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WEST EUROPE REPORT SCIENCE AND TECHNOLOGY

No. 147

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BIOTECHNOLOGY

FINNS EXPECT BREAKTHROUGH IN GENETIC ENGINEERING

Stockholm NY TEKNIK in Swedish 21 Apr 83 p 8

[Article by Juhanni Westman: "Mold Gene Makes Alcohol From Cellulose"]

[Text] Helsinki--In the future it can be cheap and simple to make alcohol from cellulose with the help of a yeast with mold genes.

Experiments with mold yeast are being conducted in Finland where a breakthrough in genetic engineering is expected.

Mold produces enzymes that break down cellulose to make alcohol. Today the price of enzymes is a large part of the production costs for cellulose alcohol.

Genetic engineers are opening up prospects for making the enzymes cheaper. "Prospects for the future," stresses Dr Jonathan Knowles, who with his Finnish colleagues at the State Technical Research Center in Helsinki is the first in the world to clone one of the important genes involved in the process.

Knowles, Tuula Teeri and Irma Salovuori isolated the mold gene that produces the enzyme for cellulose hydrolysis. The six or seven other important enzymes and the genes that control their production are also known.

The genes have been isolated, but it is not yet known which gene belongs to which enzyme. The genes are on deposit in a gene bank while the structure of the cellulose-hydrolysis gene is being studied. The next step is to determine the so-called alphabetical order, the sequence in which the adenine, cytosine, guanine and thymine molecules are present in the DNA chain.

"This will require at least a year. It will be a while before the genes are ready to be transplanted," says knowles.

They must still find out what kind of cells the new genes will be introduced into and which cellulose-decomposing enzyme activity will result. Sugar obviously plays a role. Cells without a cell nucleus, coli bacteria or bacillus subtilis--both undergoing intensive study in Finland--produce donor enzymes after gene transplantation, but do not bind the enzymes with sugar. Cells with a cell nucleus, such as yeast, do produce this bond. Apparently, the sugar must be bonded to the enzymes for the cellulose to be degraded.

Mold DNA for Yeast

Can a yeast be produced that directly ferments cellulose to sugar or to something else useful? Or can the yeast be used merely to manufacture enzymes?

If a cellulose yeast is ever to become a reality, technology must be able to transfer mold genes to yeast cells.

Researchers Helena Nevalainen and Merja Penttila understand the technology. It is a two-step process: the mold genes are combined with lambda phages, a type of virus which will act as an injection syringe for the mold genes, and this combination is introduced into coli bacteria, which in turn will reproduce the donor DNA.

"This yields a finer structure," says Penttila.

The resultant plasmids are isolated from the coli bacteria, but before they can be transferred to yeast cells, their hard cell wall must be "peeled away" so that only the cell membrane is left. The plasmids are then able to penetrate into the yeast cells, and these continue to live and divide, only now with a new genetic apparatus. A production process is a long way off yet though, emphasize both Nevalainen and Penttila.

"We have made some progress after 3 years of work," comments Knowles.

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BIOTECHNOLOGY

FRG'S POSITION IN BIOTECHNOLOGY R&D ANALYZED

Hamburg DIE ZEIT in German 11 Mar 83 pp 33-35

[Article by Wolfgang Gehrman: "Biotechnology: The Soft Giant, A Gentle Revolution Is Proceeding to Change the Industrial World"]

[Excerpts] In the area of electronics future technology there is not much to report from German industry, it has clearly lost in the gamble for microchips at a cost of billions. Firms such as Siemens, AEG or Bosch are years behind the competition from the United States and Japan. This is disastrous not because the self-esteem of the country is suffering from it. Rather, the consumptive innovation is costing domestic jobs while foreign competition is conquering the world market.

Now genetic engineering is faced with the same debacle as occurred in microelectronics: no future for the FRG in the technologies of the future?

If anyone has to be affected by the bio-boom, it is the German chemical industry. Pharmaceutical companies like Schering and Merck still have international prestige. Worldwide, Bayer, Hoechst and BASF, the chemical giants in the Rhineland, are the largest of their ilk--at least for the present.

The successor of once mighty IG Farben--always the leader in research and innovation on into the postwar period--have gotten into the business of genes much too timidly. In this area, too, the Japanese and Americans are in the forefront. Hansgeorg Gareis, director of pharmaceuticals at Hoechst, concedes without hesitation: "The Americans at least are way out in front of us."

Professor Gareis should know. For the Americans have pulled off the first coup on the German market--against Hoechst. For a month now the U.S., conglomerate Eli Lilly has been selling in the FRG the first product mass-produced through genetic engineering: human insulin. In the FRG approximately 420,000 diabetics are dependent on the vital hormone which controls the blood sugar level in the body. Worldwide the insulin market has a sales volume worth over DM700 million.

Flourishing Bio-Business

Biotechnology involves a gentle chemistry: its raw materials grow back and thus can never run out, as coal and oil can; their transformation processes take place under less extreme temperatures and pressures than do petrochemical processes--they require substantially less energy; bioprocesses are often single-stage processes and thus convenient; finally, they are especially safe for the environment.

In the end it might be possible for biotechnology to reconcile two bitterly alienated camps: green environmentalists and the chemical industry. The transformation of biomass into gas is a gentle technology which is highly prized among the alternatives. The chemical industry could be helpful in implementing broad use of it. Hoechst chief Rolf Sammet has realized that "the chemical industry likewise cannot close its mind to the slogan "Back to nature!" American molecular biologist Leslie Glick, founder of the Genex genetics firm, estimates that in the foreseeable future one-fourth of all chemical production will be altered by biotechnology.

Microbes which have been improved through genetic engineering will ultimately also be able to transform many kinds of waste into harmless or even useful materials more effectively than has been the case. Even now conventionally bred bacteria are working real miracles in the settling tanks of the chemical industry. Custom-made micro-organisms can also transform oil discharges at sea into food for marine animals. Other bacteria are useful in mining nonferrous metals. When sprayed in solution form over barely productive strip mine deposits, their discharges eat the metals out of the rock. In the same way microbes can economically exploit even the most miserable oil deposit--all this thanks to biotechnology.

Since the future of the new technology is just now beginning, the opportunities for German industry cannot yet be totally lost. Anyone wanting to be part of the bio-business will need three kinds of things:

--A lot of money: development of a single new drug takes about 10 years and costs DM80 to 100 million.

--Access to the results of basic research which is primarily being done at universities, but also in the leading venture capital enterprises.

--The skill to transform basic knowledge into products and to manufacture them industrially.

Only in the United States is there the ideal combination of the three factors. An army of molecular biologists at the universities provides the critical mass of basic knowledge which is the source of exciting discoveries. Favorable tax laws make it profitable for big earners to put their money into risky undertakings. This is why in the beginning the venture capital companies involved in genetic engineering were swimming in money which at first they squandered without concern for losses.

The genetic engineering companies in Boston and San Francisco produce a swirling mixture of intellect and money. America's big industry is located close enough to the actions so that it can seize an opportunity if the small research companies have something lucrative to offer. Conglomerates like DuPont and Monsanto, Dow Chemical and Eli Lilly are vigorously involved in expanding their own genetic engineering laboratories in order to be able to turn basic knowledge into products without any problems.

The Germans' Deficit

The starting conditions for German industry in this area are much worse. To be sure, it lacks neither the necessary money nor the technical production skills in biochemistry. Almost all large chemical and pharmaceutical firms are busily expanding their biolaboratories. Yet what is lacking is basic research at home.

Not that there are no renowned German microbiologists. Bayer is cooperating with the Institute of Genetics at Cologne University and with the Max Planck Institute for Breeding Research in Cologne. BASF supports genetic engineering research at Heidelberg University in the amount of DM5 million annually. Together with the state of Berlin Schering will establish a research institute for cell biology at a cost of DM80 million for which certain highly respected scientists will be found.

Yet the number of top researchers in the FRG can be ticked off on two hands. Moreover, they do not have the academic base nor the working conditions improved by private infusions of capital that their American colleagues have. It is no wonder that several talented people are turning their backs on the FRG and going to the United States.

One of them is Axel Ullrich. It was none other than he at Genentech in San Francisco who genetically altered those bacteria which today produce human insulin for Eli Lilly--to the regret of German competitor Hoechst. Ullrich says: "The funny thing is that in general the first important steps in respect to application were made by Germans--in the United States." In addition to Ullrich, there was his colleague Peter Seeberg who implanted in *E. coli* bacteria the genetic information for the human growth hormone somatotrophin.

The two Germans joined Genentech with their knowledge which they acquired as holders of fellowships from the German Research Association (DFG) at the University of California. Axel Ullrich, as head scientist, earns \$60,000 a year there. In addition, after 4 years he will also own 10,000 Genentech shares.

