facilities extending beyond the protocols.

The introduction of the E-DSS-1 protocol is not just a purely technical replacement of one D-channel protocol with another. The D-channel protocol reflects most additional facilities of the network. Consequently, the introduction of the E-DSS-1 protocol also signifies changes and extensions to these facilities.

For example, the 1-TR-6 protocol supports the "terminal equipment selection on the passive bus" facility. This makes it possible for the caller to select one specific terminal among several (of the same telecommunications service) connected to a passive bus. For example, he can select among several telephones. This is done by dialing a specific number (terminal selection number) in the last digit of the call number. The European D-channel protocol, on the other hand, will support the

comparable but not identical cluster call number facility. This facility also allows selecting a specific terminal by means of the call number dialed. However, selecting the terminal in this case need not be done using just the last digit of the call number. Rather, all digits may be used for this purpose.

Another example is the subaddress facility. This provides additional addressing facilities for data applications. This facility is not contained in the 1-TR-6 protocol but is being supported for the first time by the E-DSS-1 protocol. However, not all facilities of the E-DSS-1 protocol can be offered as soon as 1993. Some will not be available until later years.

Introducing Euro-ISDN will allow the use of facilities on a Europe-wide basis because of the ISDN standards that have been worked out on a Europe-wide basis. These facilities include, for example, supporting closed user groups that span national borders. It will also bring into being the European domestic market for ISDN terminal equipment with its advantages for ISDN customers and manufacturers. In addition, it will make the national utilization of ISDN even more attractive because of the new facilities.

D2-MAC Deciphering Standard Designated

*93WS0149A Paris AFP SCIENCES in French
19 Nov 92 pp 20, 21*

[Article: "D2-MAC Encoded Televised Programs: Eurocrypt Is Now Official European Decoding Standard"]

[Text] Paris—SIMAVELEC [Association of Electronic Audiovisual Equipment Industries] announced on 16 November that Eurocrypt, the D2-MAC decoding standard for televised programs received via cable or satellite, has been designated the official European standard.

Mr. Francois Hue, SIMAVELEC's technical director, indicated that the completion of work on the standardization of Eurocrypt, which an EC directive had called for by July 1993 at the latest, means that all pay-television programs telecast in Europe under the D2-MAC standard, by way of transition toward high-definition television [HDTV], will be accessible through a decoder meeting the Eurocrypt standard.

The more than 500,000 D2-MAC-Eurocrypt decoders that are already in circulation in Europe, and that are necessary for the reception of some 10 European channels, can be used by inserting a chip card with an embedded secret code. Eurocrypt has the distinctive feature of being an open system. This means that any manufacturer wishing to manufacture these decoders can do so, since their technical specifications have been published.

On the other hand, the Syster and Videocrypt systems—used for decoding transmissions by Canal Plus and Rupert Murdoch's British channels, respectively, under

the SECAM and PAL standards—being proprietary, their fabrication is not open to all manufacturers.

Alcatel Launches Cellular Auto Phone

93WS0149C Paris AFP SCIENCES in French
19 Nov 92 pp 21, 22

[Article: "Alcatel Launches Its First GSM Radiotelephone Models"]

[Text] Paris—The Alcatel telecommunications group announced, on 16 November, the launching of its first portable GSM [Global System for Mobile Communication] radiotelephone models.

GSM is a new European digital radiotelephone service (essentially for car phones), in which the terminals work with a chip card. On 16 November, preceded by Motorola and Nokia in particular, Alcatel began marketing five portable radiotelephone models. These terminals weigh approximately 2 kilograms, have the form of a cellular car phone, and, depending on the version, are integrated into the car's dashboard, are removable, or are completely portable. Such modification of the set's software as may be needed with the advent of future new services will be able to be done by remote loading, without taking the set apart or changing chips.

These new GSM digital car phones have received the European ITA [Interim Type Approval]. Alcatel will not distribute them directly to the public but rather through telecommunications operators, services-marketing companies, and automobile manufacturers. They will cost approximately 6,000 to 6,500 French francs [FR] not including tax, said Mr. Jacques Imbert, president of Alcatel Radio Space and Defense.

Within three months, Alcatel is also expected to announce the marketing of completely portable terminals (smaller) at a tentatively indicated price of Fr7,000 to Fr8,000 not including taxes. The French group was preceded by Motorola, which has just announced the launching of its first GSM portable.

These terminals will be manufactured in France, at the Laval (Mayenne) factory, which in 1993 is slated to produce around 100,000 sets. "This production is oversized, in order to gain a head start on the market," says Mr. Imbert, pointing out that the group preferred to concentrate production in France rather than delocalize it, since rapid evolution of the sets requires "a unified site for design studies and means of production." Most of the components are of European origin, with SGS-Thomson as their main source.

