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West Europe Report

SCIENCE AND TECHNOLOGY

No. 157

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WEST EUROPE REPORT

SCIENCE AND TECHNOLOGY

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CONTENTS

[III - WE - 151 S&T]

BIOTECHNOLOGY

FRG ENZYME TECHNOLOGY, JAPANESE COMPETITION OUTLINED

Frankfurt/Main FRANKFURTER ALLGEMEINE in German 31 Aug 83 p 31

/Article by Rainer Floehl: "Chemistry with Immobilized Enzymes and Cells"/

/Excerpts/ The immobilization of entire cells is to a certain extent the culmination of a development which began in the FRG in the mid fifties. At that time, G Manecke at the Institute for Organic Chemistry at the Free University of Berlin methodically attempted for the first time to chemically bond water-soluble, biologically active materials to plastics to make them insoluble. In the 1960's Manecke was able to chemically bond a whole series of enzymes to plastics without destroying their unique biochemical capabilities.

In Japan enzyme technology is farther advanced. At the firm Tanabe Seiyaku, Ichiro Chibata--along with Manecke, one of the pioneers of enzyme immobilization--had already used an immobilized aminoacylase for the production of L-amino acids in 1969. These products are needed in large quantitites as food additives and as animal feeds. The aminoacylase makes possible the separation of D- and L-amino acids which are generated in equal quantities during synthesis. Since the organism can only use the L form, it has to be separated from the D form. This is still most easily done with enzymes. Of practical importance is the conversion of penicillin into 6-amino penicillin acid from which semisynthetic penicillins are constructed. In the United States and Europe immobilized enzymes are used in great quantities for converting corn starch into a sugar syrup. The production cost of this syrup was significantly reduced by immobilizing the clucoseisomerase.

An obvious economic success is the enzyme membrane reactor, a biotechnological process developed independently in the FRG with BMFT /Federal Ministry for Research and Technology/ support. It was developed by Professor C Wandrey--now at the Nuclear Research Facility at Juelich--while he was at the Technical University at Hannover and then optimized jointly with micro-biologist M R Kula of the Society for Biotechnological Research and W Leuchtenberger of Degussa Research in Frankfurt to the point where the cost of synthesizing L-amino acids could be greatly reduced.

In the case of the membrane reactor, the enzyme is contained in the reaction solution which after final conversion flows across an ultramembrane, a bundle of hollow fibers. This membrane is permeable for small molecules like amino acids but not for the relatively large enzyme molecules. The enzyme thus remains in the reaction solution and is available immediately for a new cycle. Whether or not this form of membrane reactor will prevail is not yet clear in view of the fact that it has advantages in other configurations.

Its future is also critically dependent on the outcome of whole-cell immobilization, a process which is being increasingly tested experimentally and is also being used at times industrially instead of immobilized enzymes. Immobilization of cells is the consequent advancement of enzyme fixing. The chemical processes for the immobilization of cells--developments in the FRG have come primarily from the working groups under Professors J Klein of the Institute for Technical Chemistry and F Wagner of the Institute for Biochemistry and Biotechnology at the Technical University of Braunschweig--has matured to the point where whole cells can be included in polymeric frameworks.

The enzymatic activities achievable with immobilized cells are 20 to 80 percent of the performance potential of free cells. Cells, as intact biochemical factories, offer many advantages over isolated enzymes. The greatest advancement lies in the process wherein not just individual enzymes but entire enzyme systems can be used to catalize a series of successive conversions. Further, reactions are now possible which could not be made to go in bioreactors because specific cell structures are required.

As in the case of enzymes, cells also have to be imbedded in the plastics with care. The suspension structures must not overly impede the necessary contact with the compounds to be converted. Klein and Manecke have succeeded in immobilizing a number of microorganisms with various materials. In addition to the synthetic polymers, such as epoxides and polyurethane, natural gels of alginate and chitin are also of practical importance.

Such immobilized cells with their enzyme apparatus can catalyze a sequence of several reactions. If they are fed, they can even do tasks which require energy; usually decomposition reactions are involved since they go easier. In cases where cell multiplication is undesirable, cell division can be prevented by adding small quantities of antibiotics. K Mosbach of the University of Lund has produced human insulin for several days at a time in this manner with genetically altered bacillus subtilis immobilized in agar-agar.