Ullrich says: "Not even for the same money would I work in the FRG because here I have much better working conditions. At a German university I would perhaps have been given 3 staff workers--here there are 10 in my group." His judgement about the prospects of German industry in genetic engineering is: "I'm pessimistic." Development is horrendously fast. That is what is underestimated in the FRG. The large German firms are counting on our

patents being challengeable. In any case none of them is licensed here although they have all been here. It's too big a poker game for them here."

In actual fact licenses of the bio-boutiques are expensive. Yet Stephen Cooper Rowe, Genentech's marketing manager, says: "Decisive in this business is getting the jump on the competition. Whoever is there first, thanks to our license, has 80 percent of the markets--that is worth quite a bit of money."

Hoechst has had to learn this lesson in the case of human insulin. Nonetheless, the company persistently rejects any cooperation with venture capital companies. Hoechst researcher Gareis says: "Whatever they can do, we can do ourselves."

Bayer and Schering appear to be rather inclined to self-doubts. In the past year Bayer brought a majority share in the genetic engineering firm Molecular Diagnostics in West Haven, Connecticut. Via its U.S. subsidiary Miles, the multi from Leverkusen is working together with the laboratory firm Genetic Systems in Seattle. Schering has a research agreement with the Genex Corporation, one of the four leading genetic engineering companies.

Hoechst on the other hand is staking more on science which is as yet untainted by financial self-interests. Two years ago the Frankfurt conglomerate shocked the German public with the news that it was giving \$50 million to an American researcher. With the money genetic engineering pioneer Howard Goodman at Massachusetts General Hospital in Boston is supposed to establish a department of molecular biology and run it. In this way Hoechst is guaranteeing for itself the first rights to exploit Goodman's research results and the opportunity to have Hoechst scientists trained in Boston. Yet the spectacular arrangement was not even the idea of Hoechst managers. The initiative came from Howard Goodman.

Poker For the Profits

Goodman's dry response to the question as to what solid results Hoechst thus far has been able to derive from its Boston connection is: "Zero."

Moreover, unfortunately the competition has vigorously joined in the kibitzing. Even DuPont, the American chemical giant, has revealed its generosity in respect to the Harvard Medical School--Goodman's hospital is its teaching hospital--and donated DM15 million.

Hoechst's prospects of being served just as well by American scientists as U.S. industry is, is viewed with skepticism by Heidelberg molecular biologist Ekkehardt Bautz, in a manner not totally free of envy: "Anyone with an overseas orientation simply does not have access because of the distance."

With far more zeal than German industry another competitor in the genetics business is trying to bridge the great distance to America; Japan. It is characteristic that the Japanese pharmaceutical multi Green Cross was the

first company to take over a genetic engineering license from Stanford University. For a good reason: Until recently the Asians had no basic knowledge of any kind of genetic engineering. They are catching up all the more quickly.

Every even half-way interesting microbe company in the United States now has Japanese customers. Axel Ullrich, a German researcher in San Francisco, says: "The Japanese will pay almost any price for know-how. First they enter into cooperative arrangements, then they copy the methods. When genetic engineering flourished, Japanese scientists showed up very quickly in the U.S. Laboratories. And they do not stay here, they return to Japan."

If the Japanese fill their gap in basic research they will be unbeatable in biotechnology. For nowhere in the world do companies have so much experience with traditional biological-industrial processes than in Japan. Japan's food industry has perfect control in fermentation methods because of Asian nutritional habits.

Japan's Ministry of International Trade and Industry (MITI) is doing everything possible in order to help the industry. Eight years ago the MITI declared microbiology a priority technology. By 1990 the 14 leading chemical and pharmaceutical conglomerates are to receive DM260 million from the state for biotechnological experiments. The companies will presumably spend some multiple of this sum out of their own funds. As a result, 30 percent of the energy-intensive, oil-dependent processes in chemistry are to be replaced by biological processes.

In contrast, state research support in the FRG appears rather pitiful. Of course, in the past 3 years the Ministry for Research has put a substantial sum into biotechnology, amounting to DM240 million. Yet the money has been frittered away on a large number of uncoordinated individual projects.

Bonn has determined that the driving force in genetic engineering development is to be the Association for Biotechnological Research (GBF), one of the nation's great research facilities. It is to become the link between universities and industry, which in the United States is accomplished by the venture capital companies. Yet the GBF and its scientists, who are paid federal employee wages, are located way out in the sticks, in Braunschweig, as far removed from the sites of the German chemical industry as humanly possible.

Even Boston is closer, as Hoechst has already learned.

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ELECTRONICS

SIEMENS PRODUCES HIGH-TECHNOLOGY MOS IC'S IN AUSTRIA

Paris ELECTRONIQUE ACTUALITES in French 11 Mar 83 pp 1, 18

[Article by JP Della Musia: "Siemens Accepts the Economic Challenge of the Standard MOS"]

[Text] Villach--"Siemens is now the third largest electrical equipment company in the world, ahead of Philips. MOS technology is the key to the future in electronics. Siemens cannot therefore allow itself to not be one of the large manufacturers of MOS integrated circuits." This is the reasoning that has led and continues to lead Siemens to invest heavily in this field, especially since the end of the 1970's. The head of Siemens's MOS division is in Munich, but its branches are now mostly in Villach, in an 8000 square-meter plant located in the south of Austria. The plant's production is presently reaching 4500 wafers per week. Thanks to its five steppers, it provides among other things, the bulk of the group's 64K RAM production.

It is curious to note that the European companies involved in the production of standard MOS circuits often give different justifications for this activity, despite the fact that they all lose a great deal of money because of it. Thus, for Siemens, the justification is that "we cannot fail to be in it, especially since the group's existence gives us long range chances of success."

Officially, the detailed reasons that have led Siemens, among others, to invest 130 million DM (380 million francs) in Villach to carry out production under the best possible industrial conditions, are:

There are fewer and fewer pure independent semiconductor specialists in the world;

Investment costs are now so high that they become inapproachable for small companies;

Independent companies do not have access to the systems know-how that permits innovation in integrated circuits (as in the case of COFIDEC for telecom, for instance);

The development risks that have to be taken become unaffordable for small companies. The development costs for an integrated circuit of several tens of

thousand gates can exceed 10 million francs, without even discussing microprocessors. And then, this circuit can find itself outdated by a competitor on the day of its release.

Consequently, according to Siemens, only the large groups have a chance of success over the long term.

However, the German company admits that 40 percent of its production is intended for the group (at market rates). It is therefore quite probable that if the Siemens semiconductor division has been in fact able to invest that much in MOS technology, it is more in the overall strategic interest of the group (mastery of the systems know-how required for integrated circuits) than for the opportunity for direct profits represented by the manufacturing of MOS circuits.

The fact that Siemens aims only at long term interests is obvious when we know that the Villach star product is the 64K RAM, the circuit whose complexity/price ratio is the highest in the world: the company which knows how to industrialize this product at an acceptable cost has a very valuable know-how for the mass production of all other MOS products. But only a few Japanese companies are making money with this product under the production conditions of the Far East. You have to have a very strong back or extraordinary know-how to hope to make a profit under European conditions. A rough example is illustrative: the turnover generated by a four-inch wafer must be of the order of 2500 francs with advanced technologies, to allow a European semiconductor manufacturer to survive. About 200 64K RAM's are integrated on such a wafer, with one out of three (33 percent yield) being good under favorable circumstances. These observations could lead to a sales price of about 38 francs. Yet, the market price is 20 francs in large quantities, partly because the Japanese do not need 2500 francs per wafer to be financially successful, and partly because some of them are supposed to experience manufacturing yields which exceed 50 percent.

Austria's Strength

Siemens says that its yields are among the best four Japanese yields, but it acknowledges losing money in selling its RAM's, which is not surprising.

Why did Siemens select Austria for its MOS production plant? There are several explanations.

Austria has given Siemens financial aid for this installation;

Since 1970, Siemens already had at Villach an assembly plant for discrete semiconductors;

Austrian workers speak German (which is important for product quality);

Austrians accept to work in three eight-hour shifts (the Germans do not);

Austrian salary costs are 30 percent lower than German ones;

Austria has electronics schools.

As a result, 70 million DM (200 million francs) were invested in the plant that was available in 1980, to install an MOS diffusion and assembly line, whose size is already being doubled. At present, this plant produces more than one million 16K and 64K RAM's per month, and has 750 employees.

