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## ADVANCED MATERIALS

### Improved Method for Manufacturing Fiber Composites

92WS0615B Stockholm NY TEKNIK in Swedish  
21 May 92 p 20

[Article by Hakan Bertmar: "Manufacturing Method for Fiber Composites Given New Life"—first paragraph is NY TEKNIK introduction]

[Text] Injection, a method for producing fiber composites, is making rapid gains. The method is environmentally friendly, flexible and rational and the parts produced are of good quality. At Sicomp in Pitea the last obstacles are being eliminated before the method makes its definitive breakthrough.

Polymer-based fiber composites are a design material in which different kinds of fibers, for example fiberglass, are used to reinforce a polymer material such as polyester. Different kinds of fibers and basic materials can be combined, producing a wide variety of fiber composite materials.

One of the manufacturing methods for producing fiber composite parts is injection, or RTM (resin transfer molding) as it is called internationally. The method has been around for 40 years. In Sweden it was used as early as the late 1950s when 1.5 meter high and 0.5 meter broad containers for lead batteries were mass produced. In the 1970s truck hoods were made in a single piece using the injection method.

"Today the body of the army's tracked vehicle is manufactured with very modern injection methods," said Peter Gudmundson, president of Sicomp.

However the injection method has had a hard time winning acceptance. It is time-consuming, involves a lot of manual work and the production tempo has been low. It is only in the last few years that machines for automating injection have come out. This has enabled more established processes such as hot pressing, manual construction and autoclaving to maintain their standing.

One of the big bottlenecks has been that there was no effective method of preforming the fiber reinforcement. In the past the reinforcement was often placed directly in the injection mold by hand and molded in place. That meant unacceptably long cycle times to produce a part.

The researchers at Sicomp have concentrated on solving this problem, but they have also sought to optimize the entire process.

"The goal is to develop preforming technology and come up with instructions that will make it easier for designers to utilize injection. For example we use a computer program that simulates the mold filling process and gives the designer guidance on fill times for different geometric shapes and types of fiber," said Anders Strombeck of Sicomp.

Some time ago a relatively new method for producing molds was also tried. Ordinarily compression molds are made from plastic, which can handle a series of 1,000 parts. For

larger series metal molds are used. The drawback is that the molds are expensive, usually costing more than 100,000 kronor.

"We tried making a mold from an acrylic resin mixed with powdered and granulated aluminum. In only two days we made the mold, used it for injection and produced a finished product. A mold of this kind costs around 20,000 kronor and it can handle series of up to 40,000 parts," Strombeck said.

Sicomp has also worked with the Swedish engineering industry to develop the injection process. Goteborg's Applicator company has produced a special injection unit that Sicomp is using in its research. Later this unit was successfully turned into a commercially available product and sold around the world.

A big advantage of the injection method is that it is environmentally friendly. Because the molding occurs in a closed unit all gas emissions, styrene, for example, can be controlled.

Investment costs are low because the method is based on low pressure, 0.1-1.0 MPA, during injection. This permits the use of simpler molds and moldholders.

The method is flexible. There is a large selection of polymers and fibers that can be used.

Parts with complex shapes and narrow tolerances can be produced. Today it is possible to achieve Class A finishes, in other words the same finish found on a car body, with the help of injection. Inserting cores of other material in the mold also works well, making it possible to produce very rigid sandwich structures.

"Injection is the manufacturing method that appears to have the greatest possibility of combining high durability and low production cost," Peter Gudmundson said.

The automobile industry is working on using the method to manufacture panels with a high surface finish in an environmentally friendly way. Weight-bearing components like floors can also be produced with the injection technique.

The airplane industry has also finally begun to note the advantages of the injection technique when it comes to reducing the cost of manufacturing complicated composite parts. An American airplane manufacturer has tried it out on wing tanks and will now go further with wing root parts and large parts of the fuselage.

#### [Box, p 20 (left)]

The injection process can be divided into three steps.

1. First the reinforcement material is cut out. It is then placed in a special preforming mold. The reinforcement is pressed into its final form under low pressure and heat. The preformed shape is then stiff enough to handle.

There are several alternative ways to manufacture preforms. One method that has become quite popular is the method in the illustration [not included], thermoforming, where the binder is already bonded with the reinforcement. It melts

during draping in the preform and when the binder hardens the reinforcement keeps its shape.

"This is the quickest and most industrially oriented method," Anders Strombeck said.

2. The preforms are slipped onto a foam model of the part to be manufactured and the whole thing is then placed in the injection mold.

3. The upper and lower sections of the mold are locked together and the fluid polymer is usually pressed into the mold through a hole in the upper half of the mold.

After injection is completed the part hardens in the mold. Normally it is removed before it is entirely hard and allowed to continue hardening.

[Box, p 20 (right)]

#### **This is Sicomp**

Sicomp (Swedish Institute of Composites) was established as an institution in 1988 by the Swedish state and ABB, each of which has a 50 percent interest. For the past year the institute has had 20 employees and a well-organized process and testing laboratory for polymer-based fiber composites.

Approximately two-thirds of the activity is aimed at developing new and improved manufacturing methods for fiber composites.

Another important area is the development of reliable methods for designing fiber composite parts.

A continuous educational process also takes place here to teach designers how to utilize the advantages of fiber composites in their designs.

#### **MBB Improves Production Processes for Composite Materials**

*92WS0622C Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 12 Jun 92 p 8*

[Text] The use of composite materials, made for example from carbon fibers and epoxy resin, as basic material for structural building components even today presents difficulties. In the first place the high costs of materials are still a considerable obstacle, and in the second the production cost is relatively high, since in order to achieve the desired thickness of a building component, several 0.10 mm thick layers, woven from reinforcing fibers, must be laid over each other and bonded together. Even the use of computer-controlled layering machines only leads to an appreciable reduction of costs where geometrically simple structures are to be produced.

The company of Messerschmitt-Bolkow-Blohm GmbH (MBB) hopes to achieve a considerable simplification of production techniques and thereby at the same time a considerable cost reduction through the use of integrally woven, knitted, or braided textile three-dimensional fiber preforms, which will be fabricated already during the textile process.

As the company magazine "New-Tech News" (February 92) reports, fiber preforms can be produced which, for example, can contain fibers running in the direction of thickness or local fiber reinforcements, and can thereby possess three-dimensional structures with integrally woven webs. By this means the time-consuming and costly lamination (glueing together) of the individual prepregged glass fabrics would be considerably reduced, and a better damage tolerance could be achieved.

MBB has undertaken a research project in this field in cooperation with the company of Vorwerk & Co., Wuppertal, and the Stuttgart Institute for Aircraft Construction. The aim is to test three-dimensional reinforced fiber preforms for fabrication into fiber composite building components, and to learn their properties as reinforcing material.

In the testing, carbon and fiber materials were used, as well as hybrid yarns made from a mixture of thermoplast and carbon fibers. In order to produce three-dimensional fiber structures, modifications and completely new textile fabrication processes were required, which made it possible to produce economically three-dimensional woven fabrics. The use of these materials would be possible especially in building components which were exposed to the dangers of impact and crushing, MBB emphasized.

"The development as well as the use of three-dimensional reinforced composite materials presupposes that suitable theoretical models are available, in order to be able to calculate adhesion properties in their dependence on the material of the fiber and the matrix, as well as on the geometry of the fiber," the company writes. "This is considerably more difficult to accomplish with three-dimensional woven fabrics than with two-dimensional layer laminates on account of the geometrically complex structure of the fiber. In the first place the geometry of the fiber structure must be understood as exactly as possible, and in the second the stress and strain conditions in the material, which must be simulated in the mathematical model, are considerably more complex." In the three-dimensional structures, on account of the "series connection" of areas with varying rigidity, increases in strain occur which decisively affect the malfunction mechanism and thereby the closeness of the weave.

Textile fabrication processes in the form of combined plaiting and lapping procedures are very costly and complicated. They are mainly limited to exotic applications, such as the manufacture of rocket jets from carbon, reinforced with carbon fibers (CFC), which is serviceable up to 1,800 centigrade. Weaving technology makes possible three types of woven fabrics—multilayer weaves for monolithic construction forms, spaced weaves for sandwich construction forms, and integral weaves for integral construction forms. In this way large-surface structures can be manufactured in a cost-favourable manner.

Plaiting technology, used with individual bobbin guidance, can achieve almost any fiber orientation in the three-dimensional structure. In this way the best possibly adapted preforms can be produced, which are geared for the load-carrying capacity which is later to be expected from the

building component. With machine technology brittle reinforcing fibers, such as glass and carbon fibers, can also be processed.

Weaving and knitting technology is already so far advanced that with the help of modern computer-controlled facilities cost-favourable preforms can be produced. According to the statements of MBB the extremely good draping ability of the knitted fabrics is especially advantageous during further processing.

Three-dimensional fiber preforms can be used in various ways, as for example for the forward edge of the tail unit of an aircraft. In addition to better damage tolerance, in this case also a pronounced reduction of production time by 60 percent was the result. A further possible use is for the engine support of an automobile. In the case of this heavily loaded structural component the advantage would be that in the event of a collision a complete breakdown would be avoided, and that the component would still demonstrate a load-bearing safety function.

#### **Finland: Novel Wrought Steel Reduces Heat Treatment**

*92WS0661K Taddington NEW MATERIALS INTERNATIONAL in English Jun 92 pp 4-5*

[Article: "Finland: Wrought Steel Reduces Heat Treatment"]

[Text] Imatra steel has introduced a novel type of wrought steel suitable for direct hardening. Called Imaform it is said to have excellent mechanical qualities, is cheaper and requires fewer working stages than previously used wrought steels.

The properties of the Imaform-steel are based mainly on the low carbon content, about 0.08 percent, said engineer Eerik Hocksell of the Imatra Steel Oy Ab Development Center in Finland, where the steel has been developed.

With this low carbon content the steel can be cooled down in water after the forging without any risk of cracking. Tempering treatment after the hardening is also unnecessary, because the microstructure with low carbon content is sufficiently tough even as hardened.

The alloying materials of manganese, chrome and boron also improve hardenability and ensure the development of a suitable micro structure. The alloying can be tailored according to the object of use. It is determined by the size and required strength of the wrought steel piece as well as the forge process, said Hocksell.

The forging temperature of Imaform is about 1,200°C. After forging, the pieces can be hardened either directly or from the temperature 900-1,000°C. Mechanical properties are not dependent on the quenching temperature, which reduces significantly the dispersion of the physical properties. Cold water is used as the hardening liquid.

When directly hardened from forging the yield strength of 900-1,000 MPa depends on the piece size. This strength is of the same order as in tempering steels and clearly better than in micro alloy steels.

By adjusting the alloying it is possible to obtain even 1,000 MPa as the breaking strength. Elongation is at least 14 percent and impact strength over 50 J, which is a significantly better value than in micro alloy steels.

From the novel alloying of the Imaform-steel many advantages are attained in the pre- and aftertreatment stages of forged steel pieces, including mechanisation, welding, nitriding and cold-shaping.

In the rolling condition the hardness is at the most 200 HB, so that forging blanks can be cut from the bar without preceding soft-annealing. For cold-shaping the steel can be soft-annealed in the hardness of 120HB.

Imaform is suitable for many purposes, for which tempering, micro alloy and conventional direct-quenching steels have been used previously. Benefits are gained from the reduction of treatment stages and improved impact strength.

Typical components include the bard for steering devices and the suspensions for cars.

#### **BRITE-EURAM Program Results Presented at Conference in Spain**

*92WS0674A Duesseldorf VDI NACHRICHTEN in German 5 Jun 92 p 4*

[Article by Siegfried Kampfer under the rubric "This Week": "New EC Promotion Program for Industrial and Materials Technologies; Europe's Research Looking for Manufacturing Experience; the Participation of at Least Two Partners from Different Member Countries Provides for International Balance"; first paragraph is an introduction]

[Text] Seville, 5 Jun 92 (VDI-N)—With 700 projects since 1985, of which up to 300 have been concluded, and in anticipation of 500 new proposals for the period 1992 to 1993, EC's BRITE-EURAM program has proved to be a draft horse of multilateral cooperation. Thus, not only was successful research work of the past presented last week in Seville, but claims were also laid out for the future: According to EC Vice President F.M. Pandolfi, a "European Fund" is necessary in order to make funds available beyond the existing program. Primarily small and medium-sized businesses are to be the beneficiaries.

It is clear to Claus Weyrich, Siemens's research head for basic technologies that the activity of his staff has to be looked at according to the criterion of efficiency. Just a few years ago one proceeded on the assumption that one had only to bring excellent researchers together in a stimulating working environment with sufficient money in order to guarantee valuable innovations. "But this approach was too optimistic," Weyrich commented on May 25 at the BRITE-EURAM conference in Seville. On the other hand, however, "innovation" is always regarded as a general strategic goal of a manufacturing company.

The BRITE-EURAM promotion program has to be just what was wanted here, for "Basic Research in Industrial Technologies for Europe" (BRITE) and the "European Research Program on Advanced Materials" (EURAM) are

aimed at promotion in the run-up to competition. Of course, companies have to do preparatory work. For example, ABS Pumpen AG [ABS Pumps German Stock Corporation] in Lohmar needed 1.5 years to define the "Ceramic Components for Friction Applications" project, "Keramik für den Grenzreibungsbereich für Gleitlager und Dichtungen" in German, as development head Klaus Becker reported in Seville. A consultant was also engaged on a commission basis in order to present the project effectively in Brussels. Because "for the most part two-thirds of all proposals are rejected." However, now applications are already running in batches and the 250,000 German marks [DM] (including promotion) are paying off well. Five companies and institutes took part in the project Europe-wide, and a total of about DM2 million has been spent in 3.5 years.

Twelve typical and especially successful projects of the last BRITE-EURAM program were presented in Seville. More than 800 managers, engineers, scientists and politicians came together in order to sum up and at the same time to venture a look into the future. In the end the BRITE-EURAM-II program is going by the name of "Industrial and Materials Technologies 1991-94" for a total of ECU670 million of promotion (1 ECU = DM2.05).

The event was opened by EC Vice President Pandolfi. He agreed with Valente de Oliviera, the acting president of the European Research Council, with D. Javier Solana, the

Spanish minister for education and science and C. Desma, the president of the European Parliament's research committee, that research competence is by no means Europe's "Achilles heel," but transfer to industrial applications and commercial success. Therefore, the Pandolfi Initiative, as it was proclaimed in Seville, comprises the procurement of venture capital in order to facilitate for European small and medium-sized businesses for two to four years the transfer of new technologies.

There was agreement at the conference that the European dimension should by no means be repressed. However, it was also asked why high-tech is being promoted though, all the same, the EC money would be barely yielded by these companies. In addition, complaints were made of the harmony pressure of the promotion programs, that are to bring together preferred researchers from various European countries. According to what Professor Michael Kroning, a member of the conference committee, said, one should by no means allow technology research to be seen from the aspect of regional development aid, but one should rather create self-confidence in one's own efforts. And for especially sensitive key technologies, where serious industry interests of the EC are concerned, Kroning, head of the Fraunhofer Institute for Nondestructive Testing Methods in Saarbrücken, can even imagine perhaps dispensing with many "secondary development aspects" of wide-scope EC cooperation in the future.

#### Industrials and Materials Technologies

Name of Program	Period	Number of Projects	EC Budget in Million ECU (Source: EC/DG XII. As of 1 Jun 92, 1 ECU = DM2.05)
BRITE	1985/88	215	185
EURAM	1986/89	91	30
BRITE-EURAM	1989/92	397	500
Raw Materials/Recycl.	1990/92	69	23
BRITE-EURAM-II	1991/94		670

## AEROSPACE

### German Aerospace Institute To Organize EURECA-1 Experiments

92MI0538 Bonn WISSENSCHAFT WIRTSCHAFT POLITIK in German 20 May 92 p 2

[Text] The German Aerospace Research Institution [DLR] will supervise the scientific experiments for the EURECA-1 European space mission scheduled for 11 July. A user center by the name of MUSC [Microgravity User Support Center] has been set up for this purpose. It is from here that the experiments will be prepared, monitored, and controlled. Reference tests will subsequently be performed on the ground. MUSC is to serve as the prototype for further European centers for upcoming space missions.

EURECA is the first unmanned platform for long-term materials science and biological experiments. It will be stationed by an American shuttle and perform fully automatic experiments under microgravity conditions for six months at an altitude of 515 km. After a further three

months, it will be retrieved by another shuttle mission. The EURECA mission will be monitored from a single ground station only, so there will be only a few minutes each day in which data can be transferred to and from the platform. Particularly accurate data preparation is therefore called for during these minutes.

### Italian Space Agency Approves Funding for San Marco Scout Project

92MI0570 Rome SPAZIO INFORMAZIONI in Italian 13 May 92 pp 2-3

[Text] The Italian Space Agency's (ASI) board of directors has recently approved the first installment of funding for the program to increase the launch capacity of the San Marco Project, and has entrusted the Aerospace Research Center (CRA) of La Sapienza University in Rome with its management. This funding, worth 5 billion lire, is the result of decisions made more than two years ago by CIPE [Interministerial Committee for Economic Planning] to allocate 90



billion lire in funding over a three-year period from 1990 to 1992 to upgrade the San Marco launch site in Kenya, and to develop the new San Marco Scout carrier. The considerable delays that the ASI has allowed to accumulate in allocating these funds have yet to be justified, especially when, according to the agency's own president Professor Luciano Guerriero, the development of the San Marco Scout carrier and the availability of the equatorial launch site for small scientific and applications satellites play a strategic role in the development of Italian activity in this sector, as envisaged under the 1990-94 National Space Plan. "For the past two years," Professor Luigi Broglio, director of the San Marco Project, recently stated, "the 90 billion lire in funding allocated by CIPE for the development of the launch site and for the construction of an Italian launcher, with scientific collaboration from the University of Rome and industrial collaboration from BPD, has been inexplicably blocked. I have devoted years of work to Italy, I have given my ideas, and I consider this to be very serious. I would be very sorry," stressed Prof. Broglio, "if the country were to miss this opportunity to graduate from Class B to Class A. The project must not be allowed to fall through, and I do not want the blame to be put on those who, like myself, have given so much. Had we been able to start immediately, as soon as CIPE approved the funding, we would already have the new launcher that could earn Italy a frontline position in the market for small satellite launches."

It would not seem then, that the reduced allocation of funds recently approved by the ASI will be able to ensure a rapid start to the development of the first San Marco Scout prototype. This carrier (which is based on a more powerful version of the Scout developed by the American LTV) is, however, still a candidate for the launch of the Equator-S international scientific satellite, despite the recent decision by NASA not to participate in this program because of "budget" problems. CIPE's resolution, in fact, did not provide for the Scout and its supporting subsystems to be made available free of charge but for them to be acquired by LTV as part of a joint program. Germany and Japan, who from the very beginning promoted the development of the Equator-S in collaboration with NASA, have informally communicated their willingness to guarantee the funds necessary for the satellite's realization and launch into orbit. However, they are still waiting for confirmation from Italy that the San Marco Scout carrier and the equatorial launch site in Kenya, will be available for this mission. Will Italy and the ASI in particular be able to take advantage of this unrepeatable opportunity?

### **European Space Agency Contracts Assigned to Italian Companies**

#### **European Mobile System**

*92MI0572A Rome SPAZIO INFORMAZIONI  
in Italian 20 May 92*

[Text] The European Space Agency (ESA) has recently entrusted two important new contracts to companies in the IRI [Institute for the Reconstruction of Industry]-Finmeccanica group. Alenia Spazio will be responsible for the development of the payload for the EMS [European

Mobile System] for mobile communications via satellite while Fiar will be in charge of the construction of the first prototype of the MSBN user terminal on earth. The EMS contract with Alenia Spazio, which is worth about 75 billion lire, sees the Italian company as the leader of a team of European concerns (including Matra, Marconi Space, Ericsson, CASA [Aeronautic Constructions Company], Siemens Italiana, and others). This system will operate in the L band and will be carried aboard the Italian telecommunications satellite Italsat-F2 (which is scheduled to be launched in 1994 probably by an Ariane-4 carrier), making mobile voice and data communications available in the whole of western Europe and in part of eastern Europe. The EMS will remain in operation for a period of at least seven to eight years starting in 1995 and will have a maximum capacity of 70,000 users, principally transport companies.

The Fiar contract, on the other hand, is worth about 3 billion lire and concerns the construction of the first prototype of the MSBN user terminal, which, in the future mass-produced version should cost about 6-7 million lire. The terminal will enable a mobile unit (for example a large transport lorry) to send vocal messages, data, faxes, and information on location to a control station. "The EMS," said Alenia Spazio's commercial manager for ESA programs engineer Francesco Rispoli, "is the first European system of this kind and will enter into service at the same time as similar systems in the United States, Canada, and Australia. Therefore, there will be only three systems of this kind in the world at the end of 1994. The problem is that it will take time for the service to develop. It is however a big business, since according to forecasts, the potential market in Europe alone is expected to be 500,000 users before the year 2000. This will be a good opportunity for companies that produce terminals. Meanwhile, efforts are being made to set up a group of European operators possibly including EUTELSAT to commercially manage the EMS payload on behalf of the ESA."

#### **Columbus On-Board Tests**

*92MI0572B Rome SPAZIO INFORMAZIONI  
in Italian 20 May 92 pp 3-4*

[Text] The European Space Agency (ESA) has recently awarded Tecnospazio, a Comau, Fiar joint company a contract to automate the scientific experiments to be conducted on board the Columbus module of the international space station Freedom. Under the Integrated Payload Automation contract, Tecnospazio will define the methodology and developments necessary to carry out the experiments. These activities must become more automated because the astronaut, at least during the first years, will only go to the Freedom station to carry out maintenance and supply operations on the module. The ESA contract—the total value of which is unknown—involves setting up interactive experiments aboard the module that will be simulated and tested on the ground using the Telespazio Columbus Automation and Robotics Testbed that will be shortly installed at ESA laboratories.

### Increased Market Potential for Airbus A319 Suspected

92WS0579A Bonn LUFT- UND RAUMFAHRT  
in German Mar-Apr 92 p 4

["Airbus: Market for 450 A319s"]

[Text] New estimates from Airbus Industrie (AI) yield a greater market potential for the A319 than previously assumed. Sales could reach 450 units by the year 2009. Besides, AI believes that the A319 sales could generate an additional 250 orders for the A320/A321 due to the commonality effects of the airlines.

Meanwhile, a dispute over the national shares of the individual Airbus type programs has arisen between Aerospatiale and Deutsche Airbus (DA). According to Jacques Plenier, head of the Aircraft Division of Aerospatiale, the French share has continuously dropped. The French share went from 44 percent in the A300 to 40 percent in the A310 and A320 while the German share grew from 30 percent to 34 percent. If DA does final assembly of the A319 (if this aircraft is manufactured at all), the French share for this type would only be 30 percent. Then, the German share of the work over all programs would be an average of 37.8 percent, the French share 37.78 percent. Consequently, these would reach the shares of both countries (37.9 percent each) of the Airbus consortium. However, Aerospatiale obviously wants the country shares in each individual Airbus type to correspond roughly to the capital interest in AI.

### Deutsche Airbus Currently Testing Carbon Fiber Airfoil

92WS0579B Bonn LUFT- UND RAUMFAHRT  
in German Mar-Apr 92 p 6

["Deutsche Airbus Tests Carbon-Fiber Airfoil"]

[Text] Deutsche Airbus GmbH has been developing a complete wing unit using carbon-fiber construction (CFK) since 1987. The wing frame is now entering the testing stage. During static tests and an operational strength test, the behavior of the wing frame will be tested under realistic loads. Also, leak tests are being performed in the tank area.

According to an announcement by Deutsche Airbus, this technology program is the first attempt at building a complete wing unit using CFK in civilian aircraft manufacture. The CFK wing frame was constructed at the Stade factory, the plastics center of Deutsche Airbus. However, it does not have the moving parts such as the wing flaps, aileron, or spoiler.

Following the initial successful static tests, it was determined that the measured data agreed with the computed values. The knowledge gained thus far, in particular the detailed tests of the expected manufacturing costs, form the basis for deciding whether the wing frame will enter series production in the future.

As advantages over a conventional aluminum airfoil, Deutsche Airbus lists not only a savings in weight of about 20

percent but also the absolute resistance to corrosion and the airfoil's response to continuously recurring loads that is far superior to any metal.

### Eurocopter, BAe Pledge Long-Term Cooperation in Defense R&D

92WS0579C Bonn LUFT- UND RAUMFAHRT  
in German Mar-Apr 92 p 8

[Article by not given: "Eurocopter Cooperating with BAe Defence"]

[Text] Eurocopter S.A. (Aerospatiale and MBB) and BAe Defence Ltd. announced in an agreement their intentions of looking at long-term potential cooperation to be able jointly to meet the requirements of the British Ministry of Defense. In so doing, the helicopter know-how of Eurocopter will be combined with the experience of BAe Defence as the prime contractor of the British Ministry of Defense so that integrated systems can be offered by a single source.

The need of the British armed forces for an attack helicopter is behind this marriage of convenience. The two companies wish to offer the German-French helicopter Tiger, armed with Trigat missiles. The British Ministry of Defense has indicated, according to statements by Eurocopter, that this proposal would receive a fair chance with other competitors.

The possibility of jointly selling a successor to the Wessex and Puma helicopters also will be investigated.

### Germany: Airbus Industrie Investigating Ultra-High Capacity Aircraft

92WS0580A Bonn LUFT- UND RAUMFAHRT  
in German Mar-Apr 92 pp 28-30

[Unattributed article: "Europa-Jumbo Airbus UHCA"; first paragraph is LUFT- UND RAUMFAHRT introduction]

[Text] The predicted growth of air travel worldwide will lead to the development of very high capacity aircraft. At Airbus Industrie, design and market studies are already being conducted for an aircraft that can carry from 600 to 800 passengers.