The endurance of immobilized cells is especially surprising. Whereas free cells lose their catalytic activity within a few hours, immobilized cells still retain half of their catalytic activity after 20 to 40 days. Individual enzymes are still functional after two years. In Branunschweig a series of catalytic systems with free and immobilized cells has been researched in recent years to determine system performance potentials and critical technical parameters. Among the organisms investigated is the yeast candida tropicalis which decomposes phenol and is thus suitable for the purification of sewage. Further, the investigators at Braunschweig are involved with cells which break down pencillin, manufacture amino acids or convert sugar into alcohol. G Manecke has fixed various microorganisms which restructure steriod hormones, for instance hydrocortisone into prednisolone. For this microbiological processes are far superior to those of chemistry. Thus there are no limits on the bioconversion of organic molecules if one can only find the necessary microorganisms.

That Japan is also in the lead with immobilized cells is evidenced by the fact that three of these processes are already being practically applied at Seiyaku Tanabe. Development is proceeding at a slower pace than commonly believed but it must not be lost sight of that biotechnology still offers many potentials for environmental protection, for the utilization of inexpensive biomass and also for energy production, for instance with bacteria which produce hydrogen from sunlight. Add to this the fact that even the cells of higher plants and mammals can be fixed and industrially produced.

9160
CSO: 3698/418

PLANNING, STRUCTURE OF FRENCH BIOTECH INITIATIVES DESCRIBED

Paris BIOFUTUR in French Mar 83 pp 55-56

[Text] We have already referred to Compiegne University of Technology [UTC] and its educational activities in our issue No. 7 (November 1982). Here we discuss interdisciplinary research and links with industry: patterned somewhat after the American style, they make this university the first of its kind in France.

Out of nine research teams at Compiegne University of Technology, three are devoted to biotechnology. Research projects are based on decisions by the Scientific Council.

The heavy equipment is grouped in a specific department with three units which maintain and manage it (physico-chemical analysis, electronics and data processing). Moreover, each department is responsible for the specific equipment it uses.

The Firms Involved

Two regional enterprises are working in close cooperation with UTC's biotechnology teams: Orsan and its subsidiary, Eurolysine, and SAPS-Anticorrosion.

SAPS-ANTICORROSION

Company to Apply Laminate Plastics (established in 1957)

Address: Le Coudray-sur-Thelle, 67090 Valdampierre.

Telephone: 16 (4) 481-1461

Capital: 120,000 francs

CEO: Georges Besson

Staff: 30 employees

Business: manufacturer of hollow-ware in plastic; since 1973, procedures to purify gases (development of gas/liquid contactors).

Contracts: with UTC, to develop a biological aerobic reactor; with the Chemical Engineering Laboratory at Nancy.

The biological aerobic reactor:

- patent application filed in 1981;

- receives aid from ANVAR [National Agency for the Valorization of Research];

- presently being perfected at UTC;

- uses: fermentation; processing agro-food waste.

Structures Created at the Initiative of UTC

Three structures have been created to develop and market research: ITS, Valpron and Byosis.

ITS (Institute of Technology of Active Surfaces)--established in 1974.

Directors:

- administrative: Georges Broun

- scientific: Etienne Segard

Staff:

- 35 employees (PhD's in science, chemical and biochemical engineers, highly-skilled technicians, doctoral candidates)

- from the following countries: Great Britain, Spain, Russia, Mexico, Venezuela, Argentina, Mali, Benin, Vietnam.

Budget. It comes from:

- contracts with industry: 65 percent;

- Ministries of Research and Industry, Agriculture, Environment, Public Health.

Business:

- Immobilization of enzymes and micro-organisms

- Study and use of specific biological structures (active sites)

- Purification of raw materials with a high added value

- Immunological applications in parasitology.

Organization of work:

- Coordination with industrial and university laboratories, CNRS [National Center for Scientific Research], INSERM, INRA [French Institute for Agronomical Research], IRCHA [French Institute of Applied Chemistry Research], CNTS, etc.

Proposed Services:

- Technical assistance to small and medium-sized industries

- Bibliographic and technical studies

--Prospecting and evaluation of foreign processes

- Pilot facilities and development of control methods.

Work accomplished:

- Fixation of antigens on cell membranes to isolate antibodies present in blood;

- Immobilization of enzymes: lactase fixed on inactive support (protein molecules) for the continuous hydrolysis of lactose; glucose-oxidase fixed on inactive protein membrane (enzyme electrode) for titration of glucose in the blood; rennet fixed on a stirrer or on mechanical parts, such as vessels or pipes, to coagulate milk.

VALPRON (established in 1978)

Economic interest group (GIE) to improve natural products, resulting from economic agreements signed with Compiegne University the Pise Chamber of Commerce and Industry, the Picardy Chamber of Agriculture and Credit agricole.

Managing Director: Pierre Garcin de Mayes, vice-president of the Oise Chamber of Commerce and Industry, Industrial Branch.

Scientific Director: Etienne Segard.

Staff: 7 employees.

Business: expertise in processes, up to filing for patents.