Five Steppers

The Villach MOS unit shows its visitors two strong points compared to most other European units:

It has five GCA 4800 DSW steppers, and three Perkin Elmer Model 300 1/1 projection maskers (plus two Model 240 units), the former for 2 or 2.5 micron lithography for 64K RAM's, and the latter for 3 micron lines for 16K RAM's;

In addition, it operates under exceptionally clean conditions. Even the assembly is done in a clean room (5 to 15 percent improvement in yield, and three-fold improvement in reliability compared to standard room conditions). In a few weeks, Villach will in fact also be in a position to mold its plastic packages in a clean room, which will not increase yield but will improve the reliability of the products. For critical operations, the air is renewed 300 times per hour; the sticky rubber mats are cleaned every hour; and under their coveralls, workers wear an overgarment which does not produce dust and is not electrostatic.

On the other hand, Villach is slightly behind the Japanese in semiconductor assembly, which is semi-automatic for attaching chips on lead frames and for lead bonding (the latter is automatic only after one spot on the chip has been manually positioned with respect to the bonding head). However, totally automatic machines with shape recognition for the two operations will begin to be installed within two months. At present, Villach assembles locally all circuits that are produced in intermediate quantities, with the mass produced ones being assembled in Singapore.

Siemens depends heavily on the quality of its products for building a reputation. In addition to the precautions already mentioned, Siemens optically controls all its professional circuits, and burns-in for tens of hours at 125 degrees C, all the circuits it produces. Additional quality control operations are performed for large customers.

Villach also has an integrated circuit design center with 44 employees. All technologies are used, but its strong points are fast A/D converters, C-MOS telecom circuits, some microprocessor peripherals, and integrated circuits combining linear and digital features. The work distribution between Villach and Munich depends significantly on the work loads of the two centers.

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ELECTRONICS

RTC TO BEGIN COMMERCIAL PRODUCTION OF GALLIUM ARSENIDE IC'S

Paris ELECTRONIQUE ACTUALITES in French 18 Mar 83 pp 1, 20

[Article by FG]

[Text] RTC has decided to begin the production of GaAs integrated circuits (IC) at its Limeil-Brevannes installation, located at the LEP (Laboratory of Applied Physics and Electronics) site but separate from it.

RTC's first two commercial GaAs IC's, whose introduction date has not been disclosed, should be a dynamic divider-by-two operating at up to 4.2 GHz, and a low power amplifier, also good to 4.2 GHz. The 12 GHz receiving head for satellites, developed at LEP, should be sold at first in a hybrid form with an integrated amplifier.

To support the start of this industrial activity in GaAs IC's, as well as the activity in VHF frequencies and optoelectronics, RTC should triple its GaAs production facilities before the end of the year, since mastery of the material is proving to be very important for mastering components in the future.

At present, RTC has two industrial technologies for manufacturing gallium arsenide. One of them, more appropriate for optoelectronics (horizontal growth method, known as Bridgman), is in operation at Caen; the other, specially intended for VHF components and IC's (Czochralski vertical growth, which produces circular cross section ingots), is being used at Limeil-Brevannes. According to the company, the quality of RTC's GaAs is equal to the best in the world. The company offers several varieties, polycrystal or single crystal (in standard and laser quality), ingot or slices (sawed or polished), doped or semi-insulating. It should be noted that RTC does not produce this material solely for its own needs, and that it supplies GaAs on the market.

Soon, Analog GaAs IC's

RTC has thus decided to begin the industrialization of GaAs IC's at this time, even though it is aware that the market for these devices will not really take off before 1990 (according to the results of a forecast conducted by RTC).

But still according to RTC, GaAs IC's should represent the major activity of the next decade (with the massive entrance of digital IC's), and in order to be ready in time it has to start now. By the end of the current decade, the size of the GaAs market should be equivalent to that of the present VHF and optoelectronic devices.

At first, RTC will endeavor to industrialize the rapid, self-aligned planar technology (known as normally-on) developed at LEP. The circuits used to test this fabrication will be dividing circuits (dynamic divider-by-two operating at up to 10 GHz, with a consumption of 140 mW, and a static divider in the 0 to 2 GHz range, with a consumption of 5.4 mW at 1.2 GHz; by comparison, an equivalent silicon circuit consumes 500-600 mW), low noise and wide band amplifiers, the 12 GHz receiving head for satellites, and the GPS (Global Positioning System) receiver, all of which have been developed by LEP.

At the same time, RTC is also studying other technologies for industrialization, in particular a normally-off, low consumption, input grid technology.

For logic circuits, the French company, which is exploring the possibilities of HEMT (high electron mobility transistors), is also studying most of the various types of known logic circuits, such as: two-diode BFL, which is the fastest one since it makes it possible to expect 80 ps propagation times per gate with a consumption of 30-40 mW and an integration density of 200 gates per square-mm; single-diode BFL (80-200 ps, 2-5 mW, 500 gates per square-mm); and DCFL (100-200 ps, 0.2 mW, 1000 gates per square-mm). But none of the technologies are currently gelled, and all three will probably be used depending on the circuits to be fabricated.

Close the Gap With Respect to the Japanese

While starting the industrialization of GaAs IC's, RTC continues its efforts in the areas in which it is already strong, optoelectronics and VHF frequencies. Among the developments being made in the former, are the VHF orange luminescent diodes (610-620 nm) which should be available by the end of the year, as well as special components for cable television.

Optoelectronics was used to start the GaAs activities at RTC, and VHF devices then took over. In this field, the delay with respect to the Japanese is significant; the latter, with NEC, Fujitsu, and Mitsubishi in particular, presently hold 70 percent of the French market, and lead in low noise and power GaAs FET's. Without reaching the performance of Japanese components, RTC should be introducing the following: in the coming weeks, a 1.5 W FET in the 5.9-8.5 GHz band with a prematched input; in October, a 3 W device in the same frequency range with a bandpass of 1 GHz, with prematched input and output; and before the end of the year, a low noise GaAs FET with 0.5-0.6 micron buried grid, specified up to 18 GHz, which would be better than NEC's 137. As for research, LEP is currently studying the feasibility of a low noise FET characterized up to 30 GHz.

The technologic approach currently used by RTC is limited at about 8.5 GHz; for this reason, the company is developing as part of a DAII contract, a 12 GHz GaAs line similar to the bipolar achievements with the 5 GHz devices. The aim is to reach 1 W at 12 GHz by mid-1984, with 0.5-0.6 micron grids (the record in this respect belongs to Mitsubishi with 5.5 W at the same frequency). The development of the 12 GHz line should also result in fallout on devices operating at lower frequencies; we can thus expect the marketing of a transistor capable of supplying 5 W at up to 8.5 GHz by the end of next year.

We might also point out that all RTC's hyperfrequency GaAs components are sold as chips. With all its projects in the GaAs FET area, RTC has the ambition--without actually admitting it--to assume the position of Europe's manufacturer of GaAs FET's, a position which according to the company, is still open.

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ELECTRONICS

THOMSON'S POLICY FOR SEMICONDUCTORS DISCUSSED

Paris ELECTRONIQUE ACTUALITIES in French 8 Apr 83 pp 1, 12

[Article by J.P. Della Mussia: "After the Takeover of Eurotechnique and a Reorganization in Progress Thomson-SC: Continuity in Change"]

[Text] After the takeover of Eurotechnique by Thomson-CSF [General Radio Company] after the changes in the top management of this company and in the management of Thomson-Efcis, will Thomson-CSF's policy on semiconductors change? Not fundamentally. However, there will be new possibilities, and yesterday's ambitions will have a better chance of being realized.

We will mention three of the policies among those which were defined by the persons responsible for this activity, Mr Starck, deputy director of Thomson-CSF for the Electronic Components Branch, and Mr Noels, planning director at Thomson-CSF, president of Thomson-Efcis and of Eurotechnique:

--the semiconductor activity of the company will stay under this group, but it should at the same time use the latter and take initiatives to strengthen its position in the market and to be competitive;

--there is 90 percent duplication in the catalogs of Thomson-EFCIS and Eurotechnique, and everything will be carried out so that the two entities can cooperate fully at the commercial level;

--Thomson-CSF will make efforts to export chiefly under its own name since the trade agreements with NS [National Semiconductor] are to be considered only on a gradual basis, "step by step."

In terms of products, Thomson has not decided yet whether it will make RAM 64 Kbits and the 16000 microprocessor. The new products in the NS catalog, which will be produced by Thomson/Eurotechnique, will be determined basically in the next three months.

Satisfy 50 Percent of Thomson's Needs

"To say that the components branch is under Thomson is to describe the situation only from a certain point of view. In fact, Thomson needs good semiconductors and at the market price. There is no question about making exclusive purchasing

policies within the group. The semiconductor activities should thus attain the same dimensions as those of our competitors in order to be competitive.