Worldwide air travel should continue to grow in the foreseeable future. At least that is the assumption on which all market studies of the large aircraft manufacturers are based. The infrastructures both at airports and for air safety have however currently reached the limits of their capacity. Thus, if the demand continues to increase according to the predictions (not in the least due to the opening of the European internal market as of the beginning of 1993), new capacities must be created. This concerns both the infrastructure on the ground and the fleets of the airlines. Thus it must already be taken into account that the average capacity of aircraft will continue to increase, and, primarily for long range aircraft, there is the issue of the replacement for the largest civilian aircraft in the world to date, the Boeing 747, which holds approximately 400 passengers in a typical three class seating arrangement.

Boeing itself is currently studying three alternatives for a successor for today's 747-400. If the top deck or the fuselage is stretched to be able to accommodate 480 to 560 passengers, the range must be shortened by 20 to 25 percent. However, retaining the range of 14,000 km would be possible only with a completely new wing, whose development would result in very high costs. Consequently, Boeing is also

studying the alternative of developing a completely new aircraft in a single step, which would probably be called the Boeing 787 (according to the current working name 747X).

McDonnell Douglas also has extensively revised the former plans for the MD-12, which initially was supposed to be merely a stretch version of the MD-11. A concept is now being sought which would—like the dual A330/A340 project—make both a two- and four-jet version possible with largely identical construction.

With the A340, Airbus Industrie developed the largest European aircraft to date, which is supposed to enter airline service early in 1993. The capacity of the A340, at approximately 260 to 290, was designed such that this aircraft can cover the market segment just below the Boeing 747. However, for a some years intensive studies for a very high capacity aircraft (600 to 800 passengers) have already been underway both at Airbus Industrie and among the partners under the name UHCA [Ultra High Capacity Aircraft].

The most pressing need for such an aircraft must be anticipated in the Far East, where above average growth rates have been noted in recent years. The demand both within the Asian-Pacific region and over the Pacific to North America, not to mention from the Far East to Europe, is increasing very rapidly, and consequently the airlines operating in this region are among the most significant potential customers for the UHCA. This was also revealed in a survey conducted by Airbus Industrie first with 10 airlines in Asia, Europe, and North America. These companies anticipate a need just after the year 2000 for an aircraft whose seating capacity (with the same range of 13,000 km) must be roughly 50 percent greater than that offered today by the Boeing 747.

At Airbus Industrie, they are convinced that new technologies are essential to reach the objective of reducing per-seat operating costs 15 percent below current Boeing 747 values.

Airbus Industrie anticipates the greatest energy saving potential of approximately 20 percent from advanced aerodynamic concepts. These include the additional reduction of friction, interference, and induced resistance, variable wing curvature (as originally already planned for the A340),

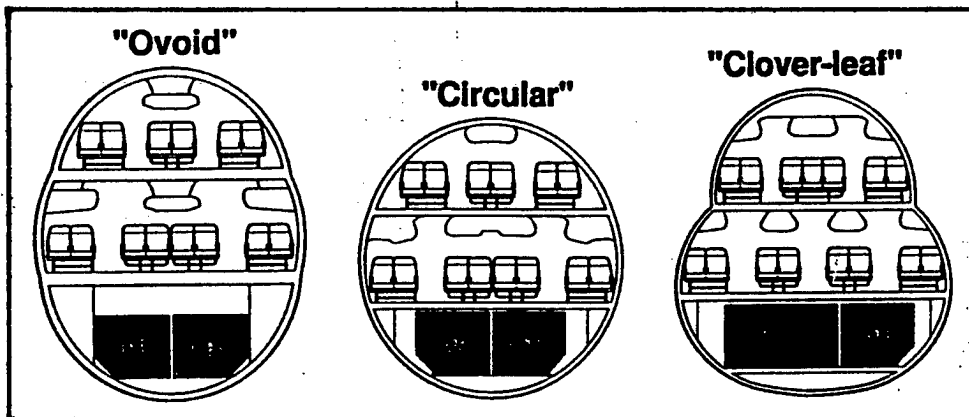
and monitoring of the turbulence caused by shockwaves, as well as improvements in the low speed range.

Significant improvements must naturally be expected from the drive. Thus, engines with a significantly higher bypass ratio should be available. At General Electric, the GF990 with a bypass ratio of approximately 10 is under development (current fan engines: approximately five to six); and Pratt & Whitney is investigating (along with MTU and Fiat) the implementation potentials for the ADP [Advanced Ducted Fan], which, like the MTU-proposed alternative CRISP [Contra Rotating Integrated Shrouded Propfan], operates with significantly higher bypass ratios and correspondingly favorable fuel consumption figures. Additional innovations, primarily in the circulation process of the core engine itself or even in the improved integration of the engine and the airframe would lead to reduced fuel consumption, estimated at approximately 18 percent by Airbus Industrie.

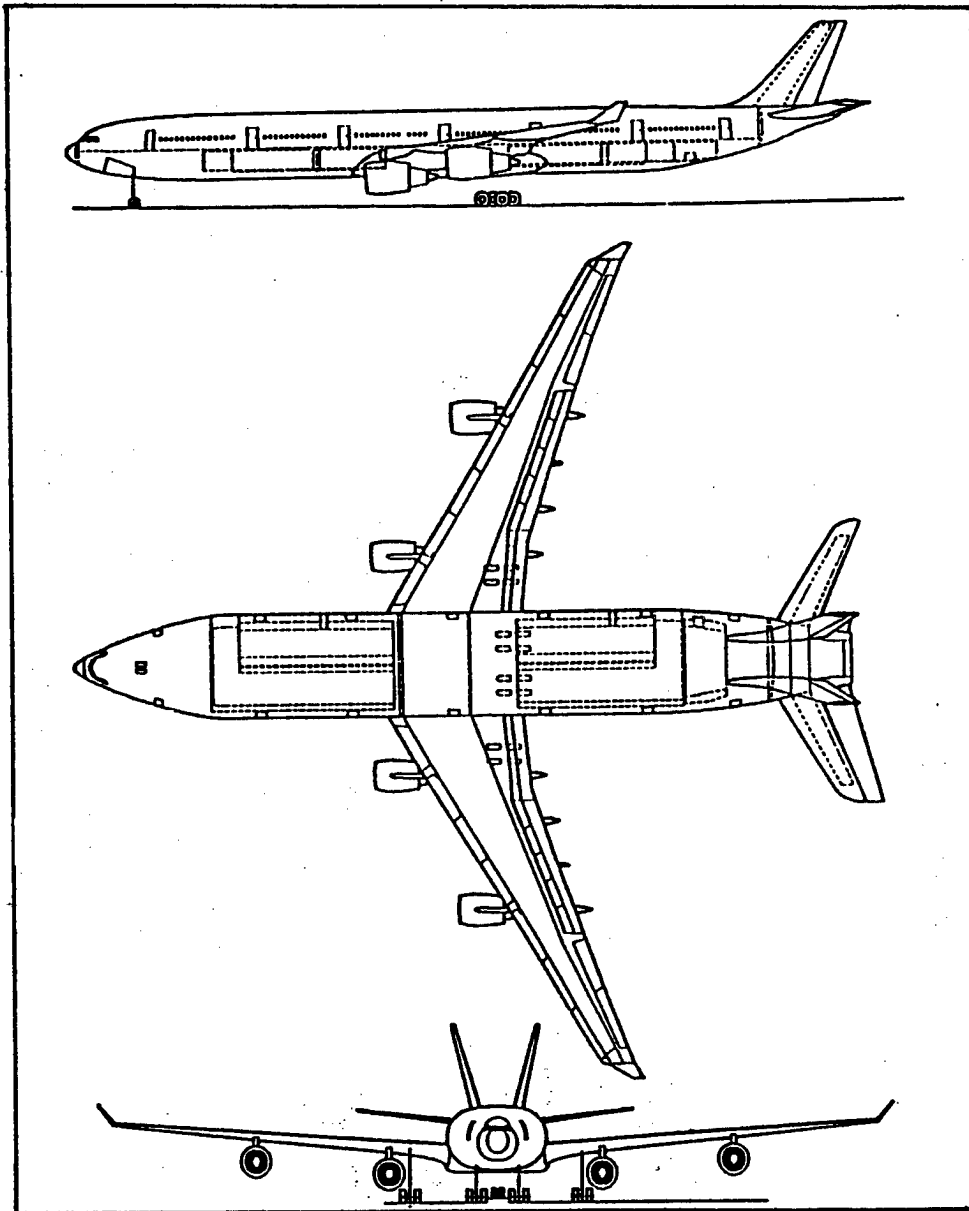
An additional 6 percent should be gained with advanced materials. This includes not only the widespread use of composite fiber materials, but also metal sandwich structures, aluminum-lithium, or even ARALL, a composite of aluminum and glass fibers. An additional 2 percent savings in fuel consumption should be anticipated with improvements to the various onboard systems.

A majority of these technologies are not yet available today. They would first have to be developed in a demanding technology program, in order to be available no later than 1997, when the UHCA should enter development and then be on the market beginning in about the year 2002.

Independent of these technologies, various aircraft concepts are currently being studied for the UHCA. The concepts of the Airbus partner companies and of Airbus Industrie still differ significantly and are being subjected to comparative evaluation. Deutsche Airbus favors a high oval fuselage cross section with three decks positioned one above the other (Study DA 2000). The advantages consist in a relatively short fuselage and favorable weight relationships, whereas both the freight volume and evacuation problems are among the less attractive features of this concept.



Airbus partners are studying concepts in multideck arrangements with differing fuselage cross sections

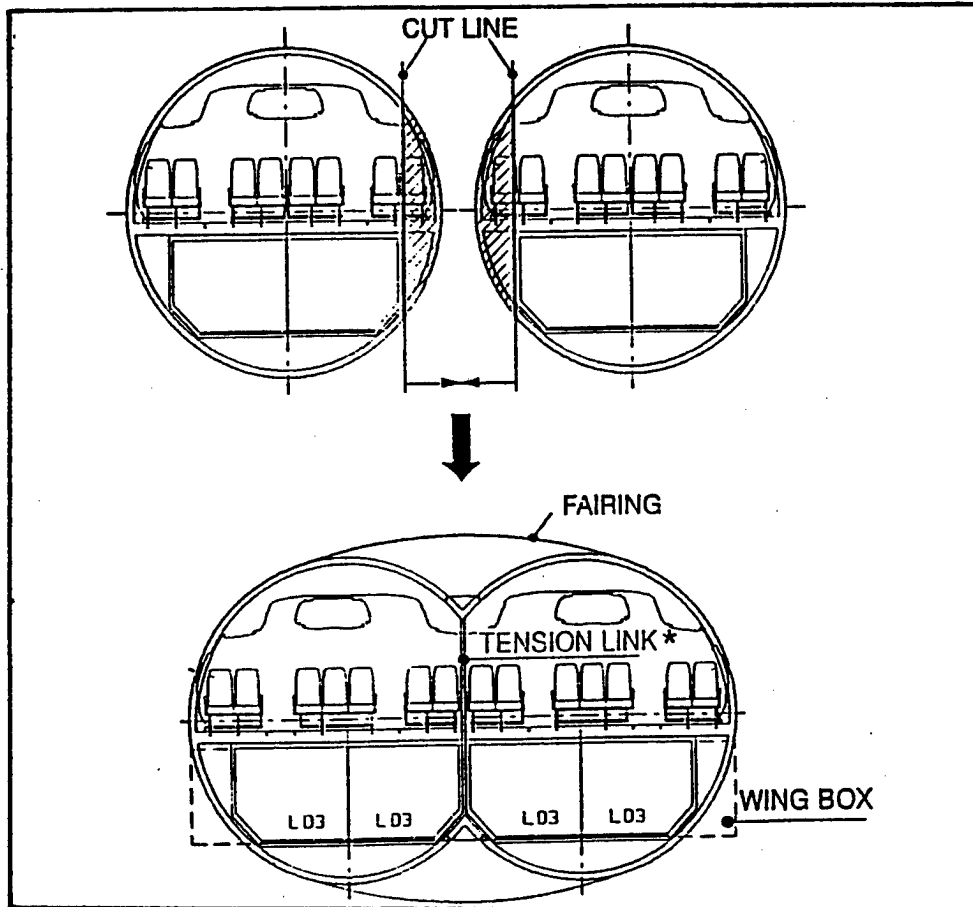


The Airbus Industrie UHCA concept with two adjacent fuselage tubes adopted from the A340 program

In contrast, in the competition of ideas with the partners, Airbus Industrie is investigating a very unusual layout: Two fuselage structures with the cross section conventional in the Airbus jumbo program are arranged next to each other, resulting in a horizontal "double-bubble" cross section. For this concept Airbus Industrie is advancing a group of advantages. Above all, with this design jumbo fuselage assemblies, systems, and components from the A340 program could be adopted so that development and production costs would be held down. Furthermore, the extremely wide fuselage seating arrangement with high comfort (four aisles with 14 seats, a maximum of three adjacent to each other, in a row). Four rows of containers could be installed next to

each other in the area below the floor. Additionally, the very wide middle section of the wing passing through the fuselage offers a large tank volume, and even the installation of the very complex landing gear in aircraft of this size would present no problem.

In addition, there is an interesting aerodynamic effect: The flat oval fuselage contributes significantly to the lift of the aircraft so that the wing span would not have to be so great. Because the dimensions of a UHCA could lead to problems on the aprons and the parking areas at the gates if they significantly exceed 65 m in width and 70 m in length.

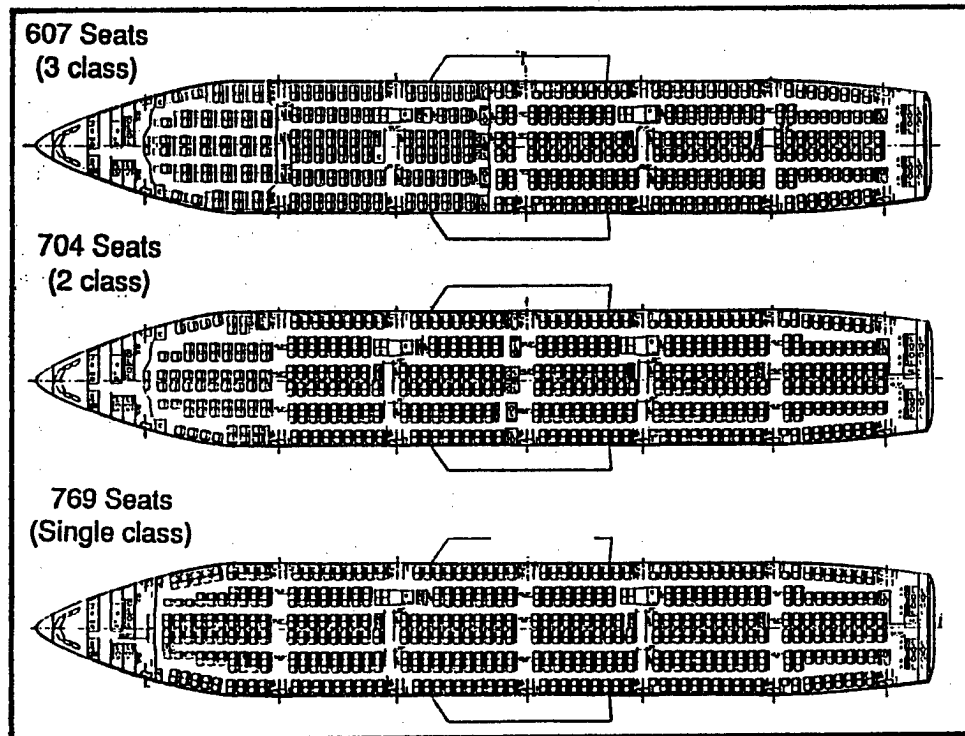


For the design of the aircraft this means new limit conditions, and the concept of the fuselage generating lift could be a solution to the wing span limitation.

However, in addition to all economic and technical issues, there will be new ways of industrial cooperation with the UHCA.

Because the sales focus will lie, as mentioned, in the Asian-Pacific region, cooperation with firms located there

presents itself. Boeing already has close ties with the Japanese aircraft industry in the 767 and 777 programs. For Airbus Industrie it will likewise be a matter of finding partners in this region, and the European consortium is ready to bring Japan in as a venture partner in this program at about 25 to 30 percent. Companies in Korea, Indonesia, and Singapore could also be included. Thus the risk associated with the high development costs of approximately \$4.5 billion to \$6 billion could be covered.



Depending on class division, the cabin of the UHCA could accommodate between 607 and 769 passengers seats with four aisles

### Germany, Russia Discuss Joint Space Effort

92MI0587 Bonn *DIE WELT* in German 15 Jun 92 p 15

[Text] For the first time in the 35-year history of space travel, the Federal Republic is considering embarking on a massive space program with the Russians. At the beginning of the International Aviation Exhibition (ILA 92) in Berlin-Schoenfeld, Werner Heinzmann, the board member responsible for space travel at German Aerospace (DASA), reported that a plan has been worked out to build a joint space station.

The idea had already been agreed on with DASA's most important partner, the French Aerospatiale. The Federal Republic and the Russians, too, could profit from the preliminary developments that had already been carried out in Germany. On behalf of the European space organization, plans had long been followed for a free-flying space laboratory known as a man-tended free flyer (MTFF). In view of the substantial budget cuts—the Federal Republic, for example, can provide only about 11 billion German marks [DM] for ESA [European Space Agency] by the year 2000 and not, as agreed in 1987, DM20 billion—the MTFF could not now be implemented.

On the other hand, as the Russians must also replace their space station Mir-1, which is gradually becoming old, with a Mir-2 in a few years' time, the MTFF could also be made into the central part of this station. The manned scientific laboratories that are currently still in Mir-1 would then also

be connected up to this central part. It will take sensitivity and flair to implement the plan envisaged by Heinzmann, because in spite of the new world space initiative to build a space station jointly with the Russians and other European partners, the German company is still backing the plans to participate in the American space station Freedom, which is to be set up in space as of 1997. Consequently, a complicated triangular European-American-Russian relationship in space may well be in store.

### Ariane's Successes, Failures, Future Viewed

92WS0589B Duesseldorf *HANDELSBLATT* in German 22-23 May 92 p 26

[Text]

### Space Travel: Europe's Launch Vehicle With German Aid

#### 68 Satellites Already Put Into Orbit by Ariane

A triple Ariane anniversary was recently celebrated in France, with guests of honor attending from the European countries involved in construction of the launch vehicle. The 500th Viking rocket engine for the European rocket was delivered at the engine manufacturer "Societe Europeene de Propulsion" (SEP) in Vernon near Paris. Meanwhile, the 50th launch of the European rocket and the conclusion of the 101st satellite transport agreement were being celebrated at the Arianespace marketing organization. Ariane's

position in the world market for civilian cargo launch vehicles has become stronger. German firms are also involved in the construction of the European rocket Ariane.

Like the development of the European launch vehicle, the history of the Viking motor for propulsion of the first and second Ariane stages has been a long series of difficult design and testing projects, carried out primarily by France since 1972, particularly at SEP. Ariane models 1 to 4 owe their success to their conventional but solid and proven technology, and that holds true as well for the Viking engines with their mid-range performance level and high reliability. The Ariane-44L, with four main engines in the first stage and four liquid fuel boosters plus one engine in the second stage, brings to nine the total of Viking assemblies in use, and thus far all have functioned flawlessly.

#### Launch Failures Due to Human Error

Both of the Ariane launch failures caused by the first stage were due to human error during final testing, so that impurities in the engine were overlooked. This type of rocket engine is a highly complex machine which must be capable of exceptional performance at extremely high pressures and temperatures in its few minutes of operation.

The validity of Ariane's technical design is also revealed in the scientific success of the European rocket, which has now conquered over 50 percent of the world market for civilian satellite transport; payloads are primarily communications satellites for the geostationary earth orbit. Ariane's expanded capability with various additional rockets still makes it possible to transport two payloads per rocket despite higher satellite weights, which has a very favorable effect on the price and competitive edge. A total of 68 satellites have been transported with the 50 Ariane launches made to date, including earth resources technology satellites like the Giotto space probe to Halley's Comet.

#### A Very Successful Export Article.

The fulfillment of the 101 launch agreements obtained by Arianespace to date represents a financial volume of about 10.7 billion German marks [DM]. Over half of the turnover results from services for customers outside Europe; the Ariane rocket is thus a very successful export article. If one does not include the development costs paid for by the state, then the Arianespace marketing organization makes an annual profit, which is returned to the stockholders as dividends. Last year it was DM4.6 million.

The future of the European portion of the worldwide satellite transport industry will be guaranteed by the development of the new, more powerful Ariane-5 rocket, which is supposed to be ready for use by 1996 and can transport three of the modern communication satellites at once. The three German firms MBB-Erno, MAN-Technologie, and Dornier are also involved in this new Ariane model, together accounting for about 20 percent of the total development costs. In about 10 years, the Ariane-5 rocket is also to transport the manned European space plane Hermes into earth orbit for the first time. The Vulcain main engines for the middle stage, with hydrogen and oxygen propulsion, as well as two solid fuel boosters on the side form the core of

the Ariane-5. These components will also be developed largely at SEP in Vernon and Bordeaux. Altogether France is bearing about 55 percent of the development costs for the Ariane rocket, which is estimated to total about DM10 billion.

## AUTOMOTIVE INDUSTRY

### Direct Injected Diesel Engine Cuts Fuel Use, Emissions

92WS0598C Duesseldorf HANDELSBLATT in German  
4 Jun 92 p 24

[Article by Gerald Eifler: "Exhaust-gas Recirculation Can Greatly Reduce Emissions"]

[Text]

### Engine Technology/Direct-injection Diesel Engine—Chance as the Power Plant of the Future

The direct-injection diesel engine exhibits unequalled fuel consumption due to the lower process losses. On average, it is about 15 percent to 18 percent lower than for comparable pre-chamber diesel engines. Exhaust-gas recirculation has also succeeded in significantly reducing the emissions of this engine. Researchers at the Rhine-Westphalian Technical College (RWTH) of Aachen are sure that the future belongs to this diesel engine.

In contrast to pre-chamber engines, the fuel in a DI diesel engine is not injected into a pre-chamber or whirl chamber but instead directly into the combustion chamber. This special combustion method, however, gives it higher nitrogen oxides and hydrocarbon emissions as compared to the pre-chamber engine. A particularly advantageous measure for reducing these polluting emissions is exhaust-gas recirculation (EGR). This has been shown by comprehensive studies at the Chair for Applied Thermodynamics of the RWTH of Aachen.

In exhaust-gas recirculation, combustion gas is taken from the exhaust manifold and mixed again with fresh intake air. The connecting line from the exhaust manifold to the intake manifold can be throttled or even blocked completely by an EGR valve. In principle, recirculating exhaust gases can be used in any internal-combustion engine to reduce nitrogen oxides.

Essentially, the positive effect of this process results from a larger gas mass not participating in combustion. This mass takes heat from the combustion process and reduces the peak combustion-chamber temperatures in excess of 2000°C that occur only locally. It also reduces the probability of the combination of fuel and oxygen molecules that are susceptible to reaction. This causes slower fuel conversion and further reduces the peak temperatures in the combustion chamber.

In addition, exhaust-gas recirculation on the DI diesel engine has a positive effect on the critical hydrocarbon emissions in part-load operation. This is because it has been shown that increasing the charge temperatures helps primarily here. Recirculation of uncooled exhaust gas directly into the intake manifold can increase, at typical operating points

in the part-load range, these temperatures from 20°C to greater than 100°C. This reduces hydrocarbon emissions by about 30 percent to 40 percent.

The described effect on the peak combustion-chamber temperatures and thus the nitrogen-oxide-reducing effect remain in spite of the higher charge temperatures. As hydrocarbons are emitted not only in gaseous form but also to a high degree attached to small soot particles, the uncooled exhaust-gas recirculation also has a positive effect on the particulate emission. The amount of hydrocarbons attached to soot particles and the amounts that can be affected by exhaust-gas recirculation can be up to 80 percent in a DI diesel engine.

By appropriately metering the exhaust-gas recirculation, not only is the total particulate exhaust of the engine reduced by decreasing these components, the composition of emitted particulates is also improved. The chart shows the emission reductions possible for exhaust-gas recirculation at an operating point in deep part-load as a percentage. Besides the stated advantages, it should be mentioned in particular that exhaust-gas recirculation is very well suited to combined use with an oxidizing catalyst.

In this case, the totally reduced exhaust-gas mass flow acts such that the flow speeds decrease in the exhaust-gas system and the pollution molecules stay longer in the catalyst. Besides, the uncooled recirculation increases the exhaust-gas temperature. Both promote conversion of pollutants in the catalytic exhaust-gas post-treatment system.

Modern automobile DI engines of the future, however, will not be able to get by with only one measure for reducing pollution. Even today it has been shown that exhaust-gas recirculation, exhaust-gas turbocharging with charging-air cooling, electronically controlled injection and catalytic exhaust-gas post-treatment must be combined. However, optimal interaction between the different engine components must be ensured not only in stationary operation but also under variable conditions.

To a greater degree the trend is on to simulate the loads of genuine vehicle operation on the engine dynamometer through the use of computer control systems and to investigate specific prototype engines under variable load conditions. Compared to conventional tests in the vehicle, this provides the advantage that the units under test on the dynamometer are much more accessible and can be more easily equipped with measuring equipment. During this optimization work, clear improvements in hydrocarbon and particulate emissions were achieved.