For Alcatel, which until 1981 had a marginal position in the radiotelephone sector, the GSM system represents a sizable investment: ECU100 million (approximately Fr700 million) over the past two to three years. "Our strategy is to be present in the three GSM segments: radio infrastructures, switching, and terminals," asserts

Mr. Imbert. The group intends to capture 15 percent of the European GSM terminals market between now and 1995-1996.

Danish Company Completes Submarine Cable Projects

93WS0150E Chichester INTERNATIONAL
TELECOMMUNICATIONS INTELLIGENCE
in English 16 Nov 92 p 1

[Text] NKT Elektronik of Denmark has completed the installation of three unrepeated optical submarine cable links in Europe. The contracts were worth about US\$40 million in total.

The completion of the 300 km offshore cable link between Denmark-Germany is the first international telecom link to utilise new optical fibre amplifier technology developed by NKT Elektronik in close cooperation with Telecom Denmark. The new 'XP' optical amplifier, from the NKT 'Focus' family of new products, is used instead of a repeater to boost a signal at the start of its journey along the cable. The absence of a repeater also means that capacity of the link can be enhanced at a future date—for example, by speeding up transmission speed from the present 565 Mbit/s to 2.5 Gbit/s—by upgrading the amplifying equipment at either end. No replacement or modification will be required to the cable under the seabed.

The Denmark-Germany cable contract was awarded to NKT at the end of 1990 by a consortium of European operators including Telecom Denmark, DBT, Telecom Finland, Swedish Telecom, PTT Nederland, Norwegian Telecom, BT and Mercury Communications. The cable entered commercial service on November 6, 1992.

In the United Kingdom, a new high-capacity 565 Mbit/s optical fibre link has been established between Lancashire, the Isle of Man, Northern Ireland and central Scotland. The order was placed in October 1991 by Mercury Communications and included the supply of the cable and transmission equipment. Cable & Wireless (Marine) Limited was responsible for laying the 300 km underwater portion of 500 km link (see ITI Issue 313). The system is expected to enter service before the end of this year.

The third project involved supplying the submarine cable and the transmission equipment for a new high-speed link between Denmark and Norway. The system has a capacity of 565 Mbit/s and because attenuation in the fibres has been reduced to 0.18 dB per km, no repeater is needed to boost the signal in the 142 km submarine section of the link.

NKT was awarded the contract for the Denmark-Norway link in late 1990 by Telecom Denmark and Norwegian Telecom. It is scheduled to start operations by the end of 1992.

No Consensus on European HDTV Budget

93WS0163A Paris AFP SCIENCES in French
26 Nov 92 pp 17, 18

[Article entitled: "No Agreement Among the Twelve on Financing HDTV"]

[Text] Brussels/Paris—Funding for the development of high-definition television (HDTV) remained in suspense 19 November at the Twelve's meeting of telecommunications ministers. The ministers were unable to reach an agreement on the amount of money needed for the project.

Several countries, Great Britain and Denmark among them, felt that the Community could not commit itself to allocating funds to HDTV while the orientations of the EC's budget for the next few years are still up in the air.

Last April, the European Commission proposed granting ECU850 million over a five-year period to develop the D2-MAC transmission standards and 16/9-format sets that are expected to lead into HDTV. The proposal was supported by France and Holland, which hoped that the Twelve would adopt it on 19 November.

According to a diplomatic source, if an agreement on the EC's budget and budget increases over the next five years (the Delors II package) is reached at the Edinburgh summit on 11 and 12 December, it will be possible to call a special meeting of telecommunications ministers to reconsider the HDTV question.

But the ministers did decide in favor of a plan of action that gives priority to the D2-MAC standard and 16/9 sets. When it comes time to estimate the amount and

come up with the financing, however, the sum of ECU850 million will probably be scaled back.

Lately several specialists have come out against the interim D2-MAC standard. On the eve of the Brussels cabinet meeting, CLT (Luxemburg Television Company) president Gaston Thorn invited the ministers to "go all out on digital." "D2-MAC is history. The interval during which the standard could be used before the switch is made to digital is too short for people to make the necessary investment, given that they will have to replace everything around 2000."

Alcatel, PairGain Announce Cooperation in Development of High Bit-Rate Digital Telecom Line

93MI0191 Coburg OPTOELEKTRONIK MAGAZIN
in German Oct 92 p 185

[Text] Alcatel and PairGain Technologies have announced they have signed a letter of intent provide for close cooperation, whereby Alcatel acquires the right to develop, manufacture, and sell worldwide PairGain's HDSL (high-bit-rate digital subscriber line) products and technology.

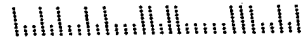
The HDSL system can be used—without a generator—to operate 2-Mbit/s and 1.5-Mbit/s services over dual copper wires, like those used for conventional telephone services. It enables network operators to provide broadband services using the existing dual wires for which conversion to optical waveguides would be unprofitable. Network operators can thus offer their customers E1/T1 lines at low installation costs.

PairGain's HDSL products use advanced VLSI [very large-scale integration] circuits, which are needed to transmit and recognize the 2B1Q-coded HDSL signal.

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