"The Thomson group, on the other hand, could be a source of innovation and easier access for the components. Our goal is to satisfy 50 percent of the requirements for Thomson's systems division (against today's 25 percent); beyond that, it would be dangerous." These were Mr Starck's words in response to the question: "Will Thomson make semiconductors for its own needs or not?" during the interview he gave us, together with Mr Noels. Mr Starck was even more precise: "If Thomson wants a certain component, we will make it; however, negotiations will be conducted, with the prospect of developing this component for other markets; if a component had only an internal use, it would be a bad component for the whole world." Mr Noels stressed that this will coincide with the shifting of the emphasis of activities at Thomson: "Before, Thomson's efforts were very much oriented toward the military and avionics; now these efforts are mainly directed toward activities which demand large serial production of components, like telephony, the general public, and telemetry. This requires a solid basis for production of semiconductors."

Only One Catalog

In terms of reuniting the activities of Efcis and Eurotechnique, the developments are equally clear: "If there is cooperation between Efcis and Eurotechnique, it is certainly that of trade services," Mr Noels affirms, and continues: "The problem is to sell more per line and more effectively; fortunate- more than 90 percent of the present catalogs of Thomson-Efcis and Eurotechnique are complementary; therefore, we will harm virtually no products in establishing our joint catalog. At present, both sales teams sell all the products separately. Several months from now, the best of the commercial network of Eurotechnique will be added to that of Thomson-Efcis." Mr Noels goes on: "At the technological level, we are in a phase of evaluation; in time, it is obvious that there will be rationalization, but we are not yet able to say who is going to do what; for the moment, circuits are produced according to favorable circumstances." In regard to compatibility of masks at Efcis and Eurotechnique, Mr Starck points out: "They are not physically compatible, but the conversion is very easily done with software in order to pass from one link to another. We are very optimistic in respect to the rationalizations."

In regard to the time-lag between the dates of introduction in the USA and in France for products made at a second source, Mr Noels estimates that the time periods will go from one year in the past to 6 months in the future: "Recently, Efcis had to simultaneously introduce new products and its H-MOS II technology, which led to delays. But now, the industrial sectors are in place and we will be more efficient in introducing new products."

Mr Noels does not want to reveal his intentions in the negotiations now in progress with NS: "Everything is open at the level of technological trade and purchase with NS: for the time being, we settle the problems we are certain to agree on; these negotiations will probably last about three months. The only thing that has been definitely agreed upon is the continuation of Eurotechnique's present activities."

Two Export Phases

Mr Noels stresses that exporting also holds all of Thomson-CSF's. "During a preliminary phase, we will try to strengthen the sales of existing products via the established sales network at Thomson-CSF and the timely establishment of Eurotechnique offices; during a second phase, we will increase our technical support abroad in order to adapt the products and to plan according to the client's requirements. Right now, we lack devices for penetrating foreign markets; we'll find them."

CA: + 30 Percent Per Year?

Finally, does Thomson-CSF have more chances for success in the field of semi-conductors than its competitors? Mr Noel's thinks so: "Our competitors do not have all the supporting domestic markets which help us thanks to our activities among the general public, in telecommunications, the military, and industry. Now all the most recent successes in semiconductors, particularly Japan's successes, have started from the needs of big groups. The groups' equipment has served as test-stands for components and then there has been an expansion to the free market. Nowadays, there is a constantly decreasing number of small, independent companies that can be successful in semiconductors." Mr Starck adds:

"Besides, we benefit from the administration's desire to promote electronics in France. We can cultivate national cooperation. It was a good thing to reduce the number of poles."

The Thomson semiconductors, including the individual units and Eurotechnique, were worth about 1,150 million francs in 1982. What goal for growth has been set, and when will profitability be reached? Mr Starck counts on an increase of 30 to 35 percent per year for the total of semiconductor activity. "And profitability will be reached as soon as possible," he specifies. "But rapid growth is necessary, and we cannot post losses that come from a decision to invest enormously in the same way as losses that result from stabilized activity."

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ELECTRONICS

THOMSON ACQUISITION OF TELEFUNKEN: ADVANTAGES, DISADVANTAGES

Paris ELECTRONIQUE ACTUALITES in French 18 Mar 83 p 2

[Unsigned article]

[Text] Thomson's spectacular reorientation toward Telefunken after the German Cartel Office's opposition to the Grundig purchase (see our last issue), demonstrates the determination of the French manufacturer to buy "shares of the market" in FRG. Thomson is indeed aware that this is the only solution for rapidly reaching a sufficiently large critical size, so as to achieve the competitiveness that will curb the Japanese advance in Europe. From this standpoint, the "exchange solution" adopted with Telefunken appears less satisfactory. However, a closer analysis of the operation as a whole discloses non-negligible advantages for Thomson.

Thomson-Brandt would spend 75 million DM (about 31 million dollars) to buy Telefunken. The parent company, AEG, would endorse all the Telefunken losses up to 1 April, which is the date on which the French group plans to take control of the German manufacturer. In 1982, Telefunken recorded a loss of 225 million DM.

One of the major advantages of the Telefunken solution is that it will definitely be less costly than the Grundig purchase project. Telefunken Fernseh und Rundfunk (TFR) carries much less weight than Grundig: 4000 employees against 30,000 for a turnover of 1.5 billion DM against 2.9 billion for Grundig.

Moreover, TFR has already been restructured, whereas everything still remains to be done at Grundig. According to some estimates, Grundig has an excess of 10,000 employees.

Telefunken on the other hand, has already sold its problem-causing foreign subsidiaries (two-thirds of last year's losses were incurred abroad).

The French Ministry of Research and Industry considers that the causes for Telefunken's last year losses have been eliminated. Thus, despite serious difficulties, Telefunken can look toward the future with a certain optimism

(last year, the company actually increased its share of the West German color television market by 6-10 percent). And it can be foreseen that in the months to come, Thomson-TFR could very well bite into the market portion held by Grundig, given the undoubtedly growing difficulties of Germany's number one manufacturer of leisure electronics.

On the other hand, it is certain that by buying Grundig Thomson would have acquired a definitely larger market share than that obtained by purchasing TFR. With Grundig, Thomson would have controlled nearly 35 percent of the FRG market of consumer products (against only 25 percent with the purchase of Telefunken). Moreover, with Grundig, Thomson would have been nearly equal in size with Philips in consumer electronics, whereas with Telefunken, the French group will represent at most two-thirds of the Dutch giant's turnover.

A "European" Dimension

But obviously, Thomson's essential goal is to increase its market share, primarily on the major European market, the German market.

This being said, even if the deal is not as good, Thomson still achieves a European dimension through the Telefunken acquisition, with 20 percent of Europe's electronic consumer goods market. Thomson thus hopes to become sufficiently large to withstand the Japanese competition, as well as to be able to negotiate with Japanese companies from a better position.

It is nevertheless true that by buying TRF, Thomson also finds itself in a rather uncomfortable position in terms of forming a European front against the Japanese invaders. This is because TFR is associated with JVC and Thorn-EMI within the J3T group which produces VHS video recorders in Berlin (we might point out that the European system Video 2000 was developed by Philips and Grundig).

In this case Thomson, by buying Telefunken instead of Grundig, and in currently marketing VHS video recorders, avoids having to distribute two different standards with all the complications--and costs--which this would have implied.

It must actually be pointed out that for Thomson, the VHS is only a temporary solution: the future for the French group is the 8 mm standard, even if Thomson has not yet determined its alliance policy in the matter, a policy which for the time being remains open.

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ELECTRONICS

FRG AUTHORIZES THOMSON PURCHASE OF TELEFUNKEN

Paris ELECTRONIQUE ACTUALITES in French 25 Mar 83 p 2

[Unsigned article]

[Text] On 18 March, the West German Cartel Office authorized Thomson-Brandt to purchase 75 percent of the shares of Telefunken Fernseh und Rundfunk (TFR), a subsidiary of the AEG group.

Control will be turned over on 1 April. AEG, which will retain 25 percent of its subsidiary's capital, will underwrite all the TFR losses recorded up to 1 April. The Cartel Office imposed no charges or conditions to the acquisition.

Thomson-Brandt will disburse 75 million DM (31 million dollars) to purchase TFR and its subsidiaries.

Thanks to this acquisition, the French group will represent 20 percent of the European electronics consumer market, or two-thirds of the Philips turnover in the same area.

On the FRG market, Thomson will control 25 percent of the color television, 10 percent of the hi-fi, and about 30 percent of the record turntable sectors. The agreement between the French group and AEG was signed on 8 March 1983.