Research at the Chair for Applied Thermodynamics at the RWTH of Aachen has the goal of being able to provide DI vehicles in the foreseeable future that, while retaining the stated advantage in fuel consumption, are at least equal in terms of emissions to the current crop of low-polluting environmental diesel vehicles. In this context, the pollution limits (carbon monoxide, hydrocarbons, nitrogen oxides corresponding to the current U.S. limits; particulate limit = 0.08 g/km) known in the Federal Republic under the key word "Potter's standard" serve as a standard.

### Renault Launches Robot for Auto Manufacture

92WS0608B Paris *TECHNIQUES ET EQUIPEMENTS DE PRODUCTION* in French  
May 92 p 19

[Article by L.V.: "Renault Automation Launches the XR 700"; first paragraph is *TECHNIQUES ET EQUIPEMENTS DE PRODUCTION* lead]

[Text] Design improvements mean fewer components, greater reliability, and lower pricing. Peugeot has already ordered 65 copies.

The Acma XR 700 is typical of a robot intended for the automobile market. It is described as a six-axis machine with a loading capacity of 125 kg, 0.3 mm repeatability, and a 2.5 m operating radius. The focus on design has resulted in very calculated improvements. The cycles of some 100 robots were studied to determine which axes were used the most. As a result of this study, particular attention was given to axes 2 and 3. The robot was also designed so that all links (electronic, pneumatic, or other) could be built into the arms, thereby increasing the occupied surface. Axis 1 has 360° rotational capability, an uncommon feature in robots of this size, which facilitates its integration into a shop.

Another key design element is the development of reliability, maintainability, and availability criteria based on Ambdec and analyses of the value added by each function. "We systematically sought the least expensive, simplest solutions that required the fewest components," says Michel Fayolle, chief of Renault Automation's robot products department. Simplification of the kinematic linkages led to an overall 30 percent reduction in the number of components. The old pneumatic balancing, which was sensitive to potential circuit dysfunctions, has been replaced by mechanical balancing using a spring and counterbalance mechanism.

According to Michel Fayolle, the systematic use of proven solutions insures the "high reliability" of the Renault Automation robot. It is considered so reliable that, on large contracts, the manufacturer is prepared to guarantee a downtime one-fifth that of the previous model.

Commercially, the reduction in the number of components means a reduction in price. The price difference could be on the order of 30 percent for a robot that is more powerful than the X 88. This pricing effort has paved the way for a first contract with Peugeot. Sixty-five XR 700s will be installed in the new Sevelnord plant in Valenciennes for the single-seater U-60, designed jointly by Peugeot and Fiat and scheduled to come out in 1994.

The nationality of robots is often a moot point. The XR 700 is, if not very "French," at least strongly "European." This is true of all the components of the kinetic chains except for the wrist reducing gears, which are manufactured by only three companies in the world, all Japanese. This decision to "go European" constitutes "a guarantee of reliability and long life," according to Michel Fayolle. "We did not underdimension anything because our studies show that robots are required to work at a faster rhythm in France and Europe than in Japan."



### **Volvo Builds New Automated Car Factory**

*92WS0615A Stockholm NY TEKNIK in Swedish  
21 May 92 p 4*

[Article by Harry Amster: "Robots Building New Volvos"—first two paragraphs are NY TEKNIK introduction]

[Text] Volvo is building a new automated car body plant in Goteborg. Over 150 industrial robots will produce the new 850 GLT model.

Production in one of Europe's most modern car factories will begin in 1994.

Beginning in 1994 the front-wheel drive 850 GLT will be manufactured at the Torslanda plant. Today all final assembly occurs in Ghent, Belgium.

Plans call for Volvo's Swedish factories to reach the same quality and efficiency as the factory in Ghent within two years.

Guidelines concerning the technical solutions that will be chosen are being drawn up at this time. A new body factory will definitely be built:

"The new body plant will have 80-90 industrial robots in the first phase and when it is fully developed it may have over 150 robots," said Bengt Goran Olsson, leader of the robot testing project.

Three big robot manufacturers are vying for the huge order. They are the American GMF, Germany's Kuka and Sweden's ABB. The various robots are currently being tested on the 240 model production line.

"We are testing them on wheel well production because this section demands a great deal from a robot. It must go into both the front and rear of the body and it has to turn 180°. It must take care of the inside and outside, so this job is very demanding," Olsson said.

Volvo decided on robots because they provide better quality, speed and precision. For example, it is easier to damage the finish if welding is performed manually.

"No one views robots as competitors today. The robots do all the hard, cramped and dirty jobs," Olsson said.

They have still not decided which robot manufacturer will get the big order:

"The decision will be made this summer and the purchase will be made by fall."

So Sweden's ABB has still not been counted out?

"No, robots today are so good that theoretically you can use any manufacturer. It depends on the total solution we are offered. We want to avoid putting a lot of small pieces together ourselves."

The future goal is to simulate the entire production at a desk. The simulation program will then be sent to the robot in the factory via diskette and production will get started immediately.

Robots now manufacture a large part of the body of the 940 model at the Torslanda plant. However there is still more manual work involved in the 240 model.

The final assembly of the 850 model now occurs in Ghent. The body welding and the "interconnection" where the body meets the chassis, drive package and axles are automated. The cost of the body factory and final assembly was two billion kronor.

"We will also have the heavy aspects of the 850 such as laser welding, the 'interconnection' and gluing performed in Torslanda. We are investing a billion kronor in machinery, tools and training," said Klas Magnusson, public relations director for the passenger car division.

Installation will begin in July 1993. Then it will take half a year to put all the machinery in place and conduct trial runs before production starts.

There are 170 robots in Ghent. At the Renault factory in Flins, where the small Clio car (NY TEKNIK 1991:8) is manufactured, 220 robots have taken over the entire body plant and parts of the final assembly. Volvo's new body factory with 150 robots will thus be one of the most automated and modern factories in Europe.

Production of the 850 model started in Ghent in the middle of 1991. Production this year is estimated at 60,000 cars.

Volvo has invested a total of 16 billion kronor in the new car, 12.5 billion in Sweden and the rest in Belgium.

### **Use of Plastics in Trucks Predicted**

*92WS0661M Toddington NEW MATERIALS  
INTERNATIONAL in English Jun 92 p 8*

[Article: "Europe: Plastics Usage in Trucks Set To Grow 50 Percent"]

[Text] A recently completed joint sponsored research project suggests that plastics producers should look more to the European truck industry in the future.

One of the main conclusions of the report is that total plastics consumption by the truck industry should rise by at least 50 percent over the decade. In addition, the successes of certain processes, such as resin transfer moulding (RTM) should become more assured as vehicle and materials producers alike strive for higher quality products in the low production volume environments of truck making.

At the same time materials such as ABS are seeing a decline in popularity as cost and performance improvements make other alternatives more attractive.

The project, by Knibb Gormezano & Partners (KGP) of Derby, UK, covered all major truck production activities in Western Europe and vehicle types from 2-tonne GVW vans to maximum weight heavy goods vehicles.

Estimates of present consumption of plastics, together with the forecast to the year 2000 were constructed for each of the four weight classes within the overall range.

But the growth in the use of plastics in the European truck industry depends on the state of the industry itself. For

example, according to KGP sales of light commercials in the 3.5- to 7.5-tonne sector will decline 37 percent in the decade to the year 2000. But those in the 7.5- to 16-tonne sector will rise 17 percent with heavy weights above 16-tonnes rising by 11 percent. In this last sector, rigid vehicle sales will decline whilst those of articulated units, with their heavy dependence on plastics, will rise by 25 percent, according to KGP.

The overall effect is that plastics consumption could rise from about 80,000 tonnes in 1990 to 110,000 tonnes in 2000. Plastics consumption attributable to light commercials could rise from about 50,000 tonnes in 1990 to about 75,000 tonnes in 2000.

According to KGP the average weight of plastics in a light truck is typically 50 kg. By 1995 this will have risen to 60 kg and by the year 2000 it will be 71 kg, according to KGP's calculations.

The biggest contribution is made up by components in sheet moulded compounds (SMC) based on unsaturated polyesters and produced by the compression moulding route. These now account for 18 kg per truck, moving up to 21 kg by 1995 and 25 kg by 2000.

Polypropylene and the copolyester components made by blow moulding account for a further 10 kg, moving up only slightly to 10.5 kg in 1995 and 12 kg in 2000.

A similar picture is shown for polyurethane soft foams (made by the open or closed mould RIM foaming technique) which will grow marginally from 10 kg in 1990 to 12 kg in 2000.

Main growth will come from the spread of hot pressed glass mat polypropylene thermoplastics, which will move from almost zero in 1990 to 3 kg in 1995 and 6 kg in 2000, and glass reinforced plastics using the RTM route. Here content will again move from near zero in 1990 to 3 kg in 1995 and 7 kg in 2000.

Wider use of polyurethanes will rise from 2 kg per vehicle in 1990 to 4 kg in 2000.

According to KGP the entire study was based on a combination of desk research and interviews with specialists in the truck and plastics industries.

In passing, interestingly, DRI has produced a forecast of commercial vehicle sales up to 2000. This shows that in the six major countries of Europe (UK, Italy, France, Germany, Spain and the Netherlands) light commercial (up to 3.5 tonnes) sales will go from 1,108,000 in 1991 to 1,246,000 in 1995 and 1,425,000 in 2000.

By the same token sales of vehicles over 3.5 tonnes (6 tonnes in some countries) will rise from 225,600 in 1991 to 208,700 in 1995 and 215,256 in 2000.

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## BIOTECHNOLOGY

### European Team Completes Chromosome Sequencing

92MI0531 Bonn DIE WELT in German  
26 May 92 p 25

[Article by Rolf H. Letusseck: "First Complete Chromosome Fully Analyzed"]

[Text] European molecular genetics laboratories have announced the successful completion of an ambitious project: For the first time, an entire chromosome has been completely sequenced. The study was carried out on baker's yeast chromosome number 3, the third smallest of the total of 16 yeast chromosomes.

Chromosomes are filiform carriers of an organism's genetic make-up, they are located in its cell nuclei and made up of deoxyribonucleic acid (DNA). Sequencing involves analyzing the DNA strand down to its molecular building blocks, or bases. In doing so, it is crucial to record with painstaking accuracy the sequence in which the bases are ordered, as each DNA consists of only four different bases.

Any three of the bases form a triplet that contains the information for an amino acid, so the order of the triplets determines the sequence in which the amino acids are linked to form a protein. This basic principle makes it possible to create a virtually unlimited variety of protein structures from a small number of building blocks. The project has now successfully revealed the sequence of 315,357 bases in the entire chromosome.

The sequencing of what is to date the longest continuous base chain is the result of a joint project undertaken by 147 colleagues working in 35 laboratories in 10 different countries, including six German research institutes. The project was organized by the European Community, which funded it with a 5 million German mark [DM] grant.

A total of 182 coding genes were found in the chromosome, only 34 of which were previously known. Fifteen of the genes found for the first time in yeast were already known from other organisms. They included some "housekeeper genes," so called on account of their carrying information on vital metabolic processes. As these processes are similar in most organisms, it comes as no surprise that the genetic information is identical or similar.

Even the researchers, however, were baffled by some of these 15 genes. For instance, the gene for the transducin beta chain is present in both humans and in baker's yeast. Transducin is a large compound protein formed from the three subunits—T-alpha, T-beta, and T-gamma—and plays a role in information processing in the human eye's photoreceptor cells. The T-beta chain's role in yeast has not yet been discovered, however.

The discovery of a nif gene was an even greater surprise. These genes are typical of bacteria and blue-green algae, which fix nitrogen from the air. Yeasts are not capable of doing this, though they nevertheless possess such a gene, which furthermore is vital to them, as the yeast cells die if the gene is destroyed by mutation.

Initial studies suggest that the protein coded by the *nif* gene is involved not only in fixing nitrogen but also in the metabolism of the mitochondria, minute organelles in which energy from nutrients is converted into a form suited to the particular organism.

Around 80 percent of the genes found were not previously known, however, even in other organisms, and their functions are as yet a matter for speculation. The high percentage of these is in itself significant: The authors in fact comment, in an article on their work published in the British scientific journal *NATURE* (No 357, page 38), that this shows how conventional methods reveal only a small proportion of the genes present, even with the yeast genotype, which has been so intensively investigated.

There is nothing arbitrary about the choice of chromosome for systematic sequencing; as sequencers put it, they do not "fish" for special genes. On the contrary, they have frequently looked to date for key enzymes or known proteins of particular importance. "That way you just find what you've been looking for," is what Hans-Werner Mewes of the Martinsried Institute of Protein Sequencing (MIPS) has to say about the conventional procedure.

The MIPS, a team drawn from the Max-Planck Institute of Biochemistry at Martinsried, near Munich, has played a major part in the sequencing of the yeast chromosome. While Professor Oliver of Manchester University was responsible for coordinating the allocation of the DNA material, Dr. Mewes and his colleagues were responsible for processing and analyzing the results as they came in. Dr. John Sgouros analyzed every coding gene by comparing it with the 50,000 known sequences in the MIPS database and constructed the chromosome's complete sequence, as each team investigated only a specific section of the chromosome. "Despite its complexity, the work division strategy was very successful," says Mewes. "American colleagues initially thought we would never manage it."

The teams are currently engaged in sequencing chromosomes 2 and 11, both of which, with lengths of 600,000 and 800,000 bases respectively, are considerably larger than chromosome 3. From 1993, two more chromosomes are to be tackled, provided funding continues.

Over all, the 16 yeast chromosomes consist of 16 million bases, whereas the figure for the human genotype is in the region of 3 billion. These figures make it doubtful whether the sequencing of the human genotype, which has been under discussion for several years, is currently feasible in return for a justifiable outlay. "For a long time it was thought that sequencing techniques would improve substantially and speed up the work," says Mewes. "But the major breakthrough has not yet been made."

#### **Italy: EC Research Center Sets Up Pharmaceutical Data Base**

*92MI0563 Milan ITALIA OGGI in Italian  
3 Jun 92 p 28*

[Article by Fiametta Bonazzi: "EC Data Base on Pharmaceuticals Takes Off"]

[Text] All the up-to-the-minute pharmaceuticals. More than 150,000, the number of pharmaceuticals circulating within the EC contained in a database that may be accessed beginning in 1993.

The EC has assigned the JRC [Joint Research Center] Institute for the Environment in Ispra near Varese with the technical installation of this database called EPCHIN [European Community Pharmaceutical Information Network]. The goal of the authorities in Brussels is to set up a comprehensive information system for the pharmaceutical sector that can act as a support tool to promote EC legislation in this sector.

"The pharmaceutical database," explained Mirto Boni from the Institute for the Environment, "will complement the services already offered by the ECDIN network which classifies and qualifies chemicals, especially the coefficient of their environmental impact. The goal is to exert concerted control on pharmaceuticals."

EPCHIN's primary task will be to collect information supplied by the authorities in each country in addition to information supplied by pharmaceutical manufacturers. The chemical substances in each product will be listed and compared as will the recommended use, dosage, and retail price in the 12 markets. "A great need is felt in this market for transparency and regulations," observed Patrick McCutcheon who is in charge of the project, "and EPCHIN could be the first step toward the development of a single pharmacopeia."

A pharmaceutical crusade began in Italy in the 1970s (led by attorney Gustavo Ghidini), to regulate the information contained in the instructions enclosed with the medications. In fact, for many specialists the Italian instructions appeared to be far more reticent than similar instructions provided in France or Germany. Since then EC regulations have progressed through a series of basic acts: from Directives No. 65 in 1965, and Nos. 318 and 319 in 1975 to standardize legislation on pharmaceuticals, to a recent set of directives (EC Council Directives Nos. 92, 93, 94 and 95 of March 31, 1992) on the wholesale distribution of medicines, classification of pharmaceuticals, labeling, and instructions, in addition to the advertising of substances for human consumption. In the meantime, rapid progress is being made on the completion of the EPCHIN data base.

#### **European Scientists Decipher Yeast Chromosome Molecule**

##### **EC-Supported Project**

*92WS0584A Frankfurt/Main FRANKFURTE  
ALLGEMEINE in German, 13 May 92 p N1*

[Article by Barbara Hobom]

[Text] European molecular biologists through a team effort have determined the sequence of the building blocks of chromosome III of baker's yeast. A genuine chromosome has thereby for the first time been completely sequenced. Baker's yeast possesses 16 chromosomes. The genetic text

can be read letter for letter; its content is however for the most part still enigmatic. Only one tiny blemish is to be found in the base sequence of this enormously long linear deoxyribonucleic acid (DNA) molecule. One of its ends is missing a small remnant of uniform sequences, which vary in their lengths and consequently can barely be determined with exactitude.

Thirty-five work groups from 11 European countries took part in the solution of the structure, among them six groups of German researchers—from the Universities of Darmstadt, Duesseldorf, Giessen, Konstanz, and Munich, as well as from the Data Bank for Protein Sequences at the Max-Planck Institute for Biochemistry in Martinsried. The determination of the base pair sequences of the yeast chromosome was begun in January 1989, and the sequencing was concluded in May 1991. The results of this remarkable research enterprise have now been published in the journal *NATURE* (Vol 357, p 38). In the publication 147 researchers are listed as authors. The extensive sequence is stored in the Data Bank of the European Molecular Biological Laboratory (EMBL) in Heidelberg, and in principle can be looked at there by any scientist.

The work was financed by the European Community within the framework of the Biotechnology Action Program (BAP). The enterprise was under the strict central direction of the Belgian biochemist Andree Goffreau of the University of Louvain. Each of the participating laboratories committed itself to determining the sequence of an average of 10,000 base pairs. This also included shorter overlapping areas, which later facilitated the linear classification of the individual chromosome fragments and also aided in quality control. Each laboratory was assigned the chromosome fragment which it was to sequence by Steven Oliver of the Institute for Science and Technology in Manchester.

A large part of the initial fragments, the so-called clones, had been provided by American researchers, in part also by Japanese researchers. For each base pair ECU2, i.e. four marks were available in research money. This was rather generously allocated, and allowed many laboratories to follow their own leads, in addition to carrying out their obligations. While some researchers easily dealt with their workloads, many were overtaxed by the task assigned to them.

What sort of discoveries have been produced by the sequencing of this first eukaryotic chromosome, which is derived from nucleate cells? Many researchers were surprised by how much new territory still lies concealed in chromosome III. Baker's yeast is one of the organisms which have been the best researched in terms of genetics. However it became apparent through sequence analysis that the majority of its genes are not yet even known. Till now the scientists had recorded 34 gene locations on the genetic map of chromosome III. Through analysis of the microstructure, however, now 182 so-called open reading frames have come to light. These chromosome segments show several structural features which are typical for true genes. They can therefore count as presumed genes, even if their structure is not yet known.

Possibly the chromosome contains still many more genes. The researchers have temporarily classified as possible genes only those open reading frames whose protein products include at least 100 amino acids. Often however proteins are smaller than this arbitrarily set value. Some of the newly discovered yeast genes resemble genes that are already known. Many form proteins which are involved in elementary metabolic processes. Others have functions which are as yet inexplicable. Among these is a gene which resembles a nitrogen-fixing gene of bacteria.

Most of the newly discovered genes are still enigmatic. As the sequence of the building blocks indicates, the gene products show no similarity to already known protein substances. This was revealed by the sequence analyses in the data bank of the Max-Planck Institute in Martinsried, where the building block sequences of the genes of all known protein substances are stored. Evidently then there are still many cellular functions which until now have escaped the molecular biologists. The gene researchers were, to be sure, irritated by their observation that many of these unknown genes could be eliminated, without this having any recognizable consequences for the viability of the yeast cells. They do not, however, consider these genes to be superfluous. They suspect rather that the simple yeast cell is much more flexible, and therefore more survivable than had been previously imagined.

Now that the test run, the sequencing of chromosome III, has proved successful, the European Community has set up a successor program (BRIDGE). With the help of this program chromosomes II and XI will now be deciphered at a still faster tempo. In addition to this American, Canadian, and Japanese researchers have begun the sequencing of each of the other yeast chromosomes. By around the year 2000 the molecular biologists intend to have explained all the 14 million base pairs of the yeast chromosome. From the functional analysis of the comparatively simply constructed yeast chromosome, which is to follow, they hope to find clues to the organization and content of the genetic molecules of human beings. These are 200 times as long and of a much more complex construction than those of yeast.

#### Scientist Comments on Results

927WS0584B Munich *SUEDDEUTSCHE ZEITUNG*  
in German, 7 May 92 p 54

[Interview of Dr. Hans-Werner Mewes of the Max Planck Institute for Biochemistry, Martinsried, by Martin Thurau of the *SUEDDEUTSCHE ZEITUNG*]

[Text]

**SZ [Sueddeutsche Zeitung]:** You and your collaborator John Sgouros are involved in a project of the European Community in which the genetic code of baker's yeast is to be explained. This Thursday you are presenting the first results in Brussels. What is this all about?

**Mewes:** In the project the entire genetic information of baker's yeast is to be deciphered. In a three-year-long pilot phase one of 16 genetic code units, chromosome 3, was analyzed. In this so-called sequencing the order of the sections of the long thread of the genetic code will be

determined. The genetic information is stored in the sequence of the sections, the bases. This work has now been concluded. As a result of it a chromosome of a so-called eukaryont has for the first time been completely sequenced. These organisms, among which are also the higher life forms, all have a similar biological organization of their cells. Chromosome 3 of yeast is 315,000 bases long, and the total genetic code (DNA) contains approximately 15 million bases. In comparison with this, human DNA, whose sequencing is being planned in the U.S., is composed of 3 billion bases. At the present time chromosomes 2 and 11 are also being systematically deciphered. During the next few years all 16 chromosomes are to be deciphered. To be sure, the 35 laboratories from 10 European countries who are involved in the project of the European Commission are not the only ones who are working on this.

**SZ:** Why did they particularly choose baker's yeast for their research?

**Mewes:** Yeast is one of the organisms which has been the most thoroughly researched. And the genome, the genetic code, is relatively small.

**SZ:** What has come out in the analysis of the first results?

**Mewes:** It was already known that the genome of yeast is very closely packed with so-called open reading frames. These are the areas on the strand of the genetic code which store the information for the proteins, the albumens, of which the cellular apparatus is composed. We have proved how closely and efficiently the chromosome is in fact packed with usable information. We have been able to identify 182 of such open reading frames in all, each of which was longer than 300 base pairs. In the human genetic code, on the other hand, there are wide areas which presumably contain no usable information.

**SZ:** How are the data which you have obtained useful to you?

**Mewes:** One can't make much of a start with a sequence alone. No information about the structure and function of the proteins which have been synthesized by the cell can be deduced from it. Unless one finds a great resemblance to albumens from other life forms, which could already be exactly described and analyzed. Not until now, though, have we succeeded in characterizing about a third of the 182 identified open reading frames by way of computer-supported comparisons of this type, that is in determining them in terms of their functions. That was what was at first surprising. Investigations of the roundworm *C. elegans*, a model organism which has also been well researched, however, point in a different direction. Only a few scientists anticipated such a large proportion of unknown proteins. As a European data bank for protein sequences, which jointly with colleagues in the U.S. and Japan has 50,000 sequences under its management, we are positioned, so to speak, right at the source. Because of this we have also taken over the processing and analysis of the sequence data which have been determined, and have at our disposal an actual data record, on which we can base our work.

**SZ:** What questions now remain to be answered?

**Mewes:** We must now consider how we can arrive at the functions of these albumens. What do they do in the cell, and why are they necessary? We must now use other techniques in order to obtain the complete picture of a complex organism, and also ultimately to understand it, if possible.

**SZ:** What conclusions about other organisms do you hope to draw?

**Mewes:** In the case of yeast we are dealing with a relatively simple model organism, through which we can learn to understand biological functions. What albumens does an organism need in order to be capable of functioning? I do not readily use the word model organism, since naturally the program in terms of its scientific statement stands for itself. Above all we have established that in this new territory of biology we still have a long way to go. More so than most scientists had anticipated. If one goes by our experiences with chromosome 3, we believe that the human genome is still too complex by one order of magnitude for a systematic sequencing. Quite aside from the genome's two-hundred-fold greater size, in the case of human genes the path from the genetic information to the complete albumen is also somewhat more complicated. Even if one knows the gene sequence one cannot with certainty deduce from this the structure of the albumen belonging to it.

## COMPUTERS

**European Fuzzy Logic Developments Surveyed**  
*92BR0467 Zellik BELGIAN BUSINESS & INDUSTRIE in Dutch Jun 92 pp 123, 124*

[Article by Vera Monstrey: "Fuzzy Logic—Europe Follows Reluctantly"]

[Text] Fuzzy logic has not yet fully penetrated into Europe. However, the first applications and industrial products are now beginning to appear.

Fuzzy logic is a programming technique for solving problems for which the only information available is vague and unclear.

While conventional expert systems require exact data, fuzzy logic can handle vague descriptions such as "reasonably high," "fairly cold," and "very much."

In 1980, the first practical application using the fuzzy theory was achieved. The process control for a series of cement ovens in Denmark holds this honor.

A few years later, the technology was discovered by Japanese industry. Since then it has progressed so far in Japan that a number of household appliances have the fuzzy label attached. However, European experts wonder whether fuzzy logic has not become a merely stylish tag in Japan.

In Europe, matters have not progressed so fast. It is as if the industrial world has not yet fully discovered fuzzy technology. Most universities are still carrying out research. Now and then, a system is developed in cooperation with industry. Dow Chemicals has produced an Intelligent Data Reducer while working together with the department run by

Professor Vanmassenhove of the State University of Ghent. Together with this department, the SCK [Nuclear Research Center] in Mol has built a fuzzy controller; and there are also applications at Alcatel-Bell and Siemens.