Examples of processes developed:

- Construction of a "dehydration" press (150-ton prototype) financed by research funds from the beet growers union, in cooperation with Creusot-Loire;

- Process for fermenting alfalfa, other leguminous plants and press water. Industrial start: 1983. Costly investment: on average 11 million francs (research projects, prototype, and industrial development included).

BIOSYS

A corporation with commercial production (established in 1981).

CEO: Laurent Caignault

Managing Director: Etienne Segard

Staff: 12 employees plus production staff.

Business:

- Based on the marketing of very specific processes and products

- Patents purchased and royalties paid to ITS.

Examples of products marketed:

1981: rapid diagnostic test for parasites (trypanosomes), resulting from research conducted at ITS from 1977 to 1979; perfected, developed and marketed at the end of 1981, beginning of 1982.

BIOYSYS is authorized by WHO to launch new products. The company has commercial agreements with Venezuela, Brazil and Argentina.

UTC laboratories

Enzyme Technology

Director: Daniel Thomas

Staff: 41 employees.

14 posts for teachers budgeted by INSERM and CNRS; 7 from the Institute of Technology of Active Surfaces; 20 trainees (doctorate, post-doctorate, from industry)

Current operating budget: 110,000 francs every year.

Sources: industrial contracts, 98 percent; Ministry of Research and Industry. Ministry of Environment.

Research topics:

- enzymatic kinetics in heterogeneous phase;

- influence of external parameters on enzymatic activity;

- recycling and regeneration of cofactors;

--analytic and medical applications (enzyme electrodes, antibody electrodes, encapsulation of enzymes).

Biotechnological Processes

Director: Jean-Marie Lebeault

Staff: 26 employees and President T.G. Ghose (a microbiologist from New Delhi).

Structure: 6 teams: microbiology, biochemistry, chemical engineering, mechanical engineering, computer engineering and data processing, genetic engineering.

Budget:

- 2 million francs a year

- sources: 5 percent from the University, 45 percent from government agencies, 50 percent from industry.

Research topics:

- use of micro-organisms in the agro-food industry;

- production of enzymes for industrial use, in cooperation with the New Delhi Institue of Technology;

- production of biogas from beet pulp;

- design of new types of industrial reactors;

- control, automation, optimization.

9805
CSO: 3698/419

UK LEGISLATORS SEEK SUPPORT FOR BIOTECH INDUSTRY

Paris BIOFUTUR in French May 83 pp 17-18

[Text] Insufficient Government Initiatives in the Field of Biotechnology. The House of Commons Select Committee on Education, Science and Art has reproached the government for its failure to act up to now in the following areas:

- increasing financial support;

- setting up a government committee specifically for biotechnology;

- changing the links between the Medical Research Council (MRC) and Celltech, on the one hand, and the Agricultural Research Council (ARC) and the future corporation specializing in agriculture (a project initiated a year and a half ago), on the other. As for this latter project, various problems have deferred the creation of this structure, but it seems to be accepted at present. Financing for it will be provided by Ultramar and Advent Capital Ltd. Last year R. Hay and R. Cox of the Bristisch Technology Group (BTG) founded New Plant Products Ltd. to conduct "pilot" studies for the future corporation. Among the research projects proposed are the following:

- Production of jojoba/colza hybrids;

- Genetic manipulation of rhizobium and mycorhiza.

New Plant Products Ltd. is current producing inoculums of rhizobium at ARC's Rothamstead Station.

The government is trying to justify its inaction in a report addressed to the president of the committee, which shows that the funds for and the number of research workers in biotechnology amply suffice. This view, however, is not shared by the Science and Engineering Research Council (SERC) which has noted the emigration of British biotechnologists abroad, particularly to the U.S., and has set up a committee headed by Richard Pearson to study this particular problem to determine the causes and try to remedy the situation.

A University Consortium. Three universities are going to work together to develop links with industry, on the basis of specialized training, information services, etc. These include the University of Kent at Canterbury, University

College of London and Polytechnic of Central London. The Department of Industry (DOI) regards this consortium in southeastern England as one of the four priority academic centers.

Financing will be provided by the DOI and industry, particularly to develop procedures to immobilize micro-organisms on solid support and new fermentation techniques. (Source: BTN, 1 March 1983; Nature, 10 March 1983.)

9805
CSO: 3698/419

DATA NETWORK CONTRACT FROM U.S. FIRM AWARDED TO ROVSING

Copenhagen BERLINGSKE TIDENDE in Danish 2 Sep 83 Section III p 1

[Article by Erik Bendt Rasmussen: "Mammoth Order for Rovsing; Quarter Billion Kroner from USA"]

[Text] The biggest order ever received by the Danish computer industry, worth over a quarter billion kroner, has gone to Chr. Rovsing A/S.