At the end of March, Thomson will disclose its projects for a possible TFR reorganization. One of the major problems which the French group will have to solve, is that of video recorders. As we know, Thomson is currently distributing in France JVC's VHS video recorders, but has started negotiations with the Japanese firm to obtain a transfer of technology for producing video recorders in France. But in Berlin, TFR manufactures VHS video recorders in association with JVC and Thorn-EMI. Thomson will therefore have to balance TFR's activities and its own industrial projects in this field.

We might remember that at the beginning of March, Thomson had to abandon its original project of buying Grundig because of the Cartel Office's opposition. The acquisition of Grundig would have allowed the French group to control 40 percent of the European electronics consumer market.

TFR has 4000 employees, and in 1982 suffered a loss of 225 million DM with a turnover of 1.5 billion DM. Its major activity is the production of color television sets, which last year amounted to 700,000 units. Thanks to the purchase of TFR, Thomson's total production capabilities in this area will be 2.5 million units.

And lastly, it should be mentioned that last year, the Thomson group had already bought Dual, Normende, and Saba in FRG.

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ELECTRONICS

TELEFUNKEN, MOSTEK, EUROSIL: JOINT ENDEAVORS IN COMPONENTS

Paris ELECTRONIQUE ACTUALITES in French 1 Apr 83 pp 1, 11

[Article by JP Della Mussia]

[Text] Heilbronn--As part of the recent agreements between United Technologies (UTC), AEG, and Diehl, about the components activities of their subsidiaries Telefunken Electronic GmbH (TEG), Mostek, and Eurosil (see ELECTRONIQUE ACTUALITES of 11 February), the three companies have just decided to issue a combined catalog covering all the semiconductors which they produce. Mostek will be in charge of designing and manufacturing all the mass production MOS and C-MOS devices; Eurosil will devote itself to designing and manufacturing custom C-MOS circuits for the European market, as well as various standard C-MOS units for the all markets; and Telefunken Electronic will be responsible for developing among other things, all bipolar standard custom integrated circuits (IC), discrete devices, optoelectronics, hybrid circuits, and various modules. By 1987, they should form an association whose turnover will be of the order of \$1.4 billion.

Because of the systems know-how of the upstream groups, of the means implemented, and of reorganizations, this association has unquestionable chances for success. But its problem is the same as that of all the other groups which nurture high ambitions in the semiconductor field: will it be able to eliminate its losses before the shareholders become discouraged and reduce these ambitions? For the time being, the responsibility for marketing in Europe is still being discussed. Mostek and Telefunken will have the same catalogs in France as elsewhere; will two commercial networks be allowed to sell the same products?

The two major shareholders, UTC and AEG, held a press conference for German language reporters in Heilbronn (FRG) on 25 March, to update the status of negotiations between the two companies.

Genesis of a Large Group

The birth of Telefunken Electronic is quite recent. On 1 November 1982, AEG-Telefunken, United Technologies, and a subsidiary of the Dresdner Bank assigned to obtain industrial shares in the south of Germany, created this company from the former electronic components division of AEG-Telefunken. The partners' shares are 49 percent, 49 percent, and 2 percent, respectively.

As we know, United Technologies among other things, owns in the United States Pratt and Whitney (engines), Carrier (air conditioners), Otis (elevators and moving stairs), Sikorsky (helicopters), American Bosch (electronic ignitions for diesel engines), and Mostek (MOS circuits). Its European turnover (38 percent of the whole) is \$200 million. (We might note that TEG has not resumed the tube activity of AEG's former division, or the thyristor activity of the power division).

Why this joint company? AEG's directors are not reticent about it: "Before, we had neither a world sales network, nor connections to American know-how; by the same token, we had too many technologies for our financing capabilities, and were producing too many products in quantities that were too small. And lastly, preparations for the future required a large financing which would have been difficult for us to provide under the present circumstances."

In addition, Eurosil Electronic GmbH was created on 1 March 1983, based on the Eurosil company of the Diehl group. The new Eurosil, 43.6 percent of which belongs to Telefunken, 43.4 percent to UTC, and 13 percent to Diehl, is now in charge of all custom MOS, and especially C-MOS circuits in Europe, using both its own technologies, and the new C-MOS technologies that will be brought by Mostek and the UTC microelectronics center. (It should be noted that Eurosil began to produce watch and clock IC's with a 1.5 V C-MOS aluminum technology as early as 1974. In 1977, this company announced the first watch microprocessor. For this type of circuit, it currently covers 40 percent of the Far East market except Japan, has 300 employees, and in 1983, will have a turnover of 120 million francs from the 100 million circuits it will produce).

A Coherent Whole

The companies thus form a coherent whole. TEG's products, and some of Eurosil's standard products will find new outlets in the United States thanks to the Mostek sales network and to direct sales to United Technologies, which should increase the production of some lines and make it possible to achieve profitability (TEG should obtain 20 percent of its 1983 turnover in the United States). All the MOS, C-MOS, and gate array know-how of Mostek and of the UTC microelectronics center (particularly for CAD), will be made available to TEG and especially to Eurosil, which will use it for its complex custom circuits. TEG will have advanced MOS devices in its catalog. Diehl, and particularly AEG, will remain large customers and initiators of innovative circuits for TEG and Eurosil (20 percent of TEG's turnover comes from sales to the AEG group). And lastly, UTC's financing ability is a guarantee for all the present and coming offensives of these semiconductor companies.

In turn, Mostek will be able to considerably expand its catalog and have at its disposal technologies which it did not have until then. Moreover, UTC will have a European foothold for its components innovation.

The whole will be managed by a joint council, which will decide who does what. UTC estimates that its semiconductors turnover from all its subsidiaries will be \$240 million in Europe this year, and that it will reach \$1000 million in 1988. TEG's turnover this year, should be 400 million DM (1200 million francs).

By the end of 1983, UTC will have invested \$100 million in its German semiconductor operations. Design centers will subsequently be installed throughout Europe, but the manufacturing will remain concentrated in Germany. In particular, UTC holds high hopes for penetrating the European automobile market thanks to the American know-how of the new systems. But it is also very interested in the computer, telecommunications, office automation, and industrial control markets.

From Sensor to Transducer

Telefunken will keep as its task all components ranging from sensors to transducers so as to offer on the market complete system solutions. The company thus conducts research in sensors (essentially based on silicon) for industrial and consumer applications, and has a hybrid circuit manufacturing unit.

In discrete semiconductors, TEG offers or will offer high-frequency silicon and GaAs components, as well as high-voltage, glass passivated, mesa power transistors.

In optoelectronics, TEG already claims to be the largest European manufacturer, with 300 items in the catalog. Its lines are all the conventional GaAs, GaAlAs, and GaP devices, the V-lasers, integrated optical receivers, and solar cells (TEG is the only European supplier of space solar cells, and has a total production capability of 2000 square-meters per year; in 1983, the peak power of the cells it has sold will exceed 1 MW). In IC's, its development orientations are HF bipolar, complex, and power IC's (2 micron IC's for FM tuners have been in production for two years). Added to these are IIL circuits and IIL, NMOS or MNOS combinations (MOS production, among which that of the 3870 processor, is currently carried out at Heilbronn). In particular, TEG wants to become a specialist in digital and analog combinations on the same chip. GaAs IC's will be made in the future.

As to its module activity, TEG will continue its research into the automatic assembly of chips and components, as well as its development of plastic covered keyboards.

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ELECTRONICS

THOMSON TO BUILD MICROMEGA MINICOMPUTERS IN FRANCE

Paris ELECTRONIQUE ACTUALITES in French 25 Mar 83 pp 1, 6

[Unsigned article]

[Text] Production of the 16/32 bits Micromega microcomputer of the American company Fortune should begin in two months at Thomson's Brest plant.

This industrialization will enable the company to produce 500 systems in France during this year, and by 1984, to achieve a greater production capability that could reach 600 units per month, depending on demand.

This decision is to be placed in the perspective of Thomson's ambitions for this product. This year, the French manufacturer expects to obtain a turnover of 200 million francs with the Micromega, which corresponds to the sale of 200 systems, or 10 percent of the national market for top of the line micros (70 to 170 million francs depending on configuration). The company also expects to bring in 30 million francs from exportation, primarily to Africa and the Middle East. These figures should be compared to those of 1982, when Thomson sold 250 Micromegas in France for a turnover of 15.5 million francs.

In fact, 1982 was the year for installing structures that have allowed the company to set up 60 distributors and 20 maintenance centers for the product.

In addition, 70 systems have been sold to large users, for whom Micromega should play the role of network nucleus for inter- or intra-enterprise communications.