#### Predictive Planning System

Automatic telephone communications and the offering of services by telephone have taken giant steps forward in the last two years. The 077 [sex] lines have become well known to everybody, as have the many telephone quiz and games services.

The package of services available via the telephone, known as the "Kiosk Service," has been studied closely by Alcatel-Bell in the last few years. A planning tool has been developed for it, complete with algorithms which depend on fuzzy sets: CLASS (CRISP [categories for recursive information systems postulation] and Linguistic Analysis of Structured Scenarios). This planning tool is able to predict the evolution of the RTT's [Belgian Telecommunications Authority] Kiosk Service.

At the start of the study, Alcatel's aim was to be able to demonstrate the chances of success for the service, to estimate the traffic, and to set up a strategy for the expansion of the services package.

CLASS can work in CRISP (conventional rules with well defined information) as well as fuzzy mode. If there is sufficient statistical data available, then it is unnecessary to opt for a fuzzy approach. If, however, data cannot easily be expressed digitally and is based on uncertainties and the subjective knowledge of experts, a fuzzy approach can be chosen.

Predictions contain no facts or figures. Results are obtained along the lines of: In the mid-nineties, x number of people will use the Kiosk Service a great deal, y number of people will use it a certain amount ....

To achieve these results, CLASS takes into account seven major factors which, to a greater or lesser extent, influence the success of Kiosk. The experts have attributed differing degrees of importance to these seven factors; these weighed factors, together with the results, are expressed in linguistic vectors.

A comparative study of the CRISP and fuzzy modes revealed that the use of linguistic variables offers the best possibilities for converting the experience of experts into computer language. Expression of expert knowledge in precise facts and figures (CRISP mode) has limitations. Results are often unreliable, so that adjustment of the Kiosk Service could go wrong.

Since its beginning in 1989, CLASS has produced a number of practical results, which have in turn led to an improvement of the Kiosk Service. Most importantly it has become apparent that CLASS is not only an excellent predictive tool in the field of telecommunications, but also in the area of strategic planning.

#### Fuzzy Control in Robotics

In contrast to many others, Siemens Germany firmly believes in the future of fuzzy logic. To this end, the R&D department is working closely with a number of institutes and universities in the field of expert systems and fuzzy logic. Within the company itself training and support is also being supplied to various departments.

Over the last few years tools have been developed for, among other things, the automatic generation of a fuzzy controller via a linear controller, and for the coupling of FLDS [fuzzy logic development systems] systems to non-linear simulation tools. These are applied in robotics and in the development of automatic gearboxes.

Increasing demand for shorter reaction times and greater autonomy required better planning systems for robot trajectory planning, better gripper-workpiece interaction, and better control of the manipulator.

Using simple rules written in natural language, it is possible to make a robot move, for instance between a wall on one side and various sorts of obstacles on the other. The rules themselves are very simple and can also be set up by nonexperts. As an example: if distance x is very short, then y needs heavy adjustment....

The fuzzy controller in automatic gearboxes allows the driver the choice between a sportive, normal, or defensive driving attitude. The system takes into account circumstances such as overtaking another car or going uphill or downhill. During tests it has been shown that a fuzzy gearbox changes down more quickly when being driven uphill, and that it allows faster acceleration in comparison to hydraulic transmission systems.

More fuzzy applications are expected from Siemens in the next few years in the field of image recognition, household appliances, and medical diagnostics.

#### Hardware and Software

In Belgium, several companies are offering hardware and software. Not long ago, a number of fuzzy controllers were brought onto the market by Omron. In addition, Microlink is distributing the Fuzzy Microcontrollers from the American firm NeuraLogix. The NLX230 model is a card which can be used in any PC environment. It allows a high speed (30 million lines a second) and sells for 20,000 Belgian francs [BFr]. Possible applications include the improvement of PID controllers, pattern recognition, and robotics.

The Fuzzy MicroController development system, model ADS230, is a development tool which can be used with the above-mentioned card. This tool is ideal for companies or schools wishing to find out about fuzzy logic.

The latest products from NeuraLogix are the NLX110 for pattern recognition, the NLX420 for the assembly of real-time neural networks, and the NLX112, a fuzzy data comparator for real-time data.

In Europe, the Japanese firm Yokogawa distributes the muXL, a flexible control system which is already being used in the petrochemical sector for polymerization control, in

distillation processes, in the steel industry, the water treatment sector, agriculture, and in the production of cement.

Yokogawa admits that it is difficult to persuade European companies to try fuzzy logic. The West is still quite suspicious about vague reasoning, which quite simply goes against the analytical mind.

## DEFENSE R&D

### ESA-CIS Cooperation in Space Urged

92WS0549A Stuttgart FLUG REVUE in German  
May 92 pp 32-34

[Article by Gotz Wange: "Survival Help for the Mir Space Station"]

[Text]

### Germans Urge Cooperation of ESA With Russia

The Russians did convincing work during the Mir '92 Mission. Despite this, parts of their space program will only survive with western aid. Consequently, the Germans advocate participation in the ESA program.

The Russians remained true to their line to the end. Almost to the minute, eight days after the start of the mission, the German cosmonaut Klaus-Dietrich Flade, with the relieved regular crew Alexander Volkov and Sergei Krikalov, landed on earth again on March 25 (9:51 AM CET). The capsule came down only 15 km from the calculated target near the town of Archalik in North Kazakhstan. The precision with which the entire flight was handled amazed the arriving German experts time and again. Even the lift-off was punctual on 17 March. Following the approximate 1500 flights to date, the Soyuz rocket again emphasized its reputation as a reliable transport system for manned space travel.

"The mission is proof that the potential of the CIS countries can be reliably used in this difficult time," said Federal Research Minister Dr. Heinz Riesenhuber, impressed. On the way to the launch site at Baikonur, he spoke with representatives of the Kazakh government. On the return flight to Moscow, he discussed the possibilities of cooperation with representatives of the recently founded Russian space agency. He was not completely altruistic in doing this. Finally, the European Space Agency (ESA) is still looking for a way out of its financial dilemma. Using the know-how of the CIS countries could be one way. Even the ESA General Director Jean-Marie Luton has put out feelers recently in Moscow. Following discussions with Juri Koptjev, the General Director of the Russian space agency, Minister Riesenhuber was very optimistic to FLUG REVUE. "The openness for expanded cooperation is large and virtually in every area. We discussed various models of cooperation. These will first need to be examined and firmed up on various levels. These levels include the ESA, within industry, and between the governments. All participants will have to work to provide solid concepts quickly." One possibility would be to take over technology paying licensing fees or to use equipment and test facilities. Minister Riesenhuber is thinking about far closer cooperation.

According to this, Russia, or other CIS countries, could become associate ESA members. Instead of money, they could acquire an appropriate share of large-scale programs for payment in kind.

However, there is not much time until the next meeting of the ESA executive council in Madrid at the end of the year. The contours of the new orientation must become visible by this summer.

Then, the decision will be made only on the docked space laboratory APM, a contribution to the U.S. space station Freedom, and on the polar observation platform and the planned utility program POEM-1. The fates of the space shuttle Hermes and the free-flying space laboratory MTFF are still undecided. A second phase in 1996 will make this decision. Only individual technologies such as fuel cells and the heat shield will continue to receive support funds.

Proceeding step-by-step would also gain time to reconsider the Hermes program. The French will not be talked out of the plan completely—too much prestige is attached to it. However, there are significant tendencies to reduce the vehicle from a service vehicle with almost 3 tons of payload to function as an astronaut taxi. Possibly, NASA, which is also looking at empty coffers, can be convinced to participate in Hermes and to drop the development of one of its own rescue vehicles for the space station.

### Soyuz and Hermes as competitors

For this application, the Russians are also talking about the Soyuz capsule. An improved version could remain docked with the Freedom station for about two years instead of the six to nine months. In the opinion of experts, it would take years to qualify Russian equipment for the shuttle transport or to dock with the U.S. station. For this reason alone, the plan is not given a good chance.

The Russian capsules are more interesting for the Europeans. Using new materials, a reusable device could be created based on Soyuz. In this way, the ESA countries also would gain access to manned space flight without having Hermes available in the previously discussed form. "The capsule concept is today more realistic than ever before for European space travel," emphasized Professor Heinz Stoewer for FLUG REVUE. He is the managing director of the German Space Agency for Space Affairs (DARA) responsible for utilization. Even Research Minister Riesenhuber views the French as at least being ready to talk.

For DARA manager Stoewer, everything must be done now to at least keep the activities in conjunction with the Mir station alive. He hopes that not only the Germans and French will run additional missions with the Russians, but also the ESA. This could help to convert a vision into reality, something that Stoewer only dreams about now. This vision would be a truly international space station including the CIS. In Stoewer's estimate, the American space station Freedom that has already been changed a number of times will have to be reduced further for cost reasons. On the other hand, it is very improbable at this time that the Russians will be able to accomplish the reconfiguration of the Mir station scheduled for 1996. At



least the new research modules, the earth observation laboratory Priroda, and the Spectr observatory could dock with Freedom instead of Mir. With the American, European and Japanese elements, this would create a multinational space base.

Then, it might also be possible to use the heavy-duty rocket Energiya for transport tasks within the scope of the space station project. The German delegations were amazed to see the many components still awaiting assembly in the large integration hall of NPO Energiya in Baikonur. Two versions of the now most powerful rocket in the world are almost finished. A third is in preparation. However, there is a meaningful task for only one use. Immediately adjacent in the next section, the second flight unit of the Buran shuttle is now being prepared. Buran is set for use in mid-1993—once again unmanned—and to be connected to the space station Mir for seven days. Whether this will still come about in view of the precarious situation in the CIS countries is not certain. Following this, there will be no chance of further financing for the project.

For the federal German space effort, the first contact with manned Russian space was successful in the Mir '92 mission. Cosmonaut Klaus-Dietrich Flade solved small technical problems in the total of 14 experiments performed so that almost 100 percent yield is expected.

The success is also due to the extremely flexible project management by DARA. Instead of the established systems industry, they trusted the three medium-sized companies OHB System, Kayser-Threde and Panares. Despite the space limitations in Soyuz and Mir, innovative ideas resulted in a multitude of knowledge, primarily in the areas of biology and medicine. This came about without substantially exceeding the low budget. One example of how to do things right.

#### **EURODASS Consortium To Build Defensive Subsystem for EFA**

*92WS0549B Stuttgart FLUG REVUE in German  
May 92 p 64*

[Article by not given: "EFA Contract"]

[Text] The Eurodass consortium, led by GEC Marconi, received a contract valued at £200 million to develop the ELoKa system for EFA. Besides GEC, only Elettronica in Italy is currently participating because the Federal Republic and Spain first want to investigate less expensive alternatives. The Defensive Aids Subsystem (DASS) consists of an advanced passive system to detect and evaluate electronic emissions from the enemy, to activate interference transmitters and sensors that warn of approaching rockets.

#### **Dassault, SAT To Develop Self-Guided Missile System**

*Paris LE FIGARO (LE FIG-ECO SUPPLEMENT)  
in French 7 May 92 p V*

[Unsigned article: "Missiles: Agreement Between Dassault Electronique and SAT"]

[Text] Faced with the cuts in defense budgets, the Dassault group subsidiary is also betting on the civilian market of aircraft telephones.

Dassault Electronique is getting ready to conclude a cooperation agreement with SAT (Sagem group) to study and develop new self-guidance systems for missiles. The draft agreement currently submitted to the government could be signed in the next few weeks.

During the stockholders' meeting, Dassault Electronique officials explained that their primary objective was to develop new "bimodal" (electromagnetic and infrared) self-guidance devices; SAT is the European leader in infrared, and Dassault Electronique in electromagnetics. The agreement could then be extended to other types of self-guidance devices.

In seeking civilian markets to offset the cuts in defense budgets, Dassault Electronique has also started to score on the emerging market of aircraft telephones. The subsidiary of the Dassault group is betting on the Satcom system, whose antenna it manufactures. Dassault Electronique is aiming at one-quarter of a potential market estimated at 4000 planes, which represents total revenues of 500 to 600 million French francs [Fr].

#### **Three Difficult Years**

The Satcom system has already been selected by Dassault Aviation for its business plane, the Falcon 900, and by the airline companies Air France, Lufthansa, American Airlines, Malaysian Airlines, and Emirates. An agreement is also being finalized with the American company Delta Airlines. These orders represent 50 units to be delivered very shortly, and 450 in the coming months.

In 1992, Dassault Electronique's revenues should be practically unchanged, with an expected Fr3.88 billion, compared to Fr3.86 billion in 1991. The Dassault Automatismes et Telecommunications subsidiary (electronic banking and portable phones) is expected to contribute to this total with about Fr1 billion.

The group, which cleared a profit of Fr63.6 million in 1991, has not made projections for the current year. However, Bertrand Daugny, president of Dassault Electronique, estimates that "thanks to the diversification measures that have been undertaken, the company should be able to weather two or three difficult years, associated with the impaired condition of the weapons industries."

#### **Italy: Defense Officials Comment on Use of Satellites for Military Purposes**

*92MI0571 Rome SPAZIO INFORMAZIONI in Italian  
13 May 92 pp 3-4*

[Text] In Italy, as elsewhere, the deployment of sophisticated space technologies that have been designed specifically for the defense of national territories, is rapidly assuming an important role. On the one hand, the Ministry of Defense is enacting and broadening the scope of the Military Space Plan, and on the other, new opportunities for collaboration at European level particularly for telecommunications and remote sensing via satellite are beginning to



take shape. In order to provide an updated overview of the situation, SPAZIO INFORMAZIONI is publishing below recent statements made by the Secretary General for Defense, and National Director of Armaments, General Luciano Meloni, and the Chief of Staff of the Italian Air Force, General Stelio Nardini.

#### **Meloni: The Importance of European Collaboration**

"We are currently having very serious talks within Europe," Gen. Meloni confirmed, "about the post SICRAL [Italian Early Warning and Restricted Communications Satellite] period. Space is a sector in which the national armaments directors of France, the United Kingdom, Germany, Spain, and Italy, are working in ever closer cooperation. This is because we are all convinced that, when dealing with programs that will continue well past the year 2000, it is essential to work within a framework of European collaboration. It would be extremely foolish and expensive for each individual country to undertake a space program of its own with its own satellite. Apart from the Helios program (a military observation satellite originating from the French SPOT [Probational Earth Observation Satellite] program, in which we are participating with a 14 percent share together with France and Spain), SICRAL is one of our priority programs in the communications sector. The decision to continue independently with a national program," explained Meloni, "was taken after a thorough examination of the possibilities for collaboration at European level. In particular, with France to establish whether Italy could still draw some advantage from participating in the development of systems or subsystems for the SYRACUSE [Satellite Radiocommunications System] program. These programs, however, have their own stages of growth and development, and once they have passed a certain point, there are no longer any advantages to be gained by joining them. Under these circumstances the most logical choice was to proceed on our own with the SICRAL project. There are good prospects that SICRAL will further prove its importance by giving Italy the chance to approach the international scene with increased credibility."

#### **Nardini: The Utilization of Space for National Security**

"I remind you," declared Gen. Nardini, "that the Air Force has been involved in space programs since the very beginning. One has only to think of the significant support given, right from the pioneer days of the conquest of space to the San Marco Project which, for its objectives and ambitions, still remains among the most important national space projects. Though initially the Air Force's interest in space could be interpreted as no more than an emotive participation in a fascinating adventure very much in keeping with the spirit of aviation, by the early 1970s it had become apparent that space could also be used to ensure national security. A few years ago, the Defense Chiefs of Staff formulated and decreed a Military Space Plan, which takes a rational and organic approach to the wide spectrum of problems relating to the utilization of space for military needs, problems which, by virtue of specific operating requirements, are extremely complex. In particular, the plan pinpoints the operating requirements and objectives in the space sector, defines the programs necessary to fulfill these

requirements, and also defines the military organization to manage and carry out the space projects. At this point, first in the headquarters of the armed forces and later at the Ministry of Defense, a realization dawned of exactly how, and to what extent, space could be used for military ends using the Treaty on the Utilization of Space of 27 January 1967 as a starting point. The direction taken by the Italian defense forces, therefore, was towards the utilization of space for national security, but with an even more restricted line than that imposed by international agreements, specifically in relation to its not considering space as a natural extension of military operations. To be more explicit, the Italian defense forces decided against placing any arms systems, whether active or passive, in space. This choice, which was made as a matter of principle, led to the adoption of precise positions at national government level including Italy's non-adherence to the United States's Strategic Defense Initiative."

"Does this mean," the Air Force Chief of Staff asked himself "that defense activities will be completely excluded from space? No, certainly not, also because taking such a position could result in a very abstract concept. This could impose unacceptable constraints in a profoundly different real-life situation that can now be dealt with only by adopting equivocal attitudes. Needless to say, space is currently being exploited for defensive ends especially as far as early warning missile systems and controls on disarmament treaties are concerned. Are such activities illegal? Definitely not, and when these activities are put to use, this is no more than an unjustified attempt to undiscerningly deny the contribution toward peace which can be made by those systems that ensure transparency, and a reciprocal knowledge of the realities of each nation that is a signatory to the treaties."

#### **Deutsche Airbus, Aerospatiale Jointly Develop New Airbus Transporter**

*92WS0579D Bonn LUFT- UND RAUMFAHRT  
in German Mar-Apr 92 pp 16-17*

["AST Beluga Airbus Transporter"]

[Text] A new Airbus Super Transporter (AST) based on the A300-600 is being developed as an advanced successor to the Super Guppy. Deutsche Airbus and Aerospatiale are partners in the company SATIC founded in Toulouse for this program.

At the beginning of the Airbus program, a dense, daily traveled air-freight network was established between the production locations of the partner companies. Super Guppies, converted from old Boeing C-97s, have served as transports for more than 20 years. Airbus Industrie operates this service itself. Just in 1991, this transport system carried 4,777.6 tons although several assemblies for the A320 and A330/A340 programs increasingly used road-based transport (1991: 1,601 tons) for capacity and cost reasons.

On account of the increasing production, the capacity of the Super Guppy fleet has reached its limits. The age and increasing maintenance demands of these machines will permit their use for only a few more years.

Development of the new Airbus Super Transporter (AST) was started because the Airbus production system continues to rely on air transportation between factories.

Deutsche Airbus GmbH and Aerospatiale founded the Special Aircraft Transport International Company (SATIC) joint venture in Autumn 1991 in Toulouse to construct these aircraft. The staff of this company will increase to 50 German and 50 French employees.

Airbus Industrie meanwhile has given the contract for four AST aircraft to SATIC. Deutsche Airbus has passed on some of the development and production content to its subsidiary Elbe Flugzeugwerke Dresden. With the production of tail assemblies for the Fokker 100 that has already been shifted to Dresden, this AST work will be a substantial contribution to improved utilization of this former GDR maintenance plant.

The new AST special transporter is a conversion of type A300-600R giant aircraft. To create the necessary cargo volume, the fuselage shell is cut above the floor and replaced with a new structure having a radius of 3.7 m. This makes a cargo space 37.7 m long with a floor width of 5.34 m. The total cargo volume of 1400 m<sup>3</sup> is almost 30 percent greater than in the old Super Guppy. At 45.5 tons, the payload is almost double that of the Super Guppy (24.1 tons).

To increase the productivity of the transporter, the substantially higher cruising speed, at 410 knots, makes a contribution over the predecessor aircraft driven by four turboprops at 240 knots. Consequently, the AST aircraft can carry the sections for one complete A340 in only 19 hours for final assembly to Toulouse while the Super Guppy needs about 54 hours for this task.

The considerably improved economy also becomes clear in the fuel consumption. The Super Guppy, when transporting a A340 airfoil from Bremen to Toulouse, consumes 479 kg of kerosene. The AST only consumes 262 kg. On the whole, the AST can reduce transport costs by about 50 percent.

To be able to load large components into the AST, however, other changes were needed to the base airframe of the A300-600R besides enlarging the cargo space. In the Super Guppy, the entire front of the fuselage with the cockpit is swivelled to the side so that the entire cargo space cross-section is open for loading purposes. A different solution was chosen for the AST. Here, the complete cockpit of the A300-600R was lowered allowing the nose cargo door mounted above the cockpit to be opened simply. Consequently, the loading time was reduced from two to three hours to 45 minutes.

The maiden flight of the AST (A300-600T) is scheduled for 1995. After this, one aircraft is to be built annually to replace the Super Guppies gradually. SATIC, however, hopes that this special transport aircraft also may be of interest to other customers besides its prime application by Airbus Industrie. The AST is not suitable for regular cargo flights because of its limited range of 1570 km and the inadequate payload when compared to the series single-purpose cargo transporters of the large airlines. The strengths of the AST lie in special transport tasks requiring

a large cargo volume. For example, it would be conceivable to transport large satellites or the first Ariane stage to Kourou, something still done by ship. Even large, new-generation fan drives, such as the General Electric GE 90 with a fan diameter of more than 3 m, could be loaded without disassembly.

## ENERGY, ENVIRONMENT

### French Environmental Policy Discussed

#### Waste Treatment Legislation Passed

92WN0535A Paris LE MONDE in French 6 May 92 p 11

[Unattributed article: "At the Ministers' Council: The Government Adopts a Bill on Waste Elimination"]

[Text] The bill that the Ministers' Council adopted on Tuesday, 5 May at the request of Mrs. Segolene Royal, the environment minister, is a text of 14 dense pages containing tens of articles. It formalizes the new waste processing policy, for which her predecessor, Mr. Brice Lalonde, had already obtained the approval in principle of Mrs. Cresson's government earlier this year (LE MONDE, 24 January). The spirit of the bill is to contain the rising tide of waste that pollutes the country more and more every day: currently 70 million tons per year, with which we don't know what to do.

The solution applied to the problem, therefore, is the common sense solution adopted nearly 30 years ago to curb water pollution. The institution of a tax—20 French francs [Fr] per ton to be paid by garbage dump operators—collected by the Environment and Energy Management Agency and used to finance research on clean technology and the creation of waste processing centers. Applying the principle "polluters, payers" in the case of garbage should bring in Fr375 million per year.

As a corollary to this first provision, the second principle of the law is that, from now on, any dumping of unprocessed waste is prohibited. The prohibition will become effective, and any violation punished, by the year 2002. In other words, all household garbage and common industrial waste will have to be recycled one way or the other (incineration, composting, recycling, etc.). Hence the expected development of a new industrial activity, "processing."

This national policy will translate, in each department, into a waste-elimination plan that will force general councils to get involved in the great cleanup. The law contains an indispensable precaution: the operator of a waste-processing facility will be responsible for the rehabilitation of the site and will have to provide a financial guarantee to that effect. The State may act as a substitute for any defaulting "processor" and perform as a matter of course any work required to clean up a former garbage dump. Finally, waste brokering and transport will be monitored more closely.

#### Stiffer Laws on Radioactive Waste Urged

92WN0535B Paris LE MONDE in French 7 May 92 p 11

[Article by Catherine Vincent: "According to a Parliamentary Report: The Regulations on Very-Low-Radioactivity

Waste Must Be Clarified and Strengthened"—first paragraph is LE MONDE introduction]

[Text] Lowering the thresholds of "acceptable risk," rehabilitating contaminated storage sites, launching an epidemiological study of the effects of low doses of radioactivity on health: such are the main recommendations of the report on "The Management of Very Lightly Radioactive Waste," which was published on Tuesday, 5 May by Mr. Jean-Yves Le Deaut, the Meurthe-et-Moselle socialist deputy, on behalf of the Parliamentary Office for the Evaluation of Scientific and Technological Choices.

The "case" of the Saint-Aubin and Bouchet-Itteville (Essonne) nuclear waste dumps, which started in September 1990, revealed the imprecision of legislative texts concerning the elimination of low-radioactivity waste (LE MONDE, 2 November 1990). The fight among experts that followed merely confirmed it. Following the publication of the report on the management of highly radioactive nuclear waste by Mr. Christian Bataille, the Nord socialist deputy, in December 1990, this new report from the Parliamentary Office comes at the right time to provide the bases required for a genuine debate.

In France, radioactive waste is currently classified in three categories. The most dangerous, types B and C, essentially comes from the nuclear industry and require underground storage. For class-A waste (gloves, filters, contaminated tools), surface storage is required. But the regulations "concerning the general principles of protection against ionizing radiations" do not apply to the remaining waste, with radioactivity levels below 100 becquerels per gram<sup>1</sup>. However, no matter how "light" its radioactivity may be, this type of waste is produced in considerable amounts: by the nuclear industry, uranium mines, ore-processing facilities, or the nuclear-medicine departments of hospitals.

What hazard does this type of waste represent for the environment and for the population? That is the question. In spite of the massive amount of knowledge accumulated for the past half-century on how ionizing radiations work, "the long-term effect of low doses, if any, is lost in the background noise" (caused by natural radioactivity), "which in turn is variable and is not precisely known," Professor Tubiana, director of the Gustave-Roussy Institute, pointed out recently. Because of this observation, Mr. Le Deaut believes it is essential "to launch in France a large-scale epidemiological investigation of the effect of low doses of radioactivity on health." And, until the results are known, to reason "as if any additional dose of radioactivity, even minimal, might be harmful."

#### Confused and Inconsistent Legislation

Mr. Le Deaut believes that we must "tighten regulations and considerably lower the thresholds below which materials that may contain low doses of radioactive elements may be disposed of without utilization procedure." He also asks for the creation of new above-ground centers to collect very lightly radioactive waste (below 10 becquerels per gram of beta/gamma activity); these would handle waste "whose radioactivity would lie between a very low exemption threshold and type-A waste."