It is a data communications network for the big American airline American Airlines. Chr. Rovsing won the order in an intense international competition, among others, with IBM.

It will be the third largest civilian data network in the world. The data network will interconnect 14 of the largest cities in the USA and American Airlines' central data processing center in Tulsa, Oklahoma. The network is being built around Rovsing's RC80 computer. CR 80 [as published] data systems, which control communications in the network around the clock and monitor the data lines, are being set up in each of the 14 cities and at the center in Tulsa. A total of 60 CR80's [as published] will be delivered.

"Our sales in the American market will accelerate after this order. When a company like American Airlines buys our product any American concern will have confidence in it. Most airlines' data networks are overloaded, so they are in need of a change. This will be an advantage to us," says Civil Engineer Chr. F. Rovsing.

"We have been exposed to some of the most experienced data processing people I have met. Very great demands have been placed on us by the airline's personnel at the Tulsa data processing center, which is one of the most advanced in the world. When we won the order it was due to the fact that, for one thing, we were able to meet the company's special requirements and design the system entirely according to their requirements, while our competitors wanted to deliver standard systems. One of the terms of the contract is, incidentally, that we are to build a special 40-million-kroner test building for the equipment, and for 34 months we are to play host to a team of specialists from the company who demand to follow production at the closest quarters," Civil Engineer Chr. F. Rovsing says.

Has Much Experience from NATO Order

American Airlines already has a data network with 65,000 terminals, but it has no more excess capacity to manage the growing streams of communications.

This is where the RC80 system comes in.

Rovsing's data network will be the carrier of American Airlines' combined data communications for ticket reservations, bookings, air freight and passenger and flight processing, as well as the company's external and internal data communications. Because of the data network's decisive importance for the airline's reputation, quite extraordinary requirements have been placed on the data system's reliability. The network must be able to handle more than 1000 transactions, for example, ticket orders, per second in order to be able to serve the more than 100,000 terminals which are to be connected to the network over the course of a few years. They will be placed in travel bureaus, hotels, airports and local ticket offices.

"We have delivered a data network to NATO and it is from this, among other things, that we acquired the basic knowledge which has now made it possible for us to compete with the biggest computer companies in the world."

Currency Revenues of 200 Million Kroner

The exact amount of the order is for 258 million kroner, of which 50 million kroner will go to buy components for foreign currency. Thus, there will be currency revenues of 200 million kroner. Incidentally, the contract with American Airlines is worded so that none of the parties will be left holding the bag or will score big gains in case the dollar rises strongly or falls dramatically.

The order means a personnel increase of 80 men and women, half of which have already been hired. The company now has about 1100 people. Sales last year were 414 million kroner, and this will increase 50 percent this year.

8985
CSO: 3698/423

SWEDISH FIRM FIRST IN SCANDINAVIA TO MASTER GAAS TECHNOLOGY

Stockholm NY TEKNIK in Swedish 4 Aug 83 pp 12-13

[Article by Ingvor van Ginhoven]

[Text] Rifa outside Stockholm is the first in Scandinavia to be able to manufacture super-fast components in a new material--gallium arsenide.

Thus the firm has assumed a prominent position among the world's leading electronics firms.

And it took the little research group, headed by a Japanese, only a year to develop the technology.

The new components are three times faster than conventional silicon parts.

Gallium arsenide is being hailed as one of the semiconductor materials of the future when speed requirements increase for computers and electronic devices.

The fact that a Swedish electronics firm has succeeded in developing the complex technology means a boost for the Swedish semiconductor industry. The new components mean, for instance, that the transmission of light and sound from satellites will go considerably faster in the future.

The conversion of signals has been one of the biggest stumbling blocks for rapid development in this area.

Rifa now has a low-noise field-effect transistor, a laser diode and a photodiode in the new technology. The last two are made for use in fiberoptics. The transistor is meant for such things as microwave amplification on the radar band.

"In less than 1 year, a research group of eight people succeeded in coming up with components in an ultramodern technology that are among the best in the world," said Professor Hermann Grimmeiss.

Professor Grimmeiss has been head of Rifa's IC division for 2 years, but he is now returning to Lund Technical College.

The work has been led by Dr Takashi Ishii from Japan. He has worked with gallium arsenide (GaAs) for many years at the big Mitsubishi electronics company.

Components and circuits of GaAs are about three times faster than those of silicon (Si). Electron mobility is higher in gallium arsenide than in silicon.

The Technical Development Board, STU, has supported research projects into the so-called III-V compounds for a number of years. These are compounds of elements from groups III and V of the periodic system. Gallium belongs to group III and arsenic to group V. Other elements that can enter into such semiconductor compounds are aluminum (Al), indium (In) and phosphorus (P).