During this year, the system will receive the Pascal-Sol software, as well as black and white or color screens. It soon will also be endowed with a spectrum of at least 15 applications programs. At the same time, the Micromega will also be offered as an enterprise communications element. As such, it will play the role of videotex or text processing unit. It will complement other Thomson activities centered around the PABX (private telephone exchange), as well as peripherals such as the Thomfax telecopier developed in collaboration with 3M.

The Micromega is a 16/32 bit microcomputer designed around a Motorola MC 68000, whose central memory can reach 1 MB, and which can handle up to 80 MB on line. Fortune has already sold 13,500 units on the American market.

In addition, Fortune's recent listing on the stock market has brought Thomson's share from 21.6 to 17.4 percent of the American company's capital. But Thomson remains Fortune's major industrial shareholder.

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BALZERS IMPROVES MOS TECHNOLOGY WITH SPUTTERING DEVICE

Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 21 Mar 83
p 7

/Text/ The progressive miniaturization of integrated circuits implies a constantly increasing packing density of the individual components of the chips. Because the international market is imposing growing requirements on the performances of MOS /metal oxide and semiconductor/ technology--among other things with regard to working speed, type of logic, diversity of application, power supply, timing signals and placing of interfaces--the manufacturers must constantly overcome new problems. Thus the gate contact of the MOS circuits is applied on the carrier material already in the initial phase of the manufacturing process and must be able to withstand, undamaged, high temperatures up to 1,000 degrees Celsius and the effect of aggressive media during the subsequent processes. Conductive polysilicon, which has previously been used, has too high a resistance for structures less than 2 micrometers, which to a considerable extent already damages the switching speed of the transistors. Balzers reports that for this reason it has been searching for a long time for materials with better conductivity with the same process compatibility.

This condition was found in the form of silicides of metals resistant to high temperatures, such as molybdenum, tantalum, titanium and tungsten. The silicides arise at temperatures between 600 and 1,000 degrees Celsius, when the metal and silicon atoms occur in the correct proportion. The conductivity of these materials, which are to a great extent heat resistant, is about 10 times as high as that of polysilicon. The metal silicides are now applied only as an additional layer to the polysilicon to maintain the electrical properties of the components without further change in the process. There are several possible ways to produce the initial layer: simple metal coating on polysilicon, sputtering of sandwich layers from two courses, sputtering of a single silicide target, evaporation from two sources, sputtering of a single silicide target, evaporation from two sources and CVD separation. Sputtering of sandwich layers is considered today the best method.

The Balzers AG Company, which is part of the Oerlikon-Buehrle organization, proposes by means of the Planar Magnetron Sputtering Plant LLS 801 a system with which it is possible to undertake efficient manufacturing of these heat resistant metal silicides, especially by the MOS technology. This allows the simultaneous sputtering of various materials and the production of an unlimited number of sandwich layers with varying individual layer thickness. Moreover, the company states that it allows the required high stability of the process through totally automatic computer control.

INDUSTRIAL TECHNOLOGY

FRENCH ROBOTICS DEVELOPMENT EFFORTS REVIEWED

Paris FUTURIBLES in French Mar 83 pp 38-40

[Excerpts] The period from 1970 to 1980 can be considered a preparatory phase for French robotics. Researchers tried to become roboticists; businessmen, for the most part, observed what was going on abroad but declined to invest; and the government, too, was waiting hopefully and was very shy about its financial support. France woke up in 1980. The Japanese had over 100 manufacturers of robots and from 6,000 to 8,000 real robots installed; the Americans were using 2,000 to 3,000 robots. The infrastructure needed for manufacturing robots was being seriously set up in these countries. In Europe, Sweden, the FRG and Italy were off to a good start. We were now sure that robotics was important and that we were quite far behind, at least on the industrial level. So we could get to work...

It was Georges Giralt, Director of Research at the CNRS [National Center for Scientific Research], who at that time began the ARA (Advanced Automation and Robotics) program, which will continue until 1985 and which crystallizes the essence of French research activity in robotics. After 2 years of operation this program is known worldwide and is considered abroad to be of high quality. Its goal is not only to advance knowledge in the area of robotics, but, an essential point and one that is rather new in France, to transfer results to industry. This is why it includes researchers from the different disciplines involved in robotics (about 40 teams having about 150 full-time researchers) but also a complete assortment of businessmen associated with the project. Getting 40 teams to work harmoniously is no easy task. That is why the program is divided into four areas coordinated by a management or steering committee. The four poles are:

--"General Robotics," which focuses on manipulation and complex assembly, as well as computer assisted design of robotized systems.

--"Advanced Remote Operation," which is trying to make remote operating systems transparent (the operator should have the impression of working right before his own eyes with his own hands, even though the system performing the task could be located quite far away).

--"Mechanics and Technology for Robotics," which examines all the problems presented by the mechanics of robots (structures, deformations, friction, activators, etc.).

--"Flexible Shops," which is trying to control and manage as best possible these shops that can be reconfigured with hundreds of parameters.

A Look at the Situation Today

The Robotics Mission that developed its work of review, synthesis and proposal in 1981 was of great help in validating the robotics phenomenon in all of the country's structures. As a result of its conclusions, a great number of activities have either been started or are about to be.

At the research level, important projects that do not sidestep ARA are being put in place. For example, there is the one for the flexible shops, the GRECO "electrical motors," the AMES project (Automation and Economic and Social Mutations) and the multilateral robotics project that came out of the Versailles summit and that is headed by the study group Technology, Growth, Employment.

As for training, the Ministry of National Education has made the teaching of robotics and productics a fact and is going to create Regional Centers for the Teaching of Productics (CREP) that will have heavy equipment. Many of the curricula in secondary and higher education are being revised. Continuing education in the field is growing rapidly, etc.

Industry and even the banks seem to be getting active. Some large firms prefer to buy small firms that were interested in robotics and that have therefore already been "broken in" as far as financing goes. If you believe the Annual Report of Robotics in France, 50 firms claim to be making robots. Nevertheless, for the moment we are seeing more of a change in style: "This product that I have been making for so long could be of interest to robotics," than a change based on new products. The list of robot manufacturers remains short. To an observer, 1982 seems to have been an exciting year in robotics, maybe the year that it really took off.

In 1981, of the 20,000 to 25,000 robots installed in the world, Japan had the lion's share with 57.7 percent; then came the United States (16.6 percent), the USSR and Eastern Europe (13.5 percent), and finally Western Europe (11.4 percent). With 1,000 robots France could seem to be insignificant, but these 1,000 robots are over half non-French. Businessmen will find the hill hard to climb, because although growth forecasts are spectacular (+40 percent per year on the average until 1990) those who are today ready to start working will be the first to benefit.

As for research, I think that it can be stated that if we really give it the resources, it will be able to inject up-to-date robotics products into industry.

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CSO:3698/287

SCIENCE POLICY

NEW FRENCH MINISTER DEFINES INDUSTRIAL POLICY

Paris AFP SCIENCES in French 14 Apr 83 pp 1-2

[Text] Paris--Mr Fabius defines his industrial policy and reaffirms government orientations for R&D. In his first public act as minister of Industry and Research, Mr Laurent Fabius was anxious to define the three "rules of the games" that should, according to him, govern economic relations and also to reaffirm the options taken in the area of research by his predecessor, Mr Jean-Pierre Chevenement.

"The state does not intend to usurp the role of firms and entrepreneurs": this is the first of the three "rules of the game" intended to ensure a "stable economic horizon" for business, declared Mr Fabius, who spoke April 11th, on the occasion of the inauguration of the "sixth world-wide week on innovation" [INOVA 83].

The second rule concerns the relationship between economics and society, while the third touches on certain values that should be encouraged. This is particularly true in regard to risk-taking, profitability and competitiveness "which are nothing to be ashamed of, on the contrary".

"The state functions as teacher and arbiter. In certain areas, it also plays a direct role in stimulating industry (...) But it is not to involve itself in everything, nor to be a substitute for everything", the minister added.

Moreover, Mr Fabius emphasized that "economic innovation must be accompanied by social innovation". "This means we must avoid burdening the economic debate with mythological nonsense and that discussion of business results, of profits, costs, investments, working conditions, and productivity should be pursued objectively and dispassionately", he stated.

"There is no industrial venture without risk, no more than there is success without effort", the minister continued, regarding the third rule. "Therefore, our society must give due consideration to dynamic energy and responsibility (...) be open to those who are on the leading edge and especially to executives".

"It would be extremely valuable if a far-reaching measure--why not a fiscal one--could be set in motion to encourage the creation" of businesses, he declared, before expressing his wish that bankers "would gamble more on brain-power".

Profiting From Research Efforts

Moreover, Mr Fabius placed emphasis on innovation, which he termed an "absolute necessity". According to him, public authorities should have four priorities: education, development and practical application of the national research effort, the mastering of new technologies and their diffusion throughout the whole of industry, aid for innovation and for the development of innovative enterprises.