Concerning current regulations on very lightly radioactive waste—613 pages in the JOURNAL OFFICIEL—Mr. Le Deaut recalled that it has been adopted "in successive installments, without any apparent guiding lines." The result is a jumble of "confused, even inconsistent" texts. The first task of the legislator, he pointed out, should be "to simplify and clarify" this legislation, "as its uncertainties and sometimes its contradictions have done much to spread a feeling of distrust toward anything that is even remotely connected with radioactive waste." Confident that having "a single operator might make it possible to avoid past mistakes," Mr. Le Deaut finally suggests expanding the mission of the National Agency for the Management of Radioactive Waste (ANDRA) to cover "all types of waste, so as to perform the necessary arbitrations and find the solutions best adapted to the characteristics of the substances to be stored."

#### Footnotes

1. The becquerel (Bq) is a unit of radioactivity corresponding to one disintegration per second within a radioactive material.

#### Anti-Industrial Waste Program Proposed

92WN0535C Paris LE MONDE in French 8 May 92 p 11

[Article by Marc Ambroise-Rendu: "Presenting Her Working Program, Mrs. Segolene Royal Intends to Intensify the Fight to Eliminate Industrial Waste"—first paragraph is LE MONDE introduction]

[Text] On Wednesday, 6 May, Mrs. Segolene Royal, the environment minister, unfolded her working program before the press: she intends to draft at least six bills and defend them before the Parliament.

One of Mrs. Segolene Royal's most controversial bills deals with "control of the use and dissemination of genetically-altered organisms," a bill already drafted jointly by Mr. Brice Lalonde, her predecessor, and Mr. Hubert Curien, the research minister. It covers the so-called biotechnologies, i.e. the making of new high-performance vegetal or animal species, which are often obtained through genetic engineering. The bill provides that production facilities would be subject to the regulations concerning classified facilities, i.e. opening them would require a public inquiry, an impact study, and a government authorization.

Research laboratories, however, will be exempted from this new regulation, in the name of industrial secrecy, although they perform tests in open fields and thus present a hazard to the environment; this causes concern among ecologists. France Nature Environment, the most powerful federation of nature-protection associations, mentioned the precedent of nuclear secrecy, launched a protest campaign, and proposed a multitude of amendments to the bill. As a first test, Mrs. Segolene Royal will have to face their discontent next Saturday, 9 May, in Nantes, at the general assembly of France Nature Environment. She will attempt to quiet things down by promising to let the associations participate in the writing of the application decrees.

The environment minister has her departments working on several other texts. One of them, covering regional natural parks, will oblige territorial communities to make a far more serious commitment to protection than they do now if they want their parks to get an official label and subsidies. Another text aims to make public inquiries more democratic; these inquiries are the only way, and a very formal one until now, for citizens to influence industrial and major equipment projects. The procedure had already been reformed in 1986, but so timidly that the associations remained unsatisfied. Will they get what they want this time?

### Great Ambitions but Limited Means

Among the tasks that Mrs. Segolene Royal is about to tackle, there is also the introduction of the bill on waste that was written by Mr. Brice Lalonde. This ambitious bill aims to eliminate within 10 years thousands of public dumps and to create a new tax, the equivalent of the tax on water pollution. All the mayors in France are affected. In the case of industrial waste, Mrs. Royal is not satisfied with the promise made to Mr. Lalonde by a number of large companies. To prevent the government from forcing them to tackle the disposal of the most hazardous waste, these companies formed a specific association and promised to do the job themselves; but that does not satisfy the new environment minister. "Not all manufacturers are committed," Mrs. Royal observed, "and the amounts they intend to devote to the cleanup of older dumps seem very inadequate to me." She asked employers' representatives to invest more in research on clean technologies and in the elimination of older "garbage dumps."

A fifth project, still more difficult to finalize, has to do with noise, the leading urban nuisance. For the past 15 years, the many attempts made at such legislation, which would affect air and road traffic, have remained in the files. One can imagine the protests of the automobile industry, which is already going through a crisis, and of the highway lobby. Mrs. Royal herself tends to talk about "sound-proofing subsidized housing projects, setting up neighborhood noise standards, and regulating noise in factories." The main sources of noise nuisance would thus remain outside the scope of the law, except that motorcycle owners would be required through a convention to reduce their muffler noise.

Finally, the sixth chapter: the environment minister plans to tackle the destruction of landscapes, i.e. power lines, land regroupings that raze hedges and trees, highways that cut through mountains, houses that give rural communities a moth-eaten look, buildings of provocative architecture. Mrs. Royal's idea is to include landscape preservation in impact studies and to set up genuine protection zones around monuments and sensitive sites. She has already asked EDF [French Power Company] to submit a plan to bury power lines, including a timetable and financial estimates. She intends to sign a "good behavior code" with highway companies, as she just did with advertising professionals to remove 10,000 perfectly illegal roadside billboards in 37 departments by the end of June.

Such a legislative arsenal reflects the ambition displayed by the former advisor to the president of the republic: "to integrate the environment in a global society project." To assess the extent of the task, one needs to know that the application of the laws already passed under Mrs. Royal's predecessors calls for 200 complementary decrees to be written. Obviously, the ministry's resources in employees (less than 1,200) and credits (Fr 1.3 billion this year) will not suffice. To go from intentions into action, Mrs. Royal will have to obtain from Mr. Beregovoy an unprecedented boost in the 1993 budget. In the eyes of the ecological movement, this will be the litmus test for the government and for Mr. Mitterrand.

### Major German Institutes Join Forces on Environment Research

92MI0539 Bonn WISSENSCHAFT WIRTSCHAFT POLITIK in German 20 May 92 p 5

[Text] In order to improve coordination of their environmental research work, members of the Association of Major Research Institutes (AGF) have set up the Preventive Environmental Research Group in Bonn to help scientists work together, rather than, as is so often the case, in parallel in addressing the many problems facing the environment. The scientific leaders involved in setting up the group see their common quest for a solution to the ecological crisis not as a "blind flurry of activity" prior to the Earth Summit in Rio, but rather as a long-term concerted campaign. Nevertheless, they expect results within two to five years—a relatively short period in scientific terms—that will assist politicians in reaching correct decisions.

Eight of 16 major research institutes are members of the group, which is to organize a third of all the AGF's environmental projects; annual funding of around 100 million German marks [DM] will be allocated to joint air, ground, and water research. The collaboration is intended to reduce the often considerable distance between laboratory and nature by creating concrete links between basic research findings and actual environmental problems.

Professor Joachim Klein, the group's newly elected spokesman, referred at a scientific press conference to "a pan-German link creating a single research panorama." The new Environmental Research Center at Leipzig-Halle, which has been a major research institute since the start of this year, will play a special role. Located at the center of the problems facing the eastern German industrial region, its primary task will be to channel the results of research into the much-needed local reclamation measures.

Research Minister Heinz Riesenhuber also urged the new group to engage in research with direct practical applications. He felt it was necessary for "BMFT [Federal Ministry of Research and Technology] funded environment research to contribute more concrete proposals than in the past for solving environmental problems," and coined the slogan: "Recover the environment, enhance its quality, and think in terms of cycles." Riesenhuber did not consider that environment researchers based in universities were placed at a

disadvantage by the new club of major research institutes: "After all, there is no direct competitive element in the funding," he said.

### **Germany: Prospects for Reducing Truck Emissions Reviewed**

*92MI0559 Wuerzburg UMWELTMAGAZIN  
in German Jun 92 pp 36-37*

[Article by Gerd Zimmermann: "Automobiles are Getting Cleaner—Manufacturers Try Out Environment-Compatible Techniques"]

[Text] Under the pressure of stringent exhaust-gas limit values, which are due to be introduced in stages from 1992 onwards for utility vehicles throughout the EC, the search of the vehicle manufacturers for automobile concepts with low exhaust emissions is in full swing. Practical solutions are in sight: For example, direct injection into the combustion chamber and alternative regeneration methods for soot filters.

According to EC headquarters in Brussels, the future for utility vehicle manufacture will, above all, have to be a future of lower exhaust emissions and less fuel. Whereas vehicle technology in the automobile sector is gradually becoming less damaging to the environment, the vast majority of freight vehicles is still lagging behind. In Germany alone, 42,000 tonnes of carbon particles and 570,000 tonnes of NO<sub>x</sub> are discharged into the atmosphere annually through their exhaust pipes. Compared with total traffic volumes, this equates to a particle proportion of 70 percent, the proportion of nitrogen monoxide being approximately 31 percent.

In the former federal laender, the proportion of freight traffic accounted for by trucks is already more than 56 percent, with an increasing trend. Freight transportation will increase as a result of the completion of the EC internal market, the opening up of the Eastern European countries, and the increasing use of just-in-time deliveries. The federal government is requiring that limit values for utility vehicles over 3.5 tonnes be reduced in three stages throughout the EC.

#### **Reductions in Stages**

In the first stage, starting in 1992-93, nitrogen monoxide emissions are to be reduced to 9 g/kWh and particle emissions to 0.4 g/kWh. In the second stage, starting in 1995-96, the NO<sub>x</sub> emissions will have to be reduced by 40 percent, and particle emissions by 60 percent. The limit values of the third stage, starting in 1998-99, are to be defined before 1995.

In order to reduce emissions effectively, the strategy is for improved engines, optimized drive trains, reduced road resistances, and efficient post-treatment of exhaust gas.

As things stand today, the greatest potential is to be found in measures within the engine, such as improved supercharging and direct fuel injection into the combustion chamber. Direct injection requires extremely high injection pressures through multi-hole nozzles of the utmost precision. Just by using more sophisticated nozzle systems and

more efficient adaptation of the turbocharger, it has already been possible to reduce nitrogen monoxide levels by 25 percent, hydrocarbon emissions by 55 percent, and both carbon monoxide and particles by 45 percent. A further reduction in exhaust values can be achieved by means of fully electronic engine management. Particle filter systems also help. The filter comprises a large number of perforated tubes around which ceramic yarn is wound. They are arranged axially in a stainless steel muffler. The exhaust gas flows from the outside inwards through the windings, and the particles settle out on the ceramic yarn.

Superficially, this appears very simple, but achieving effective carbon particle filtration is a high tech business. One of the problems of carbon filtration relates to the extreme minuteness of the particles that have to be separated out. Approximately 50 percent of all particles are smaller than 0.00007 millimeters. To obtain 9 percent precipitation, all particles down to 0.00004 millimeters must be filtered out.

However, the particles collected in the filter do not burn spontaneously at the low exhaust gas temperatures of the energy-saving, direct-injection diesel engines for utility vehicles. They have to be eliminated by means of a special regeneration process, which also ensures that the filter does not become clogged.

In recent years, development has concentrated on three burning-off methods:

- A special burner or a supplementary heater upstream of or in the filter elevates the temperature needed for combustion of the carbon particles.
- Temporary increases in engine capacity and the catalytic coating of the ceramic body cause the carbon particles to burn. (A thin layer of copper oxide is applied to the ceramic yarn to act as a catalyst and reduce the spontaneous ignition temperature of the particles from 600° C to approximately 250° C).
- Liquid additives are added to the fuel or injected directly into the soot filter. They lower the combustion temperature necessary for burning off.

#### **Extensive Tests**

All these solutions are at present undergoing extensive testing. Ceramic soot filters with integral burners are being tried out in municipal vehicles. The dual-filter system, in particular, promises to be successful here. If either of the filters is clogged with carbon particles, it switches off automatically, and the second filter assumes the cleaning role. The clogged filter has time to regenerate. A burner connected upstream burns the carbon residues accumulated in the filter with an open flame.

The third solution could be used for freight vehicles and automobiles alike. Dosing the diesel fuel with a ferrous additive can considerably reduce the ignition temperature of the particles accumulated in the exhaust-gas particle filter. This chemical aid to ignition should be added in a ratio of 0.09 liters to 10 liters of fuel.

The main method of reducing engine noise today is by reducing engine speed. The prerequisite for this is an ample torque characteristic. New cam shapes and improved

channel and pipe guides improve gas exchange and boost the volume of combustion air. Even with a lowered nominal speed, performance is retained with this method, or may even be improved.

## FACTORY AUTOMATION, ROBOTICS

### German Firms Copy Japanese Work Organization Techniques

92WS0550A Munich TOP-BUSINESS in German  
Apr 92 pp 110-124

[Article by Brigitte Vogel: "Production Organization: Against the Japanese as a Team"—first paragraph is TOP-BUSINESS introduction]

[Text] A revolutionary development is taking place in German factories: Japanese-style teamwork is supposed to take the place of the strict division of labor based on Taylor's principles. Ahead of all the others, automobile manufacturers have hopes of greater productivity through teamwork.

Helmut Binder does not mince words. "You can't make Japanese out of Europeans by *fiat*," the electronic data processing buyer for Robert Bosch, Ltd., criticized the introduction of Far-Eastern management methods. "Now, at the end of the 20th century, there are no more crises to be dealt with as concerns concepts that have been around for decades."

The ideas with which the Stuttgart strategists at present want to lower costs and increase productivity are not really brand new. Since, behind the CIP (continuous improvement process) mobilization program lies concealed nothing more than the Japanese improvement philosophy, *kaizen*. And what is regarded as the ideal solution at Bosch today has been applied for more than 30 years now in Japan.

Ideas imported from the Far East are currently popular not only with the Stuttgart electronics company, but also on other management floors. Compete by copying? That's what it looks like.

Since the Japanese have been on their economic victory train all over the world, the creative power of German company managers do not appear to have been up to much. Whether it be MITI [(Japanese) Ministry of Trade and Industry] style industrial policy, just in time, or *kamban*—faithful like the Bhagwan's young followers, they parrot Toyota and Company's success formulas.

Until recently, without any lasting effect. Since in their analysis of Japanese economic power for years they had overlooked something fundamental. Not better production systems, not clever robots, not lower wages—as was erroneously assumed—are alone decisive. The Far Eastern competition's lead in productivity hinges on organization.

The great rethinking has already begun on German management floors: The watchword is to look on workers, machines, materials, and production process as a whole. The goal is to bring planning and execution personnel together; the solution is teamwork.

However, the consequences of this neo-German industrial philosophy can scarcely be estimated. "It will have consequences for workers and companies, for labor unions and employers comparable to those that the introduction of the assembly line once produced," prophesied Louis Hughes, chairman of the board of Adam Opel, Inc., in Ruesselsheim.

The fact that the blue-collar worker, his expertise, and his flexibility in German plants is moving back into the focal point of strategic considerations has a scientific background. After investigating 90 auto plants and hundreds of suppliers, Massachusetts Institute of Technology (MIT) researchers came up with alarming figures:

- Auto manufacturers in Japan require 16.8 hours on average to assemble a vehicle, whereas European producers need 45.5 hours.
- In Japan there is an average of 60 assembly errors per 100 cars, as against 97 for European manufacturers.
- Nearly 70 percent of all workers in Japanese plants work in teams; in Europe just 0.6 percent of them do.
- On average 5 percent of the workers are absent in Japanese auto plants; the corresponding figure in European auto plants is 12.1 percent.

A concrete example makes it clear that the cost differential is systematic.

What the MIT researchers brought to light at the Mercedes-Benz plant in Sindelfingen speaks volumes: There, "more effort went into solving those problems that arose specifically due to assembly-line operations than was necessary at the competing Japanese plant in order to put together a nearly perfect auto at the first attempt."

Speaking on behalf of the industry, Opel production chief Peter Endele also self-critically admitted: "We've concentrated too much on the technological renovation of our plants."

### Auto Industry Plays Role of Forerunner

The Japanese took an entirely different path. Their production system, "lean production" in the jargon of the trade, efficiently combines the advantages of the assembly line with the flexibility and quality of hand-crafted production. The core element in this system are independent teams, in which each individual contributes to a productivity-promoting process of continuous improvement (called *kaizen*).

This, or a similar way, is also the way things will soon be in many German workshops. Whether it be Bosch, BMW, Mercedes-Benz, VW, the automobile supplier Loehr & Bromkamp, or the Augsburg computer producer NCR—cutting straight across all branches of the industry, pilot projects are being launched or workshop workers are being prepared for what experts are already describing as "innovative self-organization of the plant."

In the process, Germany's second-largest automobile producer, Opel, has assumed the role of a forerunner. By way of example, in production shed K40 of the parent plant in Ruesselsheim, where the assembly moves "Omega" and "Senator" model auto bodies through the plant at a constant

rate, teams of from eight to 15 workers were formed on the line composed of nothing but individual workers.

#### **Motivation Through Self-Determination**

This form of teamwork plays havoc with the principles of the traditional division of labor:

- Each team is fully responsible for a specific part of the assembly operation.
- Suggestions for improving the process and increasing product quality come from team members and are no longer ordered from above.
- In keeping with the motto: "Everyone helps everyone else," they strive for as much flexibility as possible.
- Previously separate departments, quality control and supplies and equipment are now part of each team's area of responsibility.
- Elected spokesman for the team for one year, one of the team members, who also serves as moderator during regular team discussions in which operations, training arrangements, vacation plans, or other proposals are discussed, assumes responsibility for coordination.

This kind of self-determination creates motivation. "All of a sudden, workers are more than ever interested," teamwork promoter Peter Enderle sees his expectations confirmed, "in how they can do their jobs faster and better."

But explosive material also lies hidden in the redistribution of responsibility. "The tenacity of snipers at all levels is not to be underestimated," as Uwe Loos, business manager responsible for production at Offenbach automobile supplier Loehr & Bromkamp, has had to learn. Since, with this system, many people will have to say goodbye to prestige and thinking in terms of status.

At the production level, it is especially the foremen, up to now the absolute rulers of the assembly line, who are being forced to rethink things. Their new function will not be to give orders any more, but to give advice. They are supposed to support the team on technical questions and get team members to agree on concrete goals the attainment of which, furthermore, they are responsible for.

At Opel some of them felt themselves duped by the new organization of the work. Their reactions ranged from obvious defensiveness—"just leave me alone, you and your newfangled system"—to the question: "Do you mean to say that anarchy prevails now?"

At Mercedes too, a former quality controller complained about his new assignment: "Before, I could still wear the green smock [of an inspector]; now I have to drive a fork-lift truck."

It is obvious that there will be grinding of teeth and screaming when command structures are turned inside out. Yet, according to Opel manager Enderle, tackling assignments and challenges as a team has, on the whole, proven to be very successful. "Of course, this doesn't happen just by pressing buttons, but we have no other option if we want to continue to be permanently able to compete."

For the company, the step toward more democracy in the plant has already paid off. Motivation and productivity are increasing and the number of hours lost through illness has dropped. Fewer costly jobs that have to be done over again and repairs, which reduce committee quotas, are incurred and machines are better utilized.

#### **First Successes Chalked Up**

To be sure, they will not be able to measure the actual results in marks and pfennigs for one or two years yet—but the two-figure amount in millions by which the cost of wages has risen since the introduction of teamwork at the German General Motors subsidiary should flow back into the company coffers several times over.

The internal calculations of another German company make it clear that an immense potential for efficiency is inherent in team organization. On the basis of 100 pilot projects that have already been launched, it was ascertained that there would be a possible total of about DM5 million in reductions of costs for personnel. It would result in a reduction in material inventory of over DM3 million.

The savings from improvement proposals alone produced DM1.4 million last year for the drive-shaft manufacturer, Loehr & Bromkamp (200 employees, sales in 1991: DM530 million). But prophet Loos expects much more continuous improvement of the new process. His goal: By next year at the latest, every worker should hand in at least two proposals.

Naturally, this has its price. There is, on the other hand, the expense of training and training courses. Loos calculates that about 1 percent of sales volume will be invested annually in "the maintenance of team workers." "In an industry-wide comparison, we come out absolutely ahead [of the other companies] with 2.7 days of training per employee per year."

But even the best trained and motivated worker will be fighting a losing battle if bureaucratic obstacles are not eliminated, areas of competence are not redistributed, and areas of responsibility are not efficiently structured in future.

This is why Bosch manager Guenter Bensinger categorically demands: "Every single worker's assignment and role must be fundamentally changed." Juergen Hubbert, passenger-car foreman at Mercedes-Benz, where an eight-level hierarchy is not suitable for the plant, thinks along the same lines. With the introduction of interdisciplinary project teams, Hubbert said, "will the power of the department princes be practically challenged."

#### **Old Power Structures Disappear**

As early as two years ago, Loos initiated a radical change in the organization structure at Loehr & Bromkamp in order to bring the planners closer to the net product. The four leading departments (planning, quality, the Offenbach plant, and the Waldhof plant) were eliminated and seven product-related units were newly created, to each of which planning and quality control are now assigned.



Loos regards the elimination of an entire hierarchy level as a good basis for further advancing development of the company, which "is now oriented toward the worker." He is convinced that "a main department head is not really more important than the man at the machine."

More independence and checking on themselves instead of monotony in the workplace—demands that the workers, factory committees, and labor unions have long almost in vain been making—are today getting the men off the management floor and into the operation of the company.

Between the labor unions and company strategists—purely theoretical, at least—agreement prevails on the fact that the new productivity-raising work models are the right response to the Japanese challenge.

"However, it would be stupid," Franz Steinkuehler, the president of the IG Metall Company, warned, for them to overlook the negative consequences for the workers. They involve, "for example, qualification, which means the danger of overworking oneself—but not being paid for it—instead of self-determination in teamwork."

Richard Heller, the chairman of the Opel general factory committee, could not help raising the question as to whether teamwork will not after all be classified by the managers "as a simple efficiency instrument" and whether they are not going about it in the wrong way, namely "where the productivity reserves are already exhausted."

#### Pressure of Time and Hectic Pace Increasing

It is true that the response of workers who are already working on teams is, without exception, positive. But a survey conducted by the Dortmund Social Research Center after the first pilot tests at Opel shows that the pressure of time and the hectic pace have considerably increased. Conflicts and competition within the team are perceived as being especially burdensome. In the sociocultural environment of Japan, where hierarchies graded by age and group interests stifle every shred of individualism, teamwork may function outstandingly as a disciplining instrument to increase productivity. But in Europe, culture and style are shaped more by every individual's originality of behavior.

Nevertheless, the way German managers at present dictate application of the new production concept in the company, they seem to overly orient themselves along the lines of the Japanese model. "It's not enough," according to Munich business consultant Roland Berger, "to put on a kimono and copy Far Eastern management tricks."

Our own ideas, appropriate to the situation in German companies, are in demand. Otherwise, Bosch's man, Binder, is right in suspecting that the Swabian firm will only be enthusiastic over the kaizen philosophy because it is "cheap."

[Box, p 113]

#### Fit for Teamwork

Holger Karsten of the Wiesbaden consulting firm Arthur D. Little's Automotive Practice has developed 10 rules for introducing teamwork:

1. Top management commitment: Without integration and a serious commitment on the part of the top management team, absolutely nothing will work. If they do not want to visibly support the activities of the teams, they would do better to stay away from team models.

2. Integration of teams into organization structure: To see to it that the kaizen work teams are not "left hanging in mid-air," channels for reporting and committees that make decisions on their team activities must be organized.

3. Sponsor from the management floor: Acceptance of the teams must be gained quickly right from the start. This can be efficiently accomplished by a committed sponsor from the board of directors or the management who can convince the upper echelons too.

4. Intensive information: Before the teamwork system is initiated, all of those involved (managers, workers, factory committee) must be thoroughly informed about the purpose of the teams. Middle managers, especially, must be relieved of the fear that they will lose too much responsibility.

5. Inclusion of factory committee: Unless the factory committee is informed and convinced early on, any improvement program will be doomed to failure. An internal agreement is probably inevitable.

6. Training of moderators: Moderators must (especially in the beginning) be carefully chosen and prepared for their leadership role in, for example, methodology, communication, and conflict management. If economies are made concerning this point, later failure will be programmed into the system.

7. Training in methods for all participants: Once the team is formed and the moderator designated, everyone must familiarize himself with dealing with the appropriate methods, be it with the fishbone program, Pareto analysis, or the "five-why-question" method.

8. Establishing ability to deal with conflicts: The success of the teams lies in changing the business processes. Since it will not be achieved with the existing company organization without conflicts, those involved outside the teams must also be prepared for these conflicts.

9. Impressive visualizing: From the start, who is working on what aspect of the project and what progress has already been made must be graphically and convincingly "publicly" depicted. Large flipcharts, for example, are one way of doing this.

10. Creating a changeable environment: Accompanying the "tangible" analytic and organizational apparatus, an open management culture capable of learning must be established which regards mistakes as an opportunity to learn and offers incentives for participating in teamwork.

**Mercedes-Benz Adopts Group Work Organization**  
*92WS0551C Duesseldorf HANDELSBLATT*  
*in German, 5 May 92 p 12*

[Text] In the opinion of Personnel Director Heiner Tropitzsch the group work model which Mercedes-Benz AG is testing is distinctly different from the Swedish and Japanese



models. "We are opposed to copying the Japanese here in Germany," the company president Karl Feuerstein also stressed at a press interview. The company accord, which has been in effect since March, is valid for three years. After that a comprehensive agreement is to be concluded.

At present at Mercedes-Benz there are 150 projects for group work, into which 10,000 employees are included. The new factory in Rastatt is acting as the forerunner. Here group work is to be in effect for 80 percent to 90 percent of the employees involved in production. The management of Mercedes-Benz is attempting to include 50 percent of employees involved in production into group work by the mid-90s, and by 1990 to realize the latter throughout their entire production.

Tropitzsch as well as Feuerstein stressed that both the Swedish and the Japanese group work models were too one-sided. While the Swedish model almost exclusively pursues the humanistic approach of an enhancement of work for the employees, Japanese teamwork is aimed only at advances in productivity. By comparison the company agreement on group work at Mercedes-Benz establishes that the company goal of achieving improved economy, and the employees' goal of improving their work situation are of equal importance.