Rifa acquired knowledge by employing researchers who worked at the technical colleges with the help of funds from STU. The commercial link came in with Dr Ishii.

The company has used its own funds to pay for equipment and development work leading up to trial production.

"This is an investment of over 10 million kronor during a 3-year period," Hermann Grimmeiss pointed out, "and it is both a response to demand and a must if the company is to keep up with the rapid development going on in the field of electronics."

The GaAs transistor is a MESFET, i.e. a Metal Semiconductor Field-Effect Transistor. The company expects this transistor to maintain a place on the world market.

"We have managed to reduce the length of the gate to less than 1 micron, in other words a thousandth of a millimeter, which is decisive for the speed of the transistor," said Dr Ishii.

The gate is the distance the electrons must cross. The distance must not be so small that the electrons cannot be stopped, but neither can it be so great that the transition takes too long. (See illustration below.)

To get an idea of its "minuteness" one can compare it with a human hair. The tiny distance Rifa now has in its new transistor is around a hundredth the size of a hair.

With laughter we are told that the comparison is to a thin Nordic hair, not one of Dr Ishii's considerably thicker Japanese hairs.

In this size context both hairs and dust specks are enormous.

Some other characteristics of the GaAs transistor: its frequency limit lies around 50 gigaHertz. The noise factor at 12 gigaHertz is less than

3.5 decibels and maximum amplification that can be achieved at 12 giga-Hertz is around 9 decibels.

Laser Diode

The new laser diode is made of GaAs and GaAlAs (gallium aluminum arsenide) and is monochromatic. It is intended for wave lengths around 0.86 micron. Rifa will now further develop its laser diode for wave lengths in the area of 1.3-1.6 microns. This will make it better adapted for fiberoptic information transmission.

The detector or photodiode already covers this wave length area. It is a detector that receives signals from fiberoptics and turns them into electrical impulses.

Here the customer can determine for himself the wave lengths to which the photodiode should be most sensitive. This is accomplished by changing the amounts of the various component elements.

Light absorption occurs in a layer of GaInAsP (gallium indium arsenide phosphide) in a substratum of InP (indium phosphide). (See data below.)

Due to its low capacitance the photodiode has a very short reaction time, less than a nanosecond, 1 billionth of a second.

"With this product we are probably among the best in the world today," said Hermann Grimmeiss.

"Now work will continue under Dr Ishii's leadership to further develop the new technology," Professor Grimmeiss concluded.

PHOTO CAPTIONS

1. p 12 "Rifa's components of gallium arsenide are among the best in the world," says Professor Hermann Grimmeiss of Lund Technical College, a recognized expert in semiconductor technology.

2. p 12 Each chip is 350 microns by 490 microns. The transistors lie in the middle band. Because they are made of gallium arsenide, they are three times faster than conventional silicon chips.

3. p 13 Rifa is now among the world's best in the field of photodiodes. In spite of the small size of the diode, the active part, in which gallium arsenide is used, is only a fraction as large.

4. p 13 Here is the man behind the successful Rifa project--Dr Takashi Ishii from Japan.