"Our country's deficit in the area of training and education is considerable", he declared. We must react vigorously and (...) adapt our educational effort to the quantitative and qualitative needs of the economy", adding that, for him, "the investment a society makes in education is a prerequisite for the success of everything else".

For Mr Fabius, the law for orienting and programming research and technological development "crystalizes the ambition" of the government for the development and application of research efforts.

"This effort", he added, "is indispensable. Because there is no shortage of gray areas. First of all, France lags behind in patent applications. The French file for half as many patents as the English, one-third as many as the Germans, one-sixth as many as the Americans and one-fifteenth as many as the Japanese."

The "considerable" effort channeled into research must, the minister emphasized, 'be accompanied by action on the part of the scientific community to diffuse the results obtained more widely and rapidly. This diffusion must benefit citizens as well as enterprises responsible for transforming these results into added product value." Indeed, for Mr Fabius, progress is a function of industry's openness to new ideas.

"The result of all this", Mr Fabius continued, "is that on every level, that of the workshop, industry, the region, the nation, research policy must be balanced by a policy of technical training on a comparable scale, without which progress cannot be spread."

The capacity of our industry to incorporate the most recent technological advances into its products and manufacturing processes will depend in part on the success of this policy", the minister emphasized. "It is vital in this respect that public effort be directed towards support of technical research, whether it is carried out in research organizations, engineering schools, technical centers or directly in industry."

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CSO: 3698/313

SCIENCE POLICY

NEW S&T STRATEGY FORMULATED FOR EUROPE 1984-1987

Paris AFP SCIENCES in French 14 Apr 83 p 7

[Text] Brussels--A new scientific strategy for Europe--The European Community Commission has defined a program for a "new European scientific and technical strategy" designed to "establish a basis for research in Europe." Based on an analysis of economic and social needs, on an inventory of research activities in the community and in the principal countries outside the community, as well as on numerous sectorial and prospective studies, this document defines specific and very detailed objectives for 1984-87.

The commission is proposing that 3,750 million ecus (24,750 million francs at the March '83 rate) be devoted to this strategy during this period, distributed according to the table below. The commission projects that spending for research in 1987 will be equivalent to four percent of the community's budget, compared to 2.6 percent today.

Community funds devoted to research in 1982 amounted to 600 million ecus (3,960 average francs at the March 83 rate), or two percent of the public research funds of the member states.

Research constitutes an important asset for Europe: 350,000 researchers are currently at work in the community, and if we exclude defense, Europe's research capacity is twice that of Japan and is only 27 percent lower than that of the United States.

In spite of this, the commission considers that "a certain slackening of scientific productivity" has been noted in Europe for several years, due to certain "deficiencies", especially in multidisciplinary research and research that is intermediate between basic and applied research. It is also due to insufficient industrial application and to an international imbalance, not in Europe's favor, in the area of patents.

The commission recommends "a tangible increase in real community-wide efforts". A policy that will permit "the best possible utilization of continental advantages" and which has proven itself in areas such as the aerospace industry or nuclear power.

The Community's research expenditures	in millions of ecus 1984-1987	percent of total	
		1984-87	1982
Promotion of agricultural competitive- ness (including fishing)	130	3.5	1.9
Promotion of industrial competitive- ness (elimination and reduction of obstacles, traditional industries, new technologies)	1 060	28.2	18.5
Improvement in the management of raw materials	80	2.1	1.4
Improvement in the management of energy resources (nuclear fission, controlled thermonuclear fusion, re- newable energy sources, rational utilization of energy)	1 850	49.4	63.7
Increased aid to PVDs	150	4.0	0.7
Improvement of working conditions and quality of life (health protection & security, environment)	270	7.2	10.1
Improved efficiency of scientific & technical potential	5% of the total funds for S/T at end of the period		
Horizontal activities	110	2.9	3.8

(1) 1 Ecu [European monetary unit] = about 6.6. French francs or 44.6
Belgian francs (based on rates effective 11 March 1983).

9825

CSO: 3698/313

SCIENCE POLICY

BRITISH RETURN RESEARCH INSTITUTIONS TO PRIVATE SECTOR

Stockholm NY TEKNIK in Swedish 21 Apr 83 p 9

[Article by Eva Kihlstrom: "Research Denationalized"]

[Text] More and more state-owned research institutions are being returned to the private sector in England. Since 1 April last year, one hydraulics institute and one institute for marine research have changed owners. A center for computer engineering is the latest example.

The Thatcher administration feels that almost all enterprises are run more effectively and more economically as private operations. It is primarily those research institutes that have most of their clients in the private sector that are being denationalized.

The first company to get new owners was the Hydraulics Research Station in Wallingford, west of London. After 35 years of being run by the state, it was bought by a private company in April of last year.

The 250 employees will remain employed by the state for two more years. After that they will be taken over by the new owners. But these have announced that only about 80 percent of the work force will be offered continued employment.

Employees Worried

Thus, for many there is an uneasy time ahead. So far 31 employees have been notified that they cannot count on further employment at the research institute. Since the planned take-over became known, 27 employees have resigned.

The British government has promised that the conditions for the employees must not deteriorate after a company becomes private. But, as many smaller companies do not have the same opportunities to offer benefits, for example pensions, the anxiety is, in spite of the promise, great.

But there are also advantages with the new ownership. Less bureaucracy is one.

"Earlier, the limits for the operation were much more fixed," says Larry Miller who is responsible for information at the Hydraulics Research Station.

"Today we do things we couldn't have managed before. Quicker decisions and easier hiring make it easier for us to adjust to the needs of the market."

Uncertain Future

The institution receives most of its contracts from the British government. At present, it is doing well, but no one wants to predict for the future. The government's desire to save is great, and this makes many feel uncertain and anxious. They also fear that the quality of the research will fall.

The National Maritime Institute in Feltham was changed into a private company last October. The change is a trial which will last for five years. Since the reorganization, the number of employees has decreased from 270 to 240. The main part of their clientele comes from the private sector.

The latest research institute to become a private company is Cadcentre, Computer Aided Design Centre.

9843

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SCIENCE POLICY

FRANCO-JAPANESE SYMPOSIUM ON ADVANCED TECHNOLOGIES

Paris AFP SCIENCES in French 28 Apr 83 pp 3-5

/Article: "Second Franco-Japanese Symposium on Advanced Technologies"/

/Excerpts/ Opening the second Franco-Japanese symposium on advanced technologies on 27 April, Jean Auroux, secretary of state to the minister of Industry and Research declared that he was convinced that only a scientific and technical cooperation in this area can "build the foundation of industrial cooperation" between France and Japan.

Such cooperation is "perhaps the only way, by promoting the gradual interpenetration of our companies and our economies, to go beyond the trade competition that we are experiencing today," the secretary of state for Energy added.

These statements were echoed by those of Kunio Komatsu, vice minister of the Japanese Scientific and Technical Industrial Agency (MITI), who recalled the necessity, in his opinion, of maintaining "free exchanges" "without discrimination."

This symposium, which was slated to complete its work 20 April, followed the one that had been held a year ago during the trip of the French president to Japan which had opened the way for relaunching and intensifying Franco-Japanese cooperation.

On the international level, it is a logical follow-up decisions made at the Versailles summit where France and Japan were entrusted with specific responsibilities in the area of technology in a task force on the problems of technology, growth and employment.

During these two days, 35 high level specialists (15 Japanese, 20 French) studied ways to establish close cooperation between public and private laboratories in the two nations in the areas of advanced robotics, new materials of the future and solar energy.

"These sectors where the will to cooperate in research and development is based on a political will, are not the only ones where the French and Japanese are already cooperating on the industrial level," Arnoux reminded us. Elf

Aquitaine and Toray are partners in the technology of carbon fibers, PUK /Pechiney-Ugine-Kuhlman/ and Komatsu are doing the same in aeronautics, Thomson-Brandt and Japan Victor Company have just signed an agreement that will allow the French firm to manufacture video recorders under licence and its partner to draw on Thomson research to prepare the next generation of these devices in the 8mm standard.

"Beneath all this cooperation," Auroux emphasized, "there is a basic notion: that each of the two parties should find its own self interest there." This should be the case in the future for all the areas where the Japanese and French have complementary technologies capable of furthering, if not initiating "considerable socio-economic change" (robotics, solar energy). Agreements are being drawn up between Photowatt and the Japanese company Fuji for exchanges on the technology of photovoltaic cells.