The groups consist of eight to 12 members. In the staffing of the groups already existing personnel structures are not supposed to be dissolved, in order that older employees, for example, will not be forced out. The group members may thus possess widely varied qualifications. "Every man need not know how to do everything," Feuerstein stressed. Pay is oriented according to what qualifications the individual possesses. At the same time it is not crucial whether the qualifications are constantly being called for.

For the time being however no new pay system will be introduced along with the group work. "This is not urgently required," Tropitzsch said. On the other hand Feuerstein pleads for a new system with altered pay scale criteria. The firms should pay for getting at "the gold in the workers' heads," he said.

Thus there are differences of opinion between management and factory committee over the pay of the group spokesman. The company agreement at the present time provides that the demonstrated qualification for carrying out this job will not be remunerated. Only the group spokesman who is currently active will receive a supplement to his pay. The group spokesman moreover will be elected by the group members. According to the company agreement, however, it must be guaranteed that the spokesman will be accepted both by his superior and his co-workers.

The group spokesman has the job of organizing, together with the members, the assignment of work within the group, of acting as moderator at the weekly 30 minute work discussions, and of acting as speaker for the group in external matters. Increased management duties fall on those foremen who have a large number of groups under their charge. Since the group organizes its own work and vacation planning, the foreman should then have more time for

management tasks. The tasks of qualifying the group members should also devolve on the foreman. Similarly the group can make its own extensive recommendations on qualification, which can make it possible for an individual to perform additional activities within the group.

It is important that the qualification programs be drawn up in cooperation with the factory committee, and that they should require its approval. Codetermination also applies to the choice of the project, agreement as to the goals, in the question of an aborting of the project, and in the solution of problems of overriding importance, which might come to light in the course of the project. In addition to this every project is accompanied by a project team, which is made up of members both of the sectors concerned and of the factory committee.

### **German Field-Bus System Competes for Position as Universal Standard**

*92WS0574D Duesseldorf VDI NACHRICHTEN  
in German 17 Apr 92 p 21*

[Article by Gerd Krause: "Trench Warfare of Field-Bus Systems"]

[Text]

### **The First Devices for the German Standard Profibus Have Hit the Market But an International Bus Standard Has Not Yet Been Specified**

After five years of preliminary work, the Profibus field-bus organization is now hoping for a breakthrough. The initial field devices have been on the market for a short time. However, critics doubt the potential of success for this universal bus system that should solve all industrial communications problems. Other field buses have been established for a long time in the automation technology marketplace.

Karl-Peter Simon can only shake his head. "Finally, the Germans have the only standard field bus worldwide and still we are about to misplay a giant chance by arguing about bits and bytes," warns the field-bus expert from the drive specialty company Danfoss.

The basis for his complaint is the numerous German field-bus vendors who, besides the Profibus Universal Bus, recommend their special bus systems. Simon's company Danfoss is a member of the Profibus Users Organization. This is the association of large and medium-sized companies that was able to present field devices for the first time such as electric drives and flowmeters as well as applications for the standard field-bus system. This was in Hanover after five years of preliminary work.

The goal was clearly defined as early as 1987 when the predecessor organization of Profibus was brought to life, primarily at the behest of Siemens. This goal was a universal, manufacturer-independent field bus for industrial communications. It was to have uniform interface definitions extending from simple sensors and actuators at the field level up to primary networks for process control. "With Profibus," exudes Karl-Peter Simon, "the German

industry, which is dependent on exports, now has a standard system as demanded by the market, even internationally."

There is doubt about this, though. "In Europe, Profibus does not have a chance," says Dr. Robert Patzke from the board of directors of Messtechnik und Fertigungstechnologie (Measurement Engineering and Manufacturing Technology) of Wunstorf. In the area of sensors and actuators, the French field bus FIP [Flux Information Processes] is superior to Profibus. The European development appears to confirm Patzke's prognosis. Besides France, Italy and Great Britain recently decided in favor of the French FIP as the field-bus standard.

However, Profibus is relying on the unique universal system, on the standard interconnection from the lowest sensors and actuators up to the process-control level. Dr. Manfred Patz is the managing director of Softing, the systems house and Profibus member from Munich. He says, "Not even the Japanese have a comparable concept." However, the critic Patzke doubts even this saying, "The Japanese will come with their cellular bus FAIS for MAP. Their bus is already internationally recognized."

Even the Profibus champions see the problem that foreign vendors of field-bus systems are knocking on the door. "We must decide in favor of one system quickly," demands Karl-Peter Simon. The cost pressures on medium-sized businesses from foreign manufacturers are becoming greater and greater. "Whoever is developing field devices for several bus systems has enormous expenses for software development and data documentation. This is because every interface requires the expensive development of ASICs [application specific integrated circuits]."

However, the medium-sized businesses are still looking at Profibus with skepticism. It took too long for the innovative niche-market vendors to convert the Profibus concept to practical use. "While the people at Profibus go on a coffee break," sneers Markus Kuner, "we have already developed another interface." Kuner is a drive developer for Pabst Motoren, an automation company from the Black Forest. Pabst, along with more than 80 other companies, feels very comfortable in the Interbus S Club of the field-bus developer Phoenix Contact. In the meantime, the promoters of the Interbus S can point to the most applications.

Such complaints had to force Profibus into action. Indeed, Siemens, the dominant Profibus partner, surprised the engineering world at the Hannover Fair with a minor sensation. The electro giant opened its long-held secret, the DP (decentralized peripheral) protocol to all Profibus members. DP is seen as the "magic bullet" against Interbus S. With the DP protocol, applications can be implemented in the area of sensors and actuators that were previously the domain of the fast Interbus S. Even as late as a few months ago, branch insiders doubted that Siemens would play this trump card. However, the automation giant now wants to sell every manufacturer of Profibus field equipment, this means their own competitors, ASICs for this application. The competition champion Patzke has an amazingly simple explanation for this sudden courtship. "Until now, the Minister for Research has put about 18 million German marks into the

development of Profibus. If it flops, that would be the last major project for Siemens helped with tax money."

The new DP protocol could eliminate another reason for the coexistence of many bus systems, namely their differing suitability for various applications. "No field bus can do everything," emphasizes Robert Patzke unwaveringly. He points to the success of the DIN Measurement bus that he supports in the area of test and measurement technology. To specify one universal bus would also restrict the user too much and inhibit technical development. According to Patzke, "The users should decide which bus they want." The decisions of the users are eagerly awaited. For example, the automobile manufacturers Mercedes Benz and BMW will decide shortly whether they will specify Interbus S or Profibus.

#### European Prospects in Micromachines Viewed *92WS0590B Munich TOP-BUSINESS in German May 92 pp 164-167*

[Article by Andreas Beuthner: "Machines Out of the Microcosmos"]

[Text] *The worldwide research competition to develop miniature machines, which combine electronics and mechanics in the tiniest space, is in full swing. The chances are still good for the Europeans to be in the forefront of this key technology of the future.*

The smallest products of mechanical engineering can only be observed through a microscope, namely, electric motors the size of a kernel of sand; tiny gears, pumps and sensors in millimeter format; and hair-thin rotating turbines.

Even the most renowned scientists are fascinated by the developments, and become immediately excited when they hear the word "micromechanics." "It is the beginning of a revolution," Herbert Reichl, professor at the Berlin Technical University, believes. "Just like electronics, microsystem technology will drastically change entire branches of industry."

Companies and institutes in Germany, the United States, and the Far East have been engaged in micromechanics for several years. So far no one has been declared the leader in the market race; the field of competitors—the United States, Europe, and Japan—is still packed closely together. No one has as yet taken the lead as they enter the next qualifying round. Helmut Kaiser, a business consultant in Tuebingen, confirms this when he says: "There are as yet no fixed structures and relatively little market competition."

But the tempo could suddenly accelerate in this temporarily leisurely competition toward a potential market value totaling in the billions.

The worldwide demand for miniaturized sensors in 1990 reached 12.2 billion German marks [DM]. A Kaiser assessment extrapolates a total turnover of DM25 billion for 1995. The analysts anticipate strong surges forward, especially by combining electronics and micromechanics as well as through the integration of optical functions. New applications like optoelectronic transmitters in telecommunications or miniaturized machine drives will stimulate a strong

world market growth to DM65 billion by the turn of the century. "Then the widespread impact of microsystems will truly be felt," Kaiser maintains in forecasting the anticipated surge in market turnover.

While in the matter of chip production Europe threatens to sink to the status of a mere branch office for Japanese silicon manufacturers (see Top Business Jan/1992), the prospects in microsystems is much better. German research has kept close pace with the innovative tempo of Japanese and American laboratories in miniaturizing component parts down to a geometric structural size of fractions of a millimeter.

#### Business of the Future

Thus, the Liga process—an acronym formed from the names of three processes, namely, lithography, electroforming, and second casting—is a technology for the production of miniaturized objects from plastics, ceramics, or metal that is practiced worldwide. The structural heights barely reach 100 micrometers, which corresponds to a tenth of a millimeter—about the thickness of a human hair. The patents for this process come from the Karlsruhe Nuclear Research Center (KfK), which has had years of experience in the production of microscopic gears, lattices, and ducts.

The latest masterpiece from Karlsruhe is an electric micro-turbine having a rotor diameter of less than a millimeter. "The Liga process now belongs among the base technologies," asserts Professor Wolfgang Menz, director of the KfK Institute.

#### Micros on the Verge of Entering the Market

Other miniaturization specialists prefer silicon as the most promising raw material for the modeling of their three-dimensional lilliputian creations. In the technology laboratory of German Aerospace's affiliate MBB in Munich, research director Walter Kroy is coordinating work on a microlaser, whose guidance and control electronics, together with its light source and optical motors for adjusting the deflection mirror, are accommodated in a single silicon unit. The matchbox size microlaser chip will one day be used as a tool in eye surgery or perhaps also for precision working of materials.

"We shall go into series production in two years," innovation manager Horst Schmidt-Bischofshausen predicts confidently. Meanwhile, German Aerospace affiliate MBB is investing about DM45 million in the development of marketable microsystems and is building up a know-how advantage so that "the Japanese will not be able to catch up so quickly."

That may sound comforting, but there is absolutely no guarantee that the know-how is or will remain unique. With his plunge into microscopic dimensions, Richard S. Muller, a micromechanics specialist at the University of California in Berkeley and developer of the first miniature motor, fascinated countless scientists with the fiction of tiny robots, who could patrol around in the human body or, in the capacity of an inspector, could monitor the combustion chamber of an automobile engine.

Other U.S. colleagues in the Lincoln Laboratory in Lexington, among other things, developed a computer-based production facility capable of engraving extremely precise patterns in silicon discs by means of laser beams. The process represented the first time that microstructures had been constructed by means of computer software. Experts fear that the Americans, with such tools at hand, could produce large unit quantities of many variations very quickly.

Filigree masterpiece products of the most advanced high-precision technology are not unknown in Japan either. The powerful Ministry of Trade and Industry (MITI) there has already sounded the alarm and recruited a blue-ribbon industrial alliance specializing in microsystem technologies. Included in the alliance are such electronic giants as Mitsubishi, Hitachi, Fujitsu, and NEC. The thrust of the Japanese initiative is for the rapid conversion of basic research findings and chip technology into marketable products.

#### Prospects for Europe

It is no wonder that German miniaturization technologists, when they see this kind of coalition between basic research and industry, begin to worry. First to be affected are the new, innovative companies, which, at great risk and considerable effort, develop electronically integrated measurement systems, manufacturing equipment, or software tools for the major industries. This kind of business arrangement could sour almost overnight if, say, cheap micromachines made in the Far East were to flood the market. But MBB researcher Kroy does not believe the time has come for open fighting for markets yet, and says soothingly: "with the exception of sensors, technically perfected microsystems are still only the music of the future."

Minisensors, the size of buttons, along with microtechnical internal works looking like incredibly thin membranes, are already on the march in many instruments in recreation electronics, washing machines, and the airbags of the better cars. They do more than record temperatures, flow velocities, and mechanical pressure. They trigger actions like the hyperfast inflation of the airbag and they compensate for imbalances in spinning washing machines.

With innovations like the above, miniaturization pioneer companies like the Karlsruhe Company for Microstructure Technology mbH MicroParts are rapidly marking off their market terrain for Liga products. The joint affiliate companies of Hoesch AG, Huels AG, Rheinmetall GmbH, Steag AG, and VEW AG are using synchrotron-generated X-rays to produce almost imperceptible structures.

The next generation of intelligent acceleration sensors to provide automatic chassis control on automobiles is already on the laboratory table. The external size of such minimeasurement devices is just 1.5 millimeter.

The technical wizards of Karlsruhe want to use their system know-how to storm the markets of North America and the Far East. "A marketing agreement with Mitsubishi for the Japanese market has already been wrapped up," marketing

expert Stefan Kreuzberger revealed, "now we are searching for a partner in the United States."

Even while disagreement still prevails among the experts as to just what may be included under the term "microsystem," the trend to miniaturization has already extended to other branches of mechanical engineering. Research teams are puzzling over new materials like ultrathin piezoelectric ceramics through the use of which the propulsion technology of industrial robots and machine tools would catapult forward and German mechanical engineering would again occupy the leading position in the world market.

Guido Tschulena of the Battelle Institute in Frankfurt believes that "the opportunity for Europe to take the top position is now at hand."

But the sensor experts see possible pitfalls. The Japanese, as is becoming increasingly clear, are accelerating the mass marketing of household and consumer electronics as well as communications technology. As a countermove, Tschulena points to strategically favorable positions for European companies in automobile electronics, mechanical engineering, medical technology, and chemistry.

Even an exhaustive Battelle study on the market situation in micromechanical components is unable to determine which of the competitors in the final analysis and reckoning will poke his nose through the wire as the winner.

## LASERS, SENSORS, OPTICS

**Dresden Researchers Harden Metals With Lasers**  
*92WS0590A Duesseldorf HANDELSBLATT in German*  
27 May 92 p 33

[Article by Ulrike Fischer: "Shortages Make Dresden Researchers Inventive"]

[Text] The expression "scarcity can be an inspiration," is a bit of folk wisdom in the former GDR. There are no systematic limits put on the quest for economies. A development at the Fraunhofer Institute for Materials Physics and Substrate Technology (IWS) in Dresden, a former central institute of the Academy of Sciences, exemplifies the adage. A technique for hardening worn-out turbine blades by means of lasers so that they can be used again has been developed there.

The process is one of the Dresden Laser-Technology Demonstration Center's showpieces, intended to familiarize Saxony's small and medium-sized companies with the capabilities of the laser. The IWS has had more than 10 years of experience with laser applications. Because it was convinced that the new technology—under certain conditions—enjoyed advantages over other processes in the hardening of metals, a process was sought to demonstrate it. In 1987, even before the unification, East-West cooperation had been arranged with Bergmann Borsig GmbH in Berlin, which now belongs to Asea Brown Boveri.

As a test case, the steam turbines, or more exactly the turbine blades, of a Lausitz power plant, on which the teeth of time were already gnawing (called drop-impact erosion or cavitation in the professional literature), were selected. Over the long term, the high pressure, caused by the small,

steam-formed droplets impinging on the material, left behind a miniature landscape of tiny impact holes. In such cases, a protective shield would normally have been soldered on the obviously weakened parts of the turbine blades. If the blade had a through puncture, the chrome steel itself would be involved. In that case, the turbine blades would have been considered no longer useful, at least until now. A new coating is too difficult and expensive, since the surface geometry suffers from the required preliminary grinding away of the remnants of the original coating. After the grinding procedure, the blades are no longer identical in form, and are no longer suitable for the incident flow. The new plates could not be fashioned so as to be sufficiently true to size.

The IWS in Dresden, then still the Central Institute for Solid-State Physics, following the example of the Lausitz power plant, demonstrated another approach to the problem. Instead of the patchup work, the turbine blades were hardened by laser, heated at very high temperatures for a short period precisely on the most erosion-threatened sections. As in laser-hardening in general, the heat dissipated afterwards without the need for further treatment in a process called self-deterrence. This is only possible when the materials involved meet certain preconditions. Turbine blades qualify.

### Contact-Free Tool Operation

Another advantage, which has helped the laser break through into other fields as well, is that this new tool enjoys contact-free operation. Small surface irregularities or other deviations in the geometry of the blades present no problem.

The laser application developed in Dresden is, as far as is known, completely new. Since then, thanks to superior know-how, it has outstripped a parallel development in Milan. It has passed its hardness test. In 30,000 hours of operation, the Dresden blades have proven their toughness. Dr. Berndt Brenner, project director at IWS, elaborates: "Replacing the approximately 200 blades of a turbine would have cost about 100,000 German marks [DM]. Being able to recycle them results in considerable savings, providing, of course, that this newly developed technique of laser hardening is widely adopted." Expenditures and costs can be reduced, providing the technique is used right from the outset. Doing so will eliminate the need to remove, grind, and replace the blades.

In another example it was shown that the technique has advantages over other processes in cases involving certain production parts. In the case of corrugated rollers, which are necessary for the mold pressing of corrugated fiberboard and which are subjected to very strong erosion forces when waste paper is used as the raw material for the fiberboard. In this case too, only the especially wear-threatened parts are hardened with great precision, more or less intensively, depending on the degree of need.

The advantages of laser hardening in the case of the turbine blades convinced Blohm und Voss AG, who now has engaged the Dresden company to laser-harden the turbine blades for a newly constructed solid waste incinerator in

Amsterdam. The new hardening technique will be advertised for the benefit of other power plants, turbine producers, and insurance companies as well.

As regards other research plans, it is useful that IWS can refer to renowned companies such as Siemens AG, Rofin Sinar, Daimler Benz AG and many smaller enterprises in southern Germany for whom laser applications, including thin-layer technology, are being tested.

In other fields of application, e.g., in the treatment of amorphous bands or metallic pastes, laser macromaterial processing is still in the basic research stage. Among others, such research is being supported by the German Federal Ministry for Research and Technology. The thrust of the research undertaken by the IWS and its laser laboratory is directed toward the development of beneficial ecological and economic products, as is indicated by the above mentioned cases. Another showpiece process is galvanization by means of laser, the ultimate aim of which is to replace the present ecologically harmful galvanization process.

#### **German Ministry for Research and Technology Supports Further Basic Research**

Laser thin-layer technology will also be directed toward ecological problems. The experience gained in the development of X-ray mirrors will be used in the field of photovoltaics.

The new Fraunhofer Combine for Radiation and Surface Technology, to which, besides the IWS and the Fraunhofer Institute for Electron and Plasma Technology, the Fraunhofer Institute for Layer and Surface Technology (IST) in Braunschweig and the Fraunhofer Institute for Laser Technology (ILT) in Aachen also belong, will be proffering industry other new services. Besides the traditional contract research, inter-institute technological services are being planned for long-term strategic decisions in industry.

### **MICROELECTRONICS**

#### **New Siemens Head on Chip Industry, Plans**

92GE0399Z Bonn DIE WELT in German 15 Jun 92 p 12

[Interview with Heinrich von Pierer, future head of Siemens AG, by Bernhard Blohm, Ulrich Friese, and Manfred Schell; place and date not given: "All Around Us People Are up to Their Necks in Subsidies"]

[Text] *He is a manager, sportsman, and politician: Heinrich von Pierer, age 51, a multitalented man among business leaders, will take the helm of Siemens AG in October. The doctor of laws and graduate economist from Erlangen will then become head of the largest German electronics group. How does he judge the chances of the European chip industry in competition with manufacturers from the Far East? Will Siemens also have to struggle through a personnel reduction phase? Will the management structure of the group change when he takes office? Bernhard Blohm, Ulrich Friese, and Manfred Schell spoke with Heinrich von Pierer.*

[DIE WELT] Mr. von Pierer, when you sit down in the CEO's chair at the Siemens group in October, you will be the boss of more than 400,000 employees worldwide. If you

include their families, you are, so to speak, responsible for a major German city of about 1 million inhabitants. How many people will you have to know and include in decisions in order to be able to guide a giant like Siemens?

[Von Pierer] A very large amount of responsibility is in fact combined with the office—but the board of directors has not yet decided. Since our business is conducted exclusively by people, it is also important to maintain the exchange of information and ideas with as many colleagues as possible, so as to recognize problems ahead of time and in depth. But I cannot mention any precise number of persons.

[DIE WELT] Will your taking office be connected with changes in the management structure?

[Von Pierer] Most things were changed by the new system in our firm not quite three years ago. By establishing 15 independently operating units, we clearly achieved greater flexibility and efficiency. At the same time, greater transparency was accomplished and entrepreneurship strengthened at the levels below the board of directors as well. About the future management structures one might say that by statute our central board of directors will continue to consist of up to nine persons. Additional colleagues are part of an expanded circle of administration. I do not see any need for changes in this management structure.

[DIE WELT] Regarding the future allotment of responsibilities to the individual Siemens boards, the problematic field of semiconductors is apparently still vacant.

[Von Pierer] The decision about that will be announced on 1 July.

[DIE WELT] It is part of the intact "company culture" that one does not speak just about success but about problems as well. Where is Siemens having problems at this time?

[Von Pierer] Openness internally and externally is, in fact, very important. One of our problems is still the question of what is going to happen with the semiconductor division. With our decision not to build a new 64-megabit memory chip factory and instead to utilize our best locations, we have made a rapid and very important change of direction. We will not be able to determine just how that will take place in detail until the end of the year. We are not under time pressure.

[DIE WELT] But otherwise the losses in the semiconductor field would surely have accelerated such decisions.

[Von Pierer] It is clear that the great losses are causing us concern. Siemens AG could not and would not endure this situation any longer. Furthermore, our company by no means regards itself as a classic memory chip producer, but as a principal supplier of application-specific "logic components." To this end it must assure itself of access to semiconductor technologies as "basic raw material." Further, market data also argue against building a new chip factory: The worldwide demand for memory chip components will, according to the most recent studies, not increase but rather decrease—at a high level. We will therefore be able, even without mass production of the 64-megabit chip,

inexpensively to produce application-specific chips in 64-megabit technology, called ASICs [application specific integrated circuits] for short.

#### Renaissance of the Rail Increases Sales

**[DIE WELT]** Has the European semiconductor industry fallen behind the competition from Japan?

**[Von Pierer]** No, we are now even with the chip manufacturers from Japan. This is proven by the timely opening of the 16-megabit production in Corbeil-Essonnes, where we are entering the market just behind the Far East suppliers. And this applies all the more to the 64-megabit chip, which we are developing jointly with IBM and whose production, according to our most recent publications, will take place at the same time as the Asian suppliers. So this technology will become available as early as possible for our "logic products."

**[DIE WELT]** But it is strange that you as a market economist have called for EC subsidies by referring to structural disadvantages in the European chip industry.

**[Von Pierer]** That was admittedly a very rigid remark I made, which was then in the report turned into a "heavy hammer." You have to differentiate: With regard to our application-oriented chips, which we produce for our customers as well as for our own product range, there can be no talk of external financial aid. We will solve the problems there ourselves. But it is quite another matter whether a new 64-bit memory chip plant can be built in Germany, based on purely market-economic aspects. All around us people are up to their necks in subsidies, such as is shown by the most recent example from Italy, where a U.S. manufacturer was able to finance more than half of his plant with state subsidies. If you nevertheless want to survive with purely market-economic concepts against highly subsidized chip factories in Singapore or Taiwan, it gets difficult.

**[DIE WELT]** So, do you want subsidies or not?

**[Von Pierer]** No, we do not want any. We have also stated so expressly. We are not building a chip factory.

**[DIE WELT]** What improvement in performance is connected with the pure market-economic concept?

**[Von Pierer]** The decision against large-scale manufacture of the 64-megabit chip is only one measure in order to limit losses. The second one is restructuring of the semiconductor field, which we already tackled some time ago with the help of external advisers. The result of that is, for example, a cutback of approximately 2,000 jobs at our Munich location and the concentration of our semiconductor production in Regensburg, Villach, and Corbeil-Essonnes. Assembly and testing of our products will be concentrated at our Southeast Asian sites. Additional steps will still have to be worked out and implemented.

**[DIE WELT]** When cost cutting is involved, it is nowadays usually done by applying magic formulas such as "lean management" or "lean production," and personnel savings are thus quickly achieved. Do you have any such objectives?

**[Von Pierer]** We have started numerous productivity programs. One slogan about that is "Cut throughput times in half." Previously, such programs were mainly aimed at time and cost optimization in production. But since all areas of operation, including engineering performance, sales, or administration, must be optimized, we quickly changed to stressing the entire value-creating chain from the aspect of cost. The motto is: Fast and low-cost. And in some places we will have to face cutting personnel.

**[DIE WELT]** Then how can your subsidiary Siemens-Nixdorf Informationssysteme AG (SNI), which has just been completely incorporated into the Siemens group, be guided toward a profitable future?

**[Von Pierer]** In addition to semiconductors, SNI is our second problem area. There are two reasons for this: First, the general structural crisis in the international data processing industry, which affects nearly every major manufacturer. For SNI another thing is also added, namely that when two organizations as different as Nixdorf and Siemens' data and information technology sector are merged into a new business unit problems occur.

**[DIE WELT]** What do your problem solutions look like?

**[Von Pierer]** Many individual steps are necessary at SNI. One of the first was to reduce personnel. By the end of the 1991-92 business year SNI's personnel should be somewhere around 50,000 employees, since by then 4,000 jobs will have had to be eliminated. On the other hand, there is an increase in personnel in the new laender of 800 employees. But since in the meantime the framework conditions have further deteriorated, we will have to start a second restructuring phase. So the personnel cuts at SNI have not yet reached an end.

**[DIE WELT]** However, you are able to balance the reorganization work in semiconductors and at SNI with profits in other business areas such as transportation technology or energy production.