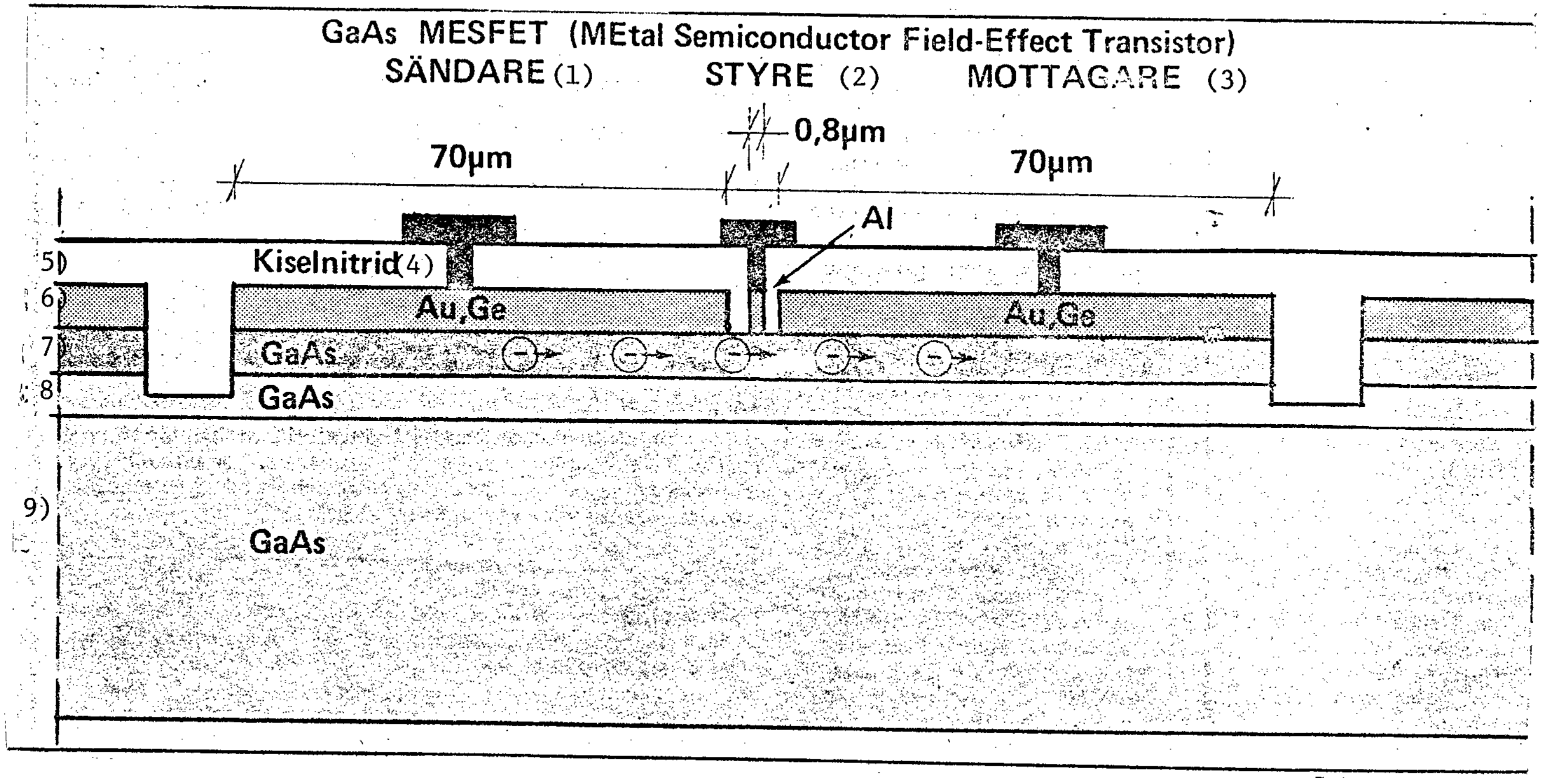
In a year's time he has led a research group made up of eight people.

Now they have reached their goal.

They are the first in Scandinavia to manufacture the super-fast components of the new semiconductor material, gallium arsenide.

Components that are three times faster than conventional silicon components.

And they are dealing with extremely complex measurements. Both hairs and specks of dust look like huge mountains in comparison.



Key:

1. Source
2. Gate
3. Drain
4. Silicon nitride
5. Insulating layer
6. Metal electrode
7. Active layer (n-saturated)
8. Insulating layer
9. Semi-insulating substratum

This is Rifa's new transistor. Electron movement occurs in the active layer of n-saturated GaAs. This contains "loose" electrons that move from the source to the drain side if a positive charge is given to the drain side. Source and drain contacts are made of an alloy of gold and germanium. The gate contact is made of aluminum. When and how many electrons move depends on the voltage over the gate. The tiny gate is only 0.8 microns across. The electrical field that affects electron movement under the gate is also limited in size and thus changes in movement can occur quickly when the charge across the gate changes. This transistor can be used in both analog and digital systems.

Equal Atom Distances in Different Layers Decisive Factor

Gallium arsenide is an example of the rapid new semiconductor material of III-V compounds. There is a complicated manufacturing process behind them. The purity of the compounds and their crystal structures are decisive factors.

One example of the manufacturing process is liquid phase epitaxis. Rifa has used this technique in manufacturing the photodiode. Based on the photodiode, the technique can be described like this:

The active layer is made up of the elements indium, gallium, arsenic and phosphorus. Indium makes up more than 90 percent of this layer.

The four elements are mixed together in their liquid phase at a specific temperature in very precise proportions. The temperature is then lowered to reduce solubility.

This mixture is placed over a substratum of indium phosphide and a layer is built up over the substratum.

This produces a very pure layer of gallium indium arsenide phosphide.

The crystal structure of the substratum acts as a pattern for the new layer so that the structure is the same in the upper layer.

The idea is to make the distances between the atoms in both layers equal. (Atomic distance is determined by means of X-ray analysis.)

As a measurement of this so-called grid adjustment, the relative difference in atomic distance is used. This is the atomic distance of the substratum minus the atomic distance of the layer and the difference divided by the atomic distance of the substratum.