"Because of their particular position in today's world," with common concerns regarding access to energy resources and to raw materials, North-South solidarity, aid to the Third World and the creation of a new international monetary system, "avoiding unbalancing fluctuations," Auroux added, "our two nations are very naturally encouraged to get together and cooperate," not only on the scientific and technological levels but also on the industrial level. "But", he added, "while Franco-Japanese industrial cooperation could turn out to be extremely profitable," it would be "on the condition that it be based on balanced relationships and that this balance be based specifically on an exchange of technologies or on access to new markets."

9969

CSO: 3698/314

SCIENCE POLICY

BRIEFS

FRENCH CIVIL RESEARCH BUDGET--10 percent less for investments.--For 1983 the civil research budget has been cut by 1 percent in investments, but it remains practically unchanged for operating funds, with the decrease applying to Fr 50 million, whereas the total for all of the research organizations amounts to Fr 13,240 million (an increase of 19 percent compared to 1982). But for investments, Fr 658 million in payment funds have been cut and 923 million in program authorizations of a total of 8,823 million. The reductions are 150 million for the Atomic Energy Commission (in a civil budget of over Fr 5 billion), 136 million for the French Agency for Energy Control, 50 million for the National Center for Space Research, 120 for the CNRS /National Scientific Research Center/, 22 million for the Computer Agency, 18 million for the National Center for Ocean Exploitation, etc. In the Research budget, program authorizations represent approximately half of the total budget. They are basically devoted to financing major equipment and new research programs. /Text/ /Paris LES ECHOS in French 9 May 83 p 3/ 9969

CSO: 3698/314

TRANSPORTATION

SWEDISH TEST WING DRAG-LOWERING DEVICE IN SWISS WIND TUNNEL

Stockholm NY TEKNIK in Swedish 21 Apr 83 p 18

[Article by Conrad Luttrupp: "Wing Ribs reduce Air Drag"]

[Text] Linkoping--Narrow ribs mounted along the top side of an airplane wing can theoretically reduce the wing's air drag. This would reduce fuel consumption. Researchers with the FFA, the Experimental Center for Aerodynamics in Linkoping, are now testing the theory on an old A-32 Lansen.

In a Swiss wind tunnel the FFA, with support from the STU [expansion unknown; probably State Technical Univ], has carried out a series of experiments in cooperation with the Ecole Polytechnique Federale Lausanne. A new series of wind-tunnel experiments is now planned in Switzerland.

The wind-tunnel experiments demonstrate that friction drag along the wing in the back of the rib is considerably lessened. Even considering the ribs' own resistance, this can result in a net gain.

Arild Bertelrud, who holds a doctor's degree in technology and is a department head at the FFA, is supervising these experiments. "Together with FMV's [expansion unknown] test department, we are carrying out full-scale experiments at Malmslatt near Linkoping. The purpose of the test flights is first to assure ourselves that the ribs pose no safety risk," says Bertelrud.

"But we will also find out if it is possible to reduce air drag under realistic conditions. Then we can judge how much work should be invested in this area.

"They are doing similar experiments in the United States. We might have a slight advantage in full-scale experiments. We have full-time use of an airplane, whereas the American researchers have one only on loan for short periods."

The Theory Behind it

The experiment is based on the following theories:

When a gas or a liquid flows along a solid surface, it is affected in that the surface slows the gas or liquid through the friction of contact. This can be the air around an airplane wing or behind the top of a car. The same is true of the water flowing along the bottom of a boat.

The fact that the flow closest to the plane is slowed has to do with the viscosity of the air, that is, the air's inner friction or inertia.

The so-called boundary layer is formed closest to the plane wing. At the very front, the air in most cases flows calmly. The airflow is laminar, and the layer is called the laminar boundary layer. At that point the drag is slight.

Farther back, the calm laminar flow breaks up and eddies. Here is where the turbulent boundary layer is located. The air drag is severe in that layer.

It is that layer that researchers hope to influence. The ribs change the structure of the turbulence and thereby reduce the drag in the turbulent boundary layer.

The Vortices Are Broken up

"We don't really know what takes place. It acts as if the ribs break up the largest vortices in the boundary layer," says Arild Bertelrud.

The two 1-centimeter wide ribs are placed 5 to 10 centimeters apart, 30 to 50 centimeters behind the leading edge of the wing and protrude 0.5 to 1 centimeter above the surface of the wing.

"Opinions differ on how much benefit they offer. But a mere one percent reduction in the drag means a saving of 100 tons of fuel per year for a plane in the DC-9 class."

If the plane is forced and the boundary layer is subjected to a large load, the air flow can no longer be kept at the wing surface. The boundary layer is said to be relieved or to break down, and the plane stalls.

Behind the relief point, the air is pulled back and forms a "back suction," resulting in severe drag.

There is a risk that the ribs will increase the air stream tendency to break down. If that is the case, the flight test at Malmslatt will discover it. Airflow breakdown is a dangerous safety risk and it can bring the whole project to a halt.

Numerous Experiments

Many methods have been tested over the years to reduce the drag in the turbulent boundary layer, not least for marine vessels.

Researchers thought that soft surfaces would lessen the intensity of the turbulence, but these have yielded no results.

Polymers, i.e., long strings of molecules, when released in water, do reduce drag, but they are expensive.

Channeled surfaces like sharkskin are being tested in the United States. This method has attained very slight drag reductions.

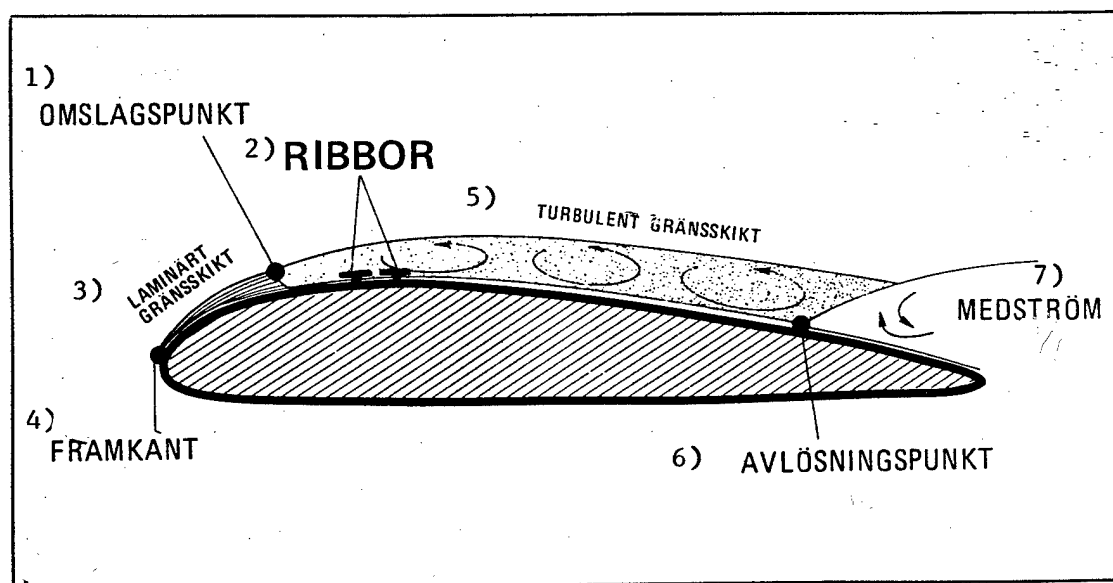
The current experiments are all being performed in wind tunnels. But the principles are the same for ships. If the experiments are successful, maybe even a ship can be equipped with ribs that breakup the vortices in the turbulent boundary layer.

Lars Larsson, adjunct professor at Chalmers and active at the ship-testing channel in Goteborg takes a wait-and-see attitude.

"An experiment would be so expensive that we must know that there is something to the idea before we start.

"If it works, one can imagine a pair of ribs about 10 meters from the prow. The ribs would be 10 centimeters wide and spaced about 1 meter apart, extending about 10 centimeters out from the hull."

A supertanker consumes about 100 tons of diesel fuel per 24 hours. A one percent reduction in drag would be a saving of about 0.5 to 1 million kronor a year.



Teckning REGINA RICHTER

- 8) *Ovanför flygplansvingen bildas ett turbulent gränsskikt. Det är luftvirvlarna i detta skikt som skapar ett luftmotstånd. Detta motstånd hoppas teknikerna i Linköping kunna minska med hjälp av ribborna som finns på bilden. Termerna förklaras i texten.*

Key:

1. turning point
2. ribs
3. laminar boundary layer
4. leading edge
5. turbulent boundary layer
6. relief point
7. wake flow

8. A turbulent boundary layer is formed about the wing. The vortices of air in this layer create a drag. The engineers in Linköping hope that the ribs shown here will help reduce this drag. The terms are explained in the text. Drawing by Regina Richter.