**[Von Pierer]** To be sure. And not just there. In transportation technology alone we tripled our turnover in the space of three years from not quite 1 billion German marks [DM] to nearly DM3 billion, which is thanks to the great performance of the employees. The trend is continuing as well. The renaissance of the rail is clearly noticeable not only in the united Germany but in foreign markets, too. And due to our technological lead we have excellent sales opportunities worldwide.

#### Bureaucrats Hamper Cleanup of Eastern Reactors

**[DIE WELT]** Railways are not the only ones enjoying a renaissance but power plants also seem to be in great demand in Eastern Europe.

**[Von Pierer]** The Energy Production/KWU [Power Plant Union] sector has developed beautifully in recent times, while the structure of our business has also changed greatly. Originally, the former KWU achieved about 70 percent of its turnover by selling nuclear power plants, while the remainder was in the conventional power plant business. Today, it is precisely the opposite: We are now getting 70

percent in the conventional sector, and 30 percent in the nuclear power plant business. At the right time, about 10 years ago, KWU switched over to the promising business area of gas turbines, meaning facilities which guarantee a high degree of efficiency but are still connected with low investment and are very low-polluting. That strategy is now paying off.

**[DIE WELT]** What prescription do you have on hand for cleaning up the outdated Chernobyl reactors in the CIS?

**[Von Pierer]** The overdue renovation of the Russian reactors cannot be accomplished in a hurry. To be sure, the 16 Chernobyl reactors which are in operation at present should quickly be turned off. But the necessary replacement capacities can only be installed in the longer term with nuclear power plants. Gas turbine plants offer a short-term solution, however, since the Russian operators could use their domestic energy source. Our German-Russian joint venture in St. Petersburg will deal with such projects in the future. From a technical aspect every precondition exists for achieving an improvement in the situation over there. But it does not involve just the Chernobyl type but an additional 50 nuclear power plants in Eastern Europe.

**[DIE WELT]** What is the hitch in the implementation?

**[Von Pierer]** Financing and bureaucracy, which make the realization of any industrial ventures difficult.

**[DIE WELT]** Does resignation play a part in this?

**[Von Pierer]** No. We are used to having a lot of patience in every large plant construction project. Time periods of several years between planning and realization are nothing unusual in our industry. Furthermore, it is important that the cleanup of the CIS power plants not be regarded as a German task but in the framework of international cooperation. I can only support the federal government's initiatives to address this topic at the upcoming global economic summit in Munich.

#### **Hesse? The Situation Is Unbearable for Us**

**[DIE WELT]** Back to the domestic area. What are your plans for representation in the capital, Berlin?

**[Von Pierer]** With the present 30,000 employees Siemens and its affiliated companies have, it is one of the largest private employers in the new federal capital. We have already extended our activities to the eastern part [of Berlin] and will also build new buildings there. Our strong presence in Berlin facilitates the development of our business in the new laender. Over the course of the next few years we will have to think about further development in Berlin and use of the potential there. It will certainly not go as far as a return to the conditions of the prewar era, since the size of our firm and its present decentralized management at home and abroad do not require it.

**[DIE WELT]** Are there additional plans for the new laender?

**[Von Pierer]** Conceptually, the activities in eastern Germany have largely been concluded. With a total of 11 factories, a multitude of representative offices, and a total of 19,000

employees, we are well anchored there. We will shortly have invested a total of about DM1 billion in the new laender. Other than that, I am happy to be allowed to participate in the economic and social unification of our country just 18 months after the reunification.

**[DIE WELT]** In the West, although involuntarily, Siemens is making negative headlines with its fuel element plant in Hanau. What is the situation there?

**[Von Pierer]** The obstacles of the Hessian Land diet have so far led to the closing of the old plant for manufacturing so-called MOX [Mixed Oxide] plutonium fuel elements. And we are hardly getting anywhere in building the new plant with its higher safety standards. Apparently without regard for the 2,000 jobs there, Environment Minister Fischer is playing some sort of ping-pong game with Bonn in order to shift the blame for his drastic measures. The situation is intolerable for us and has already led to a number of legal complaints, among them, a claim for compensation from the Land diet.

**[DIE WELT]** Is an ideological debate on the use of nuclear energy under way in Hesse, as a substitute for the entire nation?

**[Von Pierer]** Yes, that impression is unavoidable. Above all, this prevents waste removal. By the year 2000 we will have about 30 tons of plutonium from current reprocessing contracts in the FRG. This material can only be utilized in the form of the tested MOX fuel elements. And on the subject of building new nuclear power plants in this country, I can only say: If one is really serious about avoiding carbon dioxide emissions, there is no way around the use of nuclear energy.

**[DIE WELT]** Not just due to the political but above all the economic framework conditions, Germany as an industrial location is a constant topic of discussion. Do your production sites in Eastern Europe represent strategic options with a view to this?

**[Von Pierer]** This argument is exaggerated. Germany has unquestionable location qualities, such as the high skills and motivation of its people, the modern infrastructure, as well as its great political stability. This is balanced against negative factors: We simply work too little and too expensively. A certain erosion of domestic jobs is already discernible. But if Siemens now goes to Eastern Europe, it is not only due to the better cost situation. We are able to serve our markets faster and better on location.

**[DIE WELT]** Do you worry when certain business partners abroad are ostracized by international politics, that is to say are having economic sanctions imposed on them?

**[Von Pierer]** Of course we worry about that, and I believe that one should always consider sanctions carefully and particularly keep the short- and long-term effects in mind. It depends on the individual case.

#### **I Can Live With the Ridicule of the Industry**

**[DIE WELT]** As regards Siemens' foreign business, it is conspicuous that the group has a strong domestic market in Europe, but in the other key regions of the world—the



United States and Asia—it is still poorly represented. In view of the new tasks in Eastern Europe, can you adhere to the group's original goal of doubling the present market share of U.S. business from 11 percent by the year 2000?

**[Von Pierer]** We are able to determine that in the most recent past, our U.S. business has grown by an average of 17 percent a year. I would not like to go into a precise target for the U.S. market share at this time. For that we might have to grow about twice as fast as in the other foreign regions considering the rapid market growth there. And that cannot be done at present.

**[DIE WELT]** Unless one buys a lot more in the United States.

**[Von Pierer]** That is more of a theoretical possibility, since suitable acquisition objects, save for perhaps a few exceptions, are not available to us in practice.

**[DIE WELT]** There is a similar problem in Southeast Asia. Are you thinking of increasing the present share of 5 percent of the group's turnover in the medium term?

**[Von Pierer]** I admit that we are not as strongly represented in the Asian region as we would like. The dynamic there is also undoubtedly stronger than in Eastern Europe. But we have already succeeded with some things there. Such as in the field of public telecommunications technology. About 20 percent of the entire foreign telecommunications trade of Siemens AG is now in Southeast Asia. If you take the entire Asian region, it is even 50 percent.

**[DIE WELT]** Thanks to the great liquidity of the Siemens group, most recently published as DM18.7 billion, as well as the imminent capital influx of an additional DM1.86 billion from exercising option rights, the company seems excellently equipped to fulfill its future expansion goals.

**[Von Pierer]** First of all, our high liquidity means that we will not slip into financial bottlenecks in upcoming investments. And our allegedly large financial reserves form two-thirds, that is to say approximately DM14 billion, of the contra item of the Siemens pension reserve. Nevertheless, you are right: Until now no sensible investment at Siemens has ever gone awry for lack of money. Furthermore, the approximately DM1.9 billion from exercising options, insofar as they are being realized, form the equity base.

**[DIE WELT]** The nearly unlimited availability of liquid funds has sometimes attracted the ridicule of the industry, that Siemens is more of a bank with an attached electrical department. How is your firm's image doing?

**[Von Pierer]** Well, I can live with that ridicule. In certain areas our image is absolutely great, for example in technical skill, particularly as a supplier of plants and systems, in our marketing operations and our service network, as well as in our worldwide presence and financial strength. And finally: Siemens has a great deal of attraction as an employer. But we do have self-inflicted problems.

**[DIE WELT]** Doesn't your information policy react in a sluggish way as well?

**[Von Pierer]** The common prejudice that we like to cover up crises is not at all true. We provide thorough and exact

information. But it takes time, and it is sometimes difficult to convey complicated factual situations in a sound manner. Usually, no one is listening out there any more.

**[DIE WELT]** The board of directors of Siemens AG will, in all probability, decide on 1 July that in October you should be the successor to Karlheinz Kaske. What are your intentions?

**[Von Pierer]** It is my wish that our company will remain as healthy at the core as it is now, and I see no necessity whatsoever for any particular changes. As former deputy to Mr. Kaske and a member of the board of directors, I have already been able to help shape some things at the firm. I see the CEO as a relay runner, who gets the baton pressed into his hand and runs on in order to lead the team to a joint success. The speed might change and could easily change direction in a curve, but he keeps the common goal firmly in mind.

**[Box, p 12]**

### The Climber

As a high school student the native Franconian worked as a sports reporter for the local paper, ERLANGER NACHRICHTEN. At practically the same time, at age 18, Heinrich von Pierer advanced to Bavarian youth champion in tennis. Together with his friends, the manager, whose grandfather, former Imperial and Royal Major General Eduard Pierer von Esch, was elevated in 1900 to Austrian nobility, became involved in municipal politics. A career which was crowned by being elected city councillor of Erlangen in 1972.

In October Heinrich von Pierer, who likes to bury himself in literature on Greek and Roman history, will step up to being the head of the largest German electronics group (global turnover: DM73 billion; 402,000 employees). The father of three—his older daughter studies business administration—has stuck with three sports out of his numerous hobbies: tennis, skiing, and hiking. Even today, as a passionate supporter of the white sport he regularly collects points for his old club, TB [Tennis Union] Erlangen. And he believes that with his racket art he could "if necessary earn good money as a pro."

When the 51-year-old, who rose like a comet in the company—not quite two years ago he moved up to being the youngest member of the Central Board of Directors of Siemens AG—takes up his office in Munich in a little more than three months, he is assured of the broad support of the board and the directorate. Then there will not be much time for leisure time activities, however. Except for tennis, there will perhaps only be short trips to Engadin and Lake Woerther on the program.

What has he done so far as the designated successor to former group CEO Karlheinz Kaske? Will the management structure of the large enterprise change? In the DIE WELT interview Heinrich von Pierer makes use of a sports term: "I regard the chairman of the board as a relay runner, who gets the baton pressed into his hand and runs on in order to lead the team to joint success. The speed could change and then easily change direction in a curve—but he keeps the common goal firmly in mind."



### Swiss Contraves Develops High-Density Multichip Module

92BR0446 Paris *ELECTRONIQUE INTERNATIONALE*  
*HEBDO* in French 7 May 92 p 18

[Text] Contraves MicroCircuits has succeeded in integrating 9 million transistors on a five-layer thin-film multichip module (MCM) (two signaling layers with 25- and 45-micron conductors, an earth plane, a power supply plane, and an external layer for components). This switching module for telephone exchanges comprises a type-88100, 32-bit reduced instruction set circuit (RISC) processor with two memory management units, a SRAM [static random-access memory] that is accessible in 18 nanoseconds, and 24 logic chips. The set of RISC chips is TAB [tape-automated bonding] mounted on the module; for the logic chips, Contraves selected a flip-TAB cross-connection technology in order to reduce the module size. The other components are mounted in a conventional manner. The use of the thin-film MCM technology made it possible to transmit signals at a speed of 1,000 Mb/sec over a distance of 10 cm with very low diaphony. Moreover, heat dissipation measured per chip is only 0.6 watt instead of 1.5 watt for chips in pin-grid arrays.

### Eurochip Project To Train Microchip Designers

92WS0455A Duesseldorf *HANDELSBLATT* in German  
1 Apr 92 p B4

[Article by Lutz Bloos: "Microelectronics—Eurochip Finances Training at 200 Universities and Institutes—In the Future, Chip Designers Will be a Rare Commodity in Europe"]

[Text] According to Augustin W. Kaesser, of Eurochip Service Organization, the EC will need an additional 100,000 chip designers by the year 2000. At present, only approximately 3,000 design specialists are being trained in the EC. To close this gap Eurochip was established in October 1989 as part of the European Esprit program. It started work immediately.

The reason for the rapidly increasing demand for VLSI engineers, as the chip designers are called officially, is the increased use of microelectronics in all industries. More and more companies are using chips customized to their specific needs in manufacturing, process control, and monitoring. These chips recognize fingerprints in access control systems, process data from sensors of all kinds and control actuators. The applications are practically limitless.

However, the use of ASIC [application specific integrated circuits] also means an increased dependence on American and Japanese developers and manufacturers. In case of supply bottlenecks, this could slow down or paralyze individual companies or a whole industry. To prevent this from happening, Eurochip supports approximately 200 universities and institutes in the training of chip designers. At a cost of only DM30 million an additional 3,000 students of information sciences are to be trained and are expected to graduate each year.

Usually, information sciences students specialize in chip design towards the end of their studies. A chip goes through six design stages, from the initial concept to the production

layout. As a first preparatory task students have to obtain or prepare specifications which define the chip functions in detail and describe the general conditions under which the chip will work.

Then, algorithms for the computing steps and formulas have to be developed. The third step, the register transfer level, divides the chip design into subassemblies such as memory, counter, oscillators, and multiplexers which convert analog readings into digital form or convert digital commands into analog signals for control purposes. During this phase, data and control flows are developed and specified. The designer has to decide whether to use available components or develop new components.

The fourth level involves developing the chip logic, the actual chip design. The subassemblies are divided into logic gates and are simulated. A gate consists of six transistors, which carry out different computing operations depending on their circuit connections. The result is a logic plan for the digital part and a transistor network for the analog part. In the fifth step, the gates are subdivided into transistors, capacitors, diodes and resistors.

### Cost Reduction

The ultimate step is the development of a layout consisting of lines, rectangles and polygons which represent the individual elements and conductors. This layout resembles the finished chip under the microscope. Now, its functions can be tested on a computer.

To be able to check whether the chip actually works its hardware has to be tested, i.e. it has to be produced first. For a single unit, this is very expensive, easily costing DM50,000. To reduce the cost for the individual institutes, Eurochip collects designs all over Europe until there are enough for a wafer. Then, Eurochip contracts out the design implementation and sends the finished chips to the designers for testing to detect any errors that might have entered the chips.

However, not all ASIC are developed in a "vacuum" simply as a thesis without future application. Several thesis students develop a chip under contract with a company which will subsequently produce and use the chips. These designs are the company's property, and the company pays for them accordingly. Other thesis students offer their free design to companies.

In Germany, the Society for Mathematics and Data Processing (GMD) carries out the tasks of the Eurochip organization. A governing committee of well-known personalities from industry and academia is responsible for strategic decisions and general supervision. Support for the universities consists mainly of workstations and appropriate CAD software as well as test instruments. Since Eurochip acts as a large customer, manufacturers grant favorable prices. Coordination of chip production is equally important.

Of the 200 Eurochip users, 52 institutes are full members which receive all organization services free of charge. In addition, they are eligible for financial aid for a teaching position. The 60 associated institutions have free access to chip manufacturing and can purchase the software tools

from Eurochip. The other institutions from EC and EFTA countries must pay for all Eurochip services, but have the advantage of being able to buy below market price.

#### **Germany: Thin Layer Cadmium Telluride for Solar Cells**

*92WS0455B Duesseldorf HANDELSBLATT in German 1 Apr 92 p B5*

[Article by Lutz Bloos: "Solar Energy/Will Solar Energy Become Competitive?—Battelle Institute Develops Thin Layer Cell Technology"]  
ing thin layer cadmium telluride cells could mean a breakthrough in photovoltaics and a boom for solar cells in the coming years. A fivefold reduction in cost compared to cells made of amorphous silicon seems possible.

The Battelle Institute in Frankfurt is involved in the development and production process for CdTe-thin layer cells. The fact that cadmium telluride is suitable for photovoltaic applications has been known to Battelle and other research laboratories for 20 years. However, the technology could not be used until researchers had a better understanding of the basic processes and materials parameters.

"These efforts have been surprisingly successful," says Battelle staff member Dr. Dieter Bonnet, "we were able to demonstrate a particularly cost-effective separation process." With the so-called closed-space sublimation high-quality layers are separated at very high speeds and are applied to the carrier material. The process is carried out at temperatures below 700°C in a moderate vacuum of 0.1 mbar using protective gas.

For the production tests, simple window glass was used as a substrate; it was coated photovoltaically in one to two minutes. The resulting solar cells had an efficiency of 11 percent. This corresponds to the output of amorphous silicon cells whose yield, however, drops to approximately 6 percent within a few months.

At present, the Frankfurt institute is developing a concept for translating the method into a production technique. Bonnet assumes that the photovoltaic layer is separated onto moving carrier material, similar to the coating of photographic films. This could mean a throughput speed of six square meters or more per hour. This way, the developers in Frankfurt hope to create a competitive product quickly. With a production volume of 10,000 square meters per year Battelle estimates the price for ready-made modules to be less than DM200 to DM300 per square meter. This means that the cost is approximately 80 percent lower than the production cost for silicon cells.

#### **Start of Commercial Production**

Once the development has been completed and trial production has started on an institutional scale, Battelle plans to start commercial production in cooperation with industrial partners with whom they already had initial talks. Battelle hopes that this cooperation will lead to a particularly strong position in the growing world market for regenerative energy systems.

While silicon technology has made considerable progress in the past years, it still costs more than DM1 per kilowatt-hour produced. Still, countries with lots of sunshine seem to consider it a promising technology. The Iranian government, for instance, signed a contract with Telefunken Systemtechnik in January for the delivery of a complete factory for the production of solar cells and solar cell modules.

#### **German Firm To Produce Multilayer Printed Circuit Boards, Models for Surface-Mounted Device Technology**

*92WS0476B Duesseldorf VDI NACHRICHTEN in German 27 Mar 92 p 25*

[Article by not given: "Jenaer Leiterplatten Will Continue Production"]

[Text]

#### **Western Company Takes Over Jenoptik Subsidiary**

##### **New Production Building in Goschwitz**

The Wiedemann Electronic company from Ingersheim has taken over Jenaer Leiterplatten GmbH from Jenoptik GmbH. The new company will continue to operate under the old name. Wiedemann will invest about 2.5 million German marks [DM] in new machinery and equipment in this year alone. An additional DM3 million are firmly planned for a new production building in the Goschwitz industrial park.

Jenoptik announced that Wiedemann will initially take over 26 employees. If the business develops as expected, the number of employees should be increased over the intermediate term. As before, Jenaer Leiterplatten GmbH will produce single-sided and double-sided circuit boards using ultra-fine conductor technology for electronic control systems. In the future, however, multilayer circuit boards and very high-grade ultra-fine conductor technology will be produced in Jena.

Once the new production building has been completed in the Goschwitz industrial park, CAD printed circuit board artwork design, electronic development work, and prototype manufacturing for electronics using SMD technology are to be moved to Jena as new product areas.

Wiedemann Electronic GmbH has 50 employees at its headquarters in Ingersheim in Baden-Wuerttemberg. The company has specialized mainly in the development and manufacture of electronic control systems for machines. According to company data, it achieved revenues of DM7.5 million in the 1991 fiscal year.

## **TELECOMMUNICATIONS**

#### **EC's Pandolfi on Transatlantic Telecommunications Alliances**

*92BR0374 Paris ENTREPRISES & TELECOMMUNICATIONS in French Apr 92 pp 84-87*

[Interview with Filippo Maria Pandolfi, EC Commission vice president, conducted by Herve Marchal: "Plea For a Holy Alliance"]

[Text] A pragmatist first and foremost, the EC Commission vice president in charge of telecommunications, technology, and science favors a huge Euro-American cooperative effort by major firms. He hopes, moreover, in the next three months to enter into an important agreement with several American electronics giants. And he is announcing a new research and development (R&D) policy concentrating on key technologies. The Bull-IBM agreement does not shock him; entirely to the contrary, since in his opinion it should serve as an example to Olivetti. Finally, he even intends to propose a major joint R&D project with the Japanese, which would lead to sales. Europe redeployed throughout the world: a realist's Utopia?

**ENTREPRISES & TELECOMMUNICATIONS [E&T]:** The dispute between the United States and the European Community regarding the opening of public telecommunications markets appears to be worse. How do you react to this, being a fervent defender of a Euro-American cooperation policy?

**Pandolfi:** It is rather complicated. There are two aspects to this question. There is a negative aspect, the dispute over the public procurement rules. The Community has for a long time held the Buy American Act<sup>1</sup> against the United States, as it discriminates against European products. And the United States reproaches Europe for its directive on government markets, which should come into force on 1 January 1993<sup>2</sup>. Well, a tough battle is ahead. However, on the other hand the American decision means the end of the major dispute on European telecommunications.

**E&T:** You mean...

**Pandolfi:** Some provisions of the Trade Act<sup>3</sup> allow the American administration to draw up a so-called "priority" list. And who was at the head of this list for the first time in 1989? The Community. The Americans voiced their disagreement with the EC over the next two years. But this year it is over. There is no longer any dispute on the general matter of telecommunications. This is why I am pleased: They have abandoned their general accusation. However, at the same time a battle must be fought over Article 29, which relates to government markets and for which we have some good arguments.

**E&T:** How and when will you do battle?

**Pandolfi:** That is not my direct responsibility. We must consult with Martin Bangemann, my fellow Commissioner in charge of the internal market and industrial matters; this matter falls within his area of responsibility. But it is for us to choose the moment and the method.

**E&T:** What is your judgment of the access to the American market by European manufacturers in this sector?

**Pandolfi:** There are sectors where European market penetration is excellent, future technologies where the Europeans are in the lead. For example, all-digital high-definition television<sup>4</sup>. Here we have Thomson and Philips. There are other sectors where, traditionally, American policy has for a fact severely limited European market penetration. In my opinion we must, so to speak, define the rules of the game while the match is being played. For example, if we increase the degree of strategic cooperation in the information technologies and

communications sector between the major North American and European firms, I believe that the results will be balanced and symmetrical. The danger for Europe is an asymmetrical situation. A long-term view is therefore necessary for greater symmetry.

**E&T:** In which sectors do you feel Europe needs a contribution from America and where, in the intermediate term, can it expect positive results?

**Pandolfi:** Semiconductors, in other words memories and microprocessors. If we develop these technologies within a U.S.-European partnership, there will be reciprocal market opportunities. The risk is that we will not get past our historical antagonisms. And that we will thus remain in an asymmetrical situation. This is the case with Japan, for example. If we had major R&D projects with the Japanese, it would mean better penetration of the Japanese market. My view is that there is no possible "scorciatoia," or shortcut.

**E&T:** Have you had indications of good faith from American firms when cooperation is proposed to them?

**Pandolfi:** Yes, without any doubt. You know the American companies which wish to cooperate with us. There are IBM, Texas Instruments, and Hewlett-Packard. I have had a very favorable experience with the latter. They set up a factory in my hometown, Bergamo, to assemble laser printers. Mr. Young, the CEO, told me that productivity there was higher than can be found in Japan! There are also Motorola and Intel....

**E&T:** Are there concrete projects with these companies?

**Pandolfi:** I can say nothing for the moment as we are in a period of transition.... If you like, however, we could meet after spring.

**E&T:** So there will be important announcements at that time.

**Pandolfi:** I hope so, that is what I want.

**E&T:** Still in the area of U.S.-European cooperation?

**Pandolfi:** There is no *a priori* intention to exclude Japan, but we must use the golden rule of the *locus minoris resistentiae*, the path of least resistance. Moreover, cooperation with the United States began in the fifties; we belong to the same industrial culture. However, this rapprochement can be seen from another angle. One can say that it is an effect of the recession. Because of this recession we have decided to modify our R&D policy and to base it, far more than in the past, on TPs or technological priorities.

**E&T:** Can you give details of this new policy?

**Pandolfi:** The Maastricht Summit defined three major Community policies: our external responsibilities with regard to accelerating history; our cohesion, allowing weaker countries to move more effectively towards economic convergence; and, thirdly, our competitiveness. Most specifically in industry. So at the center of this need for industrial competitiveness is a reoriented R&D policy concentrating on key technologies. It is the technologies, rather than the project itself, which must be targeted. All in all, this effort, which took ECU2.4 billion in 1992, will cost the Community ECU4.2 billion in constant money terms in 1997.

Of course our approach must also be modified; it would be stupid interventionism to imagine that political or bureaucratic bodies could define a project which belongs to industry. Consequently, we must examine in a transparent and intelligible manner a number of projects proposed by the industrial sector. Then it is up to us to choose. Keeping two criteria in mind: aims and resources.

We cannot sign a treaty at Maastricht without also making coherent decisions on resources. This is Jacques Delors' current problem: how to make this text work. Each member state has its problems. Germany has its eastern half; Spain has the problem of making its merge with Europe less difficult; Italy has its exceptionally high budget deficit; the United Kingdom the problem of combining political tradition with economic reality. As for France, it is in a period of fibrillation.

**E&T:** How are you going to create the necessary momentum? For the last year or so we have had the feeling that in the technology sector Europe is on remarkably slippery ground.

**Pandolfi:** This is in effect the critical point. My problem this year will be to convince the major firms to pool a certain part of their technological R&D activities.

**E&T:** A specific example is the cooperation between Philips and Thomson on high-definition television.

**Pandolfi:** That is a most typical case. Here are two firms applying themselves to the same activity, both based in Europe, both with important joint ventures outside European borders, for example in the United States, but who always have a problem developing a joint technological research project. They have reached agreement on the general strategy, but not yet or still not on research and technology. In addition, there are factors which complicate everybody's life. For example, Philips is simultaneously developing all-digital HDTV through its American subsidiary, D2MAC and HDMAC in Eindhoven, The Netherlands, and Pal Plus in Germany through its German subsidiary. It is not easy to manage to combine such riches.