The grid adjustment should be better than 0.1 percent, which it is for Rifa's photodiode. This is important in order to reduce the dark current that is produced in the border layer between the substratum and the layer above it.

In a photodiode, it is preferable if the only time there is a current is when light signals from the fiberoptics hit the photodiode.

Note: The English counterparts for the Swedish terms used for the parts of the transistor are "source," "drain" and "gate." These terms apply to field-effect transistors. For an "ordinary" transistor, the words "emitter," "collector" and "base" are used.

6578
CSO: 3698/406

COMMENTARY ON PHILIPS R&D STRATEGY, POLICIES, MAJOR EFFORTS

Paris L'USINE NOUVELLE in French 30 Jun 83 pp 62-69

[Article by Claude Amalric: "Research and Development: The Philips System"]

[Text] Philips has become what it is today through research. Fluorescent lights, the electric razor, the magnetic cassette and the compact disc were all invented by Philips. This research has been extended by a very strong development policy. That is the great success of the giant of Eindhoven; its long-term planning and internal dialogue are only found in Japan.

"The key to European electronics is at Eindhoven." In France or West Germany, this theme is repeated regularly by all those who reject Europe's colonialization by Japanese electronics. The management of major firms constantly wonder about the intentions of the directors of the Dutch group.

They clearly know that, beyond soothing statements, their companies are not in a position to negotiate very extensive agreements with Philips, like those which link the latter with the American AT&T [American Telephone and Telegraph] for telecommunications or with Sony on the compact disc since 1979. For the most astute, it is not only a matter of a market share or industrial size (Intel, 20 times smaller sells it integrated circuit technologies). Philips' strength lies in its research potential: 4,000 research workers with 2,000 in Holland and 20,000 people in the divisions for product development: as many as IBM [International Business Machines] but twice as many in basic research! In Europe, only Siemans--with which Philips has collaborated for 25 years--has as large a research capability. Yet only Philips deals with such diverse topics as basic physics, the hair of a man's beard, the Stirling motor, televisions and biology.

Remember Fermi's discoveries, from which the Americans produced the atomic bomb? It was a Philips' copyright, purchased from the inventor, of course. It was a profitable business after the unauthorized users agreed to pay the legitimate holders just compensation after the war. Better known are fluorescent lights, the electric razor, the three-grid tube, the cassette and the compact disc, representing great achievements which go beyond the still-dominant perfectionist spirit of the Japanese. Here, invention counts--how it begins, is protected and transformed into a product: that is the question which few industrialists can answer. Philips has done it by basing itself on unchanging principles established at the beginning by its founders: autonomy, then research and manufacture of tools and dialogue within the group and with other companies. Finally, there is international expansion, with production in the market areas, if possible. These principles remain in practice in 1983.

The Philips "model" was created at the turn of the century. It has been extraordinarily constant and so has its history. This explains much behavior today which would otherwise be incomprehensible. Mainly, it explains how this group of 336,000 people scattered in 12 product divisions in 400 factories in 60 countries manages to make money when others lose so much.

Gerard Philips, a mechanical engineer, fascinated by the new electro-technology, invented a procedure to make carbon filaments last much longer than those then in use: the enterprise, financed by his banker father, was set up on 15 May 1891. The technician was not the businessman. His brother, Anton who was, appeared on the scene. He made the first profit. In 1909, an engineer was hired to free Gerard from making machinery, a symbol of independence jealously guarded. For the same reason, working under the protection of a company patent became the rule. In 1914, the first research laboratory was set up. Since they made light bulbs and soon tubes for the then new radio, they also manufactured their own glass and even the gas for the light bulbs. Autonomy came first. Simultaneously, Anton developed an international business network.

In 1927, Philpps already employed 18,000 people--10,000 in Holland; except for one detail, what would follow would be very similar to what went before. This detail, essential in the group's history, was the 1929 crisis and the series of protectionist measures in the countries affected. A lesson was learned: increase the factories in the market countries where they could be partially assimilated to national industry and avoid the problems of protectionism. Nothing else in the system's philosophy needed to be modified to deal with the next 50 years! As if to demonstrate the value of this overall concept, Philips invented, studied, developed, produced and sold its first major success--the sodium light, the yellow lighting on highways all over the world.

"We must do everything to improve communication within the enterprise and motivate our collaborators even more." By stressing concerted effort, Wisse Dekker, chairman of Philips, is only repeating the rule adopted at the beginning, in an era when authority was at best paternalistic. Today this excellent principle remains as difficult to respect. Beyond the more or less adapted administrative structures, personnel relations are a major factor in the process of innovation in the group.

This attitude is found in relations with companies producing similar or directly competing products: why dilute our efforts when we are dealing with the same matters?

The most significant example is perhaps the agreements in 1951 with Matsushita when the future electronics empire was still only a small lighting industry and no one was interested in it or its country. Warmly welcomed at Eindhoven, it formed a close association with Philips since a joint subsidiary, MEC [Matsushita Electronic Corporation] was set up in Japan "after tough but courteous negotiations" where Philips supplied continually updated knowledge in exchange for a portion of a factory in this market. MEC continues, as well as the Belgian company, Philips-Matsushita Battery Corporation, and is not the least affected by the clash between the two partners in other sectors, video equipment and, in the future, the optical disc. It is amusing when it is remembered that Philips commented bitterly after Thomson decided to associate with JVC [Victor Company of Japan]-Matsushita!

Of even greater scope are the agreements signed last January with AT&T, the American giant which is two or three times larger than Philips. The agreement is based on the principle of egalitarian exchange of telecommunications technologies.

Other agreements similar in nature with Intel or on joint research with Siemens demonstrate that Philips' directors favor this kind of exchange. The approximately 10 purchases or joint ventures approved in 1982 are all geared in the same direction. However, the Philips organization sometimes has difficulty rapidly transforming innovations into marketable products. Some see it as a fear of making a commitment in the unknown. This was the case with the timid launching of the video disc, for example, started in the United States in 1981, then in London the following year and finally truly established only in the spring of 1983.

What a mistake it would be to take this somewhat slow approach for a lack of resolution!

When Philips decided to get into the major household appliances market, its procedure was to buy increasing quantities of these goods from the Italian firm, Ignis, then at the height of its prosperity. Once it became the principal client of the manufacturer, it took over supplying the latter by purchasing 50 percent of its capital. It took over the firm completely in 1972, to the satisfaction of the founder of Ignis, Giovanni Borghi. Grundig is the German company with efforts similar to Philips; it maintains such close relations with its Dutch client-supplier that to date it has sold 24.5 percent of its capital to Philips. The Philips' take-over appears to be only a matter of time.

Philips has no equivalent in the world. It is the only electronics giant devoted to the consumer sector, at least for two-thirds of its turnover of 110.2 billion francs. Despite this specialization, it spends as much on research as the professional electronics industries (if not more--approximately six to seven percent of its turnover). Its methods, its industrial and business policies which aim at autonomy and its very long-term planning are reminiscent of the internal management of Southeast Asian groups.

Create a Climate Allowing Everyone to Develop Fully

It is through research that Philips has become what it is: "There is no method or book on managing creativity; it is the responsibility of the managers to set up structures and create a climate of mutual stimulation enabling everyone to develop fully." Pieter Kramer, head of Philips' research, who coordinates it all, has only to account to the board of directors of the group's parent company and more specifically, to one of two vice-presidents at the worldwide level, A.E. Pannenborg.

For this research specialist who came up through the ranks, research's link to the headquarters of the group is the basis for independence in research. It is not the only one: the researchers must be protected from the demands of productions but not isolated from it. "We must map out the route from idea to product. This requires a constant dialogue between the parties involved to achieve optimal functioning." Obviously, the fist on the table approach must be viewed here as a management error.

Pieter Kramer expects research workers to be "creative, competent and receptive of the ideas and competence of others." In return, the hierarchy must maintain an open atmosphere (especially to the outside world), take risks, support its collaborators and understand their problems. Finally, it must establish clear goals and precise structures--what a program!

What distinguishes Philips from other companies with good research is mainly its development. The brilliant ideas overflowing from French laboratories often bog down in this critical phase. Long, costly, unpromising, indistinct and uncertain: the development of a barely worked-out idea into a product is enough to discourage the research worker and the industrialist. For this reason, how much can successful transfers from the university to industry be replied upon? The conventional structure of research-development-preparation-manufacture involves many interfaces which slow down the future product often while transforming it. Something else had to be found. "To streamline development according to the circumstances, its organization must be able to reorganize itself permanently." This little, apparently mild sentence of Pieter Kramer encompasses all the reforms going on at Philips.

Next to the director of research, Nico Hazewindus is the development coordination director: "The 12 product divisions support research through a one to two percent levy on their sales. This gives them no rights or priority. Largely autonomous, they each have their own development, streamlined according to the product, geography or technology." One characteristic of Philips merits attention. Light bulbs are a well-known product with little variation in a stable market: logically, light bulb development is done at Eindhoven where not only the laboratories, but also a constantly improved pilot plant, are located. All other light bulb factories in the world will be exact, up-to-date replicas of the Eindhoven plant.

Technicians Tour the Factories Twice or Three Times a Year

Two or three times a year, a corps