And then I had to destroy an illusion last year. The illusion that public authorities could be the arbiters of the economic destiny of companies. Until then we rather had the feeling that, to determine the future, it was sufficient to establish a standard. My great task—which took more than 300 hours—was to bring broadcasters into the process. Five years ago, in 1986, the directive was drawn up using an exclusively technological approach. Hence mistakes such as saying that only high-power satellites could transmit television signals!

Now, the only solution is to unite all parties who are active on the market. Their destinies are linked. So the good thing about that incredible episode last year—where all cards were reshuffled—is that a consensus was obtained on the subjects to be dealt with and, in particular, the principle was established for the first time of cooperation between equipment producers and broadcasters with the aim of developing the market.

My problem now is to arrive at a viewpoint which is common to all parties on the major, independent variable in

this area: all-digital HDTV. For example, Mr. Rousselet, the chairman of Canal Plus, asked me, "Over what relevant period must I calculate the depreciation of my investments? If technological change brings the horizon closer, all my economic calculations become incorrect." We are thus in a delicate phase, and an essential one, as in signing a Memorandum of Understanding (MOU) which must be binding on all parties, we must have a clear view of this question.

**E&T:** What is your opinion on that basic and very controversial point, all-digital HDTV?

**Pandolfi:** It is true that in the middle of next year the Federal Communications Commission (FCC), which is in charge of these regulations in the United States, will make its decision, but they will be decisions on the standard to be adopted. Next it will be necessary to build a prototype receiver, and then it will take three years to come up with the first applications, and so on.... I have the feeling that the time factor is pretty much always the same. And in technology, there is the risk of imagining that when one has found the patent, everything is solved. On the contrary, it is the application phase that is terribly difficult. Look at the Japanese. They started work on high-definition television 20 years ago. They took the risk of being the pioneers. And they saw that we can get on the train at the next station. This gives us advantages. Maybe tomorrow the United States will find themselves in a comparable situation. I think that when all is said and done, all-digital technology will be the winning technology. There is no problem there.

**E&T:** Everybody is in agreement, but for the Europeans the big question is: How long?

**Pandolfi:** You are right. I have my own ideas about this, but I do not have the right to express them. You should add that, as the interesting experiments at the Winter Olympics have shown, it is also necessary to be able to make practical use of the instruments. In Albertville, there were 15 mobile stations, teams of cameramen of different nationalities.... A new technique requires a proper apprenticeship.

**E&T:** What is your assessment of the life-size experiments in European high definition at the Olympics?

**Pandolfi:** To be frank, there are still some technical problems, even with respect to the picture. However, I think that the outcome is positive. Even though the technical problems still exist, even though the reality is a bit different from the laboratory experiments, we did actually manage to carry out live experiments.

**E&T:** How are you going to make all those involved in the audiovisual industry accept common rules on high definition?

**Pandolfi:** The market will help us. The good thing about broadcasters is that they are closer to the market in some cases than television manufacturers. It is they, the broadcasters, who told me that the factor which is creating movement on the market is the 16/9 wide-screen format, much more than the standard. And then, to be completely frank, we must finally have televisions at affordable prices in the new format.

**E&T:** Programs will be needed for this format: What do the program producers say?

**Pandolfi:** At the moment they are being cautious. They are waiting. However, the impetus given by the Community, along with a major increase in promotional funding, could have an effect. I am expecting that in this area France will play a very special role. A good combination of Community action and an all-out commitment by France could make things move.

**E&T:** How much funding will you expect to offer?

**Pandolfi:** I have given a figure in the order of ECU1 billion over five years. Perhaps it will be ECU850 million. We will have to be patient until April to know, but the ballpark figure will not be changed. The major difficulty that we will have to face, besides the independent all-digital variable, is that it will be necessary to make simultaneous investment decisions in the four sectors concerned: technology, programs, satellites, broadcasters. Fortunately the difficulties are not of a theological nature. There are already the beginnings of cooperation.

**E&T:** In another field, we have just witnessed important events which, although primarily in France, are of concern to the whole European computer industry. I mean the purchase by IBM of stock in Bull. At the same time, in Italy, Olivetti is restructuring but does not seem to be looking for an alliance. Finally, IBM also has other, slightly older agreements with Siemens. Where is the European computer industry going?

**Pandolfi:** I hope that Olivetti will get a major international partner. After all, the problem is not on the domestic market. It is international. I hope that Olivetti's destiny will resemble the Bull-IBM joint venture.

**E&T:** Does the ever stronger presence of IBM in Europe bother you? Are you shocked as a European?

**Pandolfi:** Absolutely not! Absolutely not! Europe's strength lies in knowing how to go outside its borders. I think that this alliance is useful for both parties. It would be stupid to deny the advantages for IBM as that company also has its problems. But there are obviously advantages for Bull. Along with, perhaps, the feeling that their future is now better assured. Sharing difficulties is a lot better than tackling them in isolation. However, the problem is to go farther. This type of cooperation must be extended.

**E&T:** What do you have in mind, as an example?

**Pandolfi:** We have come back to the problem of the technological priority projects. I am thinking of automobile electronics. This is a key problem where there is a very wide gulf between Europe and the United States on the one side, and Japan on the other. At the moment the trend is negative. The times are against us. The course of events must be reversed. This is why my European feelings are reinforced by the recent major agreements.

**E&T:** The other major problem which is crucial to the future of European electronics is components, semiconductors. One European mainstay in this area is SGS-Thomson, a company which is equally Italian and French. In addition, there is

Siemens, as well as Philips. On the international level, none of them has sufficient weight. And attempts at a rapprochement have so far come to nothing.

**Pandolfi:** First it is necessary that the companies involved find a reasonable solution to their own problems; this will then allow a technological priority project to be defined. It would be curious to ask the public authorities to substitute themselves for the companies. My task begins precisely at the minute following the moment when they define their project.

Having said this, I am not an unconcerned spectator. I am well aware of the question of the increase in capital needed by SGS-Thomson, I know the problems of the two parties, but also the technological ambitions of Pasquale Pistorio, the CEO of SGS-Thomson, and his staff. Above and beyond the problems or ambitions of an industry, the pressure of technological progress is inexorable. Sixty-four Mbit memories had only just gone into production when the prospect of 256 Mbits already was looming. Work is in progress on certain technologies derived from research being carried out at CERN [European Center for Nuclear Research] in Geneva on particle acceleration. For 256-Mbit memories, we need a lithographic line width of 0.1 micron. That is nearly 100 silicon atoms. Extraordinary!

**E&T:** Do you feel that Siemens or even Philips are making a move on these questions of alliances?

**Pandolfi:** In terms of the subjective climate, there is an improvement compared to last year. With a trend toward imitation. A year ago the idea of cooperation between Bull and IBM was the end of the world! And now we are starting to consider such events natural. That's progress.

**E&T:** Are you not in the end defending a sort of economic Yalta, a privileged U.S.-European partnership?

**Pandolfi:** I could object slightly to the term "Yalta." However, I think that the time is not far off when the Japanese themselves will be forced to play a far greater role in the game. Now they are trying to get in under external pressure, through conventional political and diplomatic formulas such as in the case of certain agreements with the Americans. In my opinion, all that is outdated. They will be obliged to agree to reestablish symmetry. Having said that, the Americans and Europeans must behave differently. One cannot penetrate the Japanese markets without taking the question of language seriously. What rule obliges the Japanese to learn English?

#### Business

**E&T:** Do you think that you have positive contacts with the Japanese?

**Pandolfi:** I must admit that I have twice thought of going to Japan. However, I think that it is only after next summer that I could go there with any ideas. One cannot simply go there with just a politico-diplomatic attitude.

**E&T:** Then you would go there, but with what kind of idea?

**Pandolfi:** The idea is to do something jointly. The principle being that of mutual advantage. And with the curiosity of a pioneer. It is therefore necessary to go there with a proposal, an initiative. Something new where we would share the

advantages, the risks, the creativity, and obviously the market. We cannot choose a sector which is too compromised. We would have to have an area where we could get involved together. However, there is mistrust, the shadow of the past, the constraints of the present. And we also have a tendency to perceive our internal rules as untouchable. This is a bit like competition rules, which are gospel to us, whereas in the United States and Japan people are occasionally less scrupulous.

**E&T:** In the matter of telecommunications, Europe is the relatively stronger party.

**Pandolfi:** I agree completely. And I am pleased to see that we have gotten over the major difficulties. Our reorganization is complete. I should remind you of the compromise reached on 7 December 1989, which was a crucial turning point. With Brittan, the commissioner for competition, and his liberalization directive on the one side and myself with my directive on open network provision (ONP) on the other. And in the center, Quiles, as we were under the French presidency at that moment. But let's say that the triangular arrangement worked.

**E&T:** How do you see the next 10 years, in this information and communications technology sector, for Europe?

**Pandolfi:** The 1980s were focused on the idea of progress; now we are going to concentrate on the idea of controlling progress. It is like what happened in economics. After the major crisis of the 1970s and the boom at the beginning of the 1980s, we must ensure controlled, stable growth. And I think that is the destiny of this whole decade.

#### Footnotes

1. The Buy American Act is a set of regulations which give preference to American products on the U.S. market.
2. This Community directive gives preference, where the prices are the same, to European companies for equipment contracts with public authorities.
3. The Trade Act is a 1988 law on commercial exchanges which requires the U.S. Government to draw up a list of countries where the United States has a problem opening markets.
4. All-digital means the complete encoding of information, for the whole of the image sequence, into binary series (0 and 1), as in computing.

#### Alcatel To Lead Digital HDTV Project

*92BR0422 Paris ELECTRONIQUE INTERNATIONALE HEBDO in French 30 Apr 92 p 6*

[Unsigned article: "Alcatel Is To Study a System for Transmission of Digital HDTV at 22 GHz"]

[Text] Alcatel Espace has just been selected by RACE [Research and Development Program in Advanced Communications Technologies for Europe] officials as leader of a consortium of European manufacturers and radio stations to study the feasibility of a digital system for HDTV [high-definition television] transmission by satellite. Called HD-SAT, the project is a part of the RACE-II program, which

aims at establishing standards for the future European integrated broadband network. The system under study makes it possible to transmit digital HDTV programs directly by satellite or via cable networks. The HD-SAT project will use the 21.4-to-22-GHz frequency band, which the WARC [World Amateur Radio Conference] has just allocated for radio programs transmitted by satellite. The value of the contract amounts to ECU13 million (approximately 91 million French francs, the insignificant amount indicating the "exploratory" nature of the project). The consortium, led by Alcatel Espace, is composed, among others, of the French Thomson-CSF, TDF [French Telebroadcasting Company], and CCETT [Joint Center for Television and Telecommunications Studies]; the Italian Alcatel Telettra, Alenia Spazio, and RAI [Italian Radio and Television]; the German IRT; and the English Star Telematics.

#### Telecommunications Officials Interviewed on Privatization

##### Ricke Provides Justification

*92WS0468A Duesseldorf VDI NACHRICHTEN in German 27 Mar 92 p 7*

[Interview with Telekom Head Helmut Ricke, by R. Boensch and G. Krause, place not given, 27 Mar 92: "We Need Money—We Don't Have Any Money to Give"—Telekom Head Helmut Ricke Frustrated by Civil Service and Budget Laws"]

[Text] Telekom needs reforms. Civil service laws restrict employees, the lack of capital becomes more and more noticeable.

[VDI-NACHRICHTEN] You want to privatize Telekom. Are you hopeful that Article 87 of the Basic Law will be changed?

[Ricke] Prospects are surprisingly good if you compare the present situation with that of only a year ago. If we only looked at it in objective, rational terms there should be more than enough votes for the two thirds majority required in the Bundestag and Bundesrat for a change in the Basic Law.

[VDI-NACHRICHTEN] Why do you want to incorporate Telekom, do you want to become a real entrepreneur again?

[Ricke] I consider myself an entrepreneur even now although we are, strictly speaking, a federal agency.

[VDI-NACHRICHTEN] Why then do you want to privatize Telekom?

[Ricke] Our goals are clear: By the end of the decade we want to have sales of more than DM80 billion and we want to offer our customers maximum service at minimal cost.

Our efforts towards privatization will include taking care of social concerns. However, we must not forget that we have 20 percent more personnel than telecommunications operators in other parts of the world.

Another factor is capital expenditures which account for half of all costs at Telekom. We invest twice as much per DM of sales than the American network operators. To reach our goals we need better capital equipment; what we have today

won't do. Our equity ratio is currently 23 percent, in comparison, at British Telecom it is over 60 percent, and internationally, this figure is usually 50 percent. It would be unrealistic for us to expect that we can reach such a figure, but even the meager DM16 billion which we urgently need to reach the legally required equity ratio can only be obtained by broad private investments in Telekom.

[VDI-NACHRICHTEN] You lack money...

[Ricke] ...which we need urgently to work internationally. During this decade.

[VDI-NACHRICHTEN] Do you think you can keep up with the competition? What prevents you now from competing?

[Ricke] The restrictions imposed by the civil service and budget laws. You cannot manage a company with procedures which are used in public administrations.

[VDI-NACHRICHTEN] You want to prevent the Finance Minister from constantly demanding money from you?

[Ricke] We need money, we don't have any to give, that should be recognized.... Therefore privatization. The second restriction is the civil service code. The rigidity of our personnel and administrative structure prevents us from becoming competitive. We are not allowed to pay based on performance, we are losing good employees and there is no personnel turnover.

[VDI-NACHRICHTEN] Is the freedom you won through the first reform enough for making changes?

[Ricke] The opportunities provided by the first reform have not yet been exhausted. When we started to breathe life into the law concerning the postal service structure, we were faced with new tasks caused by the unification: merger with the postal service in the East and establishing an infrastructure. This has changed our priorities. However, I did underestimate the dynamics of the development around us, it has become much stronger due to the unification. Competition forces us to act much more quickly than is allowed by the first postal reform law. I could live with the fact that everybody says we are too expensive—rightly so. But what if our monopoly will be challenged by competition?

[VDI-NACHRICHTEN] Does the obligation to provide an infrastructure which, by law, keeps you from becoming more competitive?

[Ricke] No, our competitiveness has nothing to do with this: We simply have to lower our costs. This is very difficult with civil service procedures.

[VDI-NACHRICHTEN] What are your obligations based on the infrastructure mission, which ones can you drop?

[Ricke] Fulfilling an infrastructure mission does not mean that you can only fulfill it with civil servants. This mission can also be fulfilled without the Basic Law stipulating that telecommunications fall under the government's responsibility for the country's infrastructure. There are those who demand this. I could live with this, even if it is not the ideal constitution I am envisioning. My basic philosophy is: the more deregulation, the better. Whether the infrastructure

mission is laid down in the constitution or in another law, or whether a government agency below the ministerial level acts as a watchdog as is the case with Oftel in England, does not matter to an incorporated Telekom.

[VDI-NACHRICHTEN] How would you like Telekom to look in the year 2000?

[Ricke] A corporation without any government participation which still takes care of the governmental regulatory tasks. The present conflict, namely owner and regulator in one person, must be resolved. However, the decision how many networks to set up cannot be left to market forces alone, here government regulations are necessary. But this can also be done with a corporation.

#### Committee Chairman Discusses Risks

92WS0468B Duesseldorf VDI NACHRICHTEN  
in German 27 Mar 92 p 7

[Interview with Peter Paterna, SPD Postal Expert, by R. Boensch and G. Krause, place not given, 27 Mar 92: "Privatization of Telekom Would be Risky"—Peter Paterna, SPD Postal Expert, Sees Infrastructure Mission in Danger"]

[Text]

[VDI-NACHRICHTEN] Is it necessary to privatize Telekom?

[Paterna] No, this would be extremely risky. I would urgently advise the SPD not to change article 87.

[VDI-NACHRICHTEN] Mr. Ricke and others always quote the civil service laws as a bottleneck. Mr. Ricke wants a clear decision.

[Paterna] So do I, because everybody is extremely confused. There is no job left where people know for sure that it will not be changed. A situation like that has never before happened in the Postal Service, you must not forget that. The promise of job security attracts people even today.

[VDI-NACHRICHTEN] Would it not be possible to switch civil servants to a private employment contract?

[Paterna] In that case we must be quite clear about the consequences. The Postal Service employs 670,000 people; of those 325,000 are civil servants. The status of our eastern German employees has not been decided yet. It would take a lot of money to get the civil servants to give up their status. And there is no pension fund for these civil servants. Have you considered the cost of changing their pensions to a private pension fund? That would ruin the enterprises.

[VDI-NACHRICHTEN] Another reason quoted in favor of changing the civil service laws is the fact that personnel is bought by private industry and compensated based on performance.

[Paterna] In addition to civil servants, civil service employees have rights, too: After 15 years they cannot be dismissed anymore. You can imagine how many new employees could be hired between now and the year 2000: It wouldn't be many.

[VDI-NACHRICHTEN] However, the enterprises complain about the restrictions imposed by the civil service laws.



**[Paterna]** If you consider the civil service laws as an urgent problem, then we should reform the civil service laws and not take the enterprises out of the civil service. This, however, affects article 33 of the Basic Law, not article 87.

**[VDI-NACHRICHTEN]** Telekom wants to expand internationally, and for that it needs money which it does not have. It does not even reach the legally required equity ratio.

**[Paterna]** Let's cross this bridge when we get there. A government-owned enterprise cannot go bankrupt, it has unlimited borrowing power. Moreover, there is no problem in obtaining the necessary funds on the capital market.

**[VDI-NACHRICHTEN]** What do you think of a holding company owned by the government under whose roof the three postal enterprises, Telekom, Postal Service, and Postal Bank would operate with different private participation?

**[Paterna]** We already have a board of directors as a parent organization; this has proved to be just a farce. At present, there is a discussion about the benefits derived from joint usage such as the postal service and postal bank both using the postal offices. Here, a board of directors would have to intervene, but it doesn't.

**[VDI-NACHRICHTEN]** That is to say you are not completely happy with everything right now either.

**[Paterna]** Indeed, there are even more problems. It is no longer acceptable for the Postal Minister to combine the functions of regulator, legal authority, owner and politician. He has no hesitation of mixing into the daily operation of the enterprises. A third problem is the fact that Mr. Waigl has direct access to the assets of the postal enterprises. However, this would also be the case if the majority of shares of a Telekom AG would be in government hands.

**[VDI-NACHRICHTEN]** And what if the Minister of Economic Affairs were the owner?

**[Paterna]** Since the constitution of the Federal Republic says that the Minister of Economic Affairs has to come from the SPD, regardless of the party in power, this would be asking for trouble.

**[VDI-NACHRICHTEN]** If you could start a second postal reform phase, what would you change?

**[Paterna]** The enterprises need money, no doubt about that. At the same time, the budgetary situation is so tight already that not much help can be expected here. Still, a few things could be changed: The Postal Service would have to be treated like in other EC countries, i.e. no taxes and fees which would mean an extra DM1.7 billion for the enterprise. The Postal Bank would have to pay an as-if tax based on the rates for regular credit institutions. That way, it would have to pay DM50 million instead of DM250 million. Telekom, too, should only be required to pay an as-if tax and should be rewarded with investment subsidies and write-offs for its commitment in the new federal states—just like regular companies. This would bring the postal enterprises over the critical threshold of 1997-98. After that, things will improve anyhow.

**[VDI-NACHRICHTEN]** How do you solve the regulator role?

**[Paterna]** I am in favor of monopoly rights, independent of the special task of uniting Germany. Monopoly rights make up for the disadvantage of being involved in special political missions which should be required from Telekom.

**[VDI-NACHRICHTEN]** Such as?

**[Paterna]** Guaranteeing basic services nationwide and nationwide modernization of the infrastructure—even where it does not make economic sense from a company standpoint. I do not think that a purely competitive situation would take care of this.

### Italian National Telephone Company Focuses on R&D

92MI0562 Milan *ITALIA OGGI* in *Italian* 3 Jun 92 p 13

**[Text]** SIP [Italian State-Owned Telephone Company] will invest over 160 billion lire in R&D activities this year. SIP president Ernesto Pascale, who made the announcement at a seminar organized by AEI [Italian Electrical Engineering and Electronics Association] in Palermo yesterday, stated: "R&D activities are a strong point for companies wishing to attain competitive positions against others working in the telecommunications sector."

Pascale continued: "The capacity for timely innovation against a backdrop of rapid technological evolution allows for otherwise unobtainable market shares to be conquered successfully." Research in Italy still remains a limited item in company budgets. "However," reminded Pascale, "the share of GNP allocated for R&D activities in Italy did rise from 0.8 to 1.3 percent between 1980 and 1990. Despite this increase, we are still far below the average of other industrialized countries where the share of GNP allocated to research and development is much higher: 3 percent in Japan, 2.8 percent in Germany, 2.8 percent in the United States, 2.4 percent in France, and 2.2 percent in the United Kingdom." And SIP? "Our commitment has grown over the years," said Pascale. "Between 1989 and 1990 it was 21 percent and 26 percent the following year thanks to contributions from the experimental electronics and telecommunications center."

Still on the subject of research, Salvatore Randi, Italtel managing director and AEI president commented. "This sector is fundamental in controlling production processes and company strategies in the telecommunications sector." After stating that Italtel spent 320 billion lire in research last year, roughly half of all Italian national research expenditure, Randi focused on the significant advantages resulting from the international agreement with AT&T signed three years ago. "Our catalogue," said Randi, "has been enhanced with the systems we are developing jointly with our partner." The Carini plant near Palermo is moving in this direction, to produce UT line numeric switchboards and has its own software R&D center employing approximately 300 specialists.

### European High-Definition Television Standards Debate Continues

92WS0571A Paris *LE MONDE* in *French* 5 May 92 p 19

**[Unsigned article: [Article by Michel Colonna d'Istria: "Europosat In the Balance Above the Rhine"]**



[Text] Between arguments about transmission or coding standards, and position reversals on each side of the Rhine, the European satellite television is turning into vaudeville. Or is it industrial drama?

Act I: spinning at 36,000 km above the earth, are the German and French television satellites, TV Sat 2 and the twins, TDF1 and TDF2, spawned by the industrial cooperation of the two countries in the early 1980s. But prone to malfunctions, regulated to a limited number of channels, and technologically outdated because they were launched too long after their design, these satellites accommodate just a few programs (A2, Canal Plus, Euromusique, and SEPT on the French side) received only by a very small number of stations.

Act II: Europe has been after Japan since 1986 in the race for high-definition television (HDTV). European industrialists grouped under the EUREKA program have adopted a phased strategy with an intermediate standard, D2MAC, leading eventually to HDMAC starting in 1995. This policy is based on a principle formulated last December and soon to be formally adopted, making the D2MAC mandatory for satellites beginning only in 1995, and only for new services. This directive would be complemented by a global agreement (industrialists, broadcasters, cable operators, ...) known as MOU, with subsidies of ECU850 million (LE MONDE of 15 April), and whose potential signatories met in Brussels on 23 April. At that meeting, German broadcasters voiced violent objections against D2MAC and HDMAC, the European standard for HDTV.

Act III: Since 1985, France has been developing its national satellite system, whose recently launched second generation, Telecom 2A and 2B, makes it possible to broadcast up to 11 television programs. Telecom 2A was meant to provide support for a constellation of pay-TV special-interest channels under the umbrella of Canal Plus beginning in April 1992. Industrialists, France Telecom, and the majority of ministries involved would like to see Telecom 2 transmitting in D2MAC in order to adhere to the European standard and also to promote the Eurocrypt "open" coding system associated with this standard. Canal Plus is interested only in SECAM and in its own coding system, Syster. It feels that the expanded 16/9 screen format, the only internationally accepted format for future television and the only concrete D2MAC attraction, would be far better used on another satellite network that would pick up where TDF/TV SAT left off.

Act IV: Since last July, the European organization EUTELSAT has been ready to ensure this continuity, namely to order and launch, within the next 27 months, a pre-Europesat satellite to pave the way for a pan-European television satellite network which would begin to unfold in 1996. This project implies French and German consent. The French, as a consequence of the Eymery report, had supported the project to encourage D2MAC supporters beyond the Rhine. But German public networks, skeptical about the new standard and more sympathetic to the PAL-Plus option as a means of achieving the 16/9 format, have long refused to pay for this pre-Europesat. But now the German networks, realizing that the European directive is not so burdensome and that they risk facing the de-facto monopoly of the Astra Luxemburg satellites, have changed position. The Germans are said to be ready to give EUTELSAT the green light.

The French are now the ones playing for time... France-Telecom is not very eager to make it easy for PAL-Plus, nor to provide Andre Rousselet, head of Canal Plus, with an excuse to keep SECAM on Telecom 2. As summed up by a French expert, "without D2MAC, Europesat does not interest us."

Act V: In Paris, everyone is accusing everyone else of monopoly. Canal Plus is excoriating Telecom engineers for their dogmatism; they in turn bring up Rousselet's reversals of position and his dominance of the pay-TV market. The government, called upon to settle the matter, is hemming and hawing. Telecom 2A is spinning its wheels. Europesat is gathering dust on the shelf, and D2MAC is lame.

This vaudeville would be laughable if its consequences were not so serious. For one thing it delays France's entry into the era of satellite television. According to a study from the Integration Office, direct television program reception this year will be available in more than 2 million homes in Germany and 3 million in Great Britain.

For another thing, these multiple controversies weaken the arguments of the European strategy aimed at high definition television. The "compatibility" invoked with respect to the Japanese assumes an installed inventory of D2MAC receivers. As for the progress of European achievements compared to American digital HDTV projects, the European edge is getting narrower every day. If Europesat capsizes in the Rhine, a part of the European electronics industry could go down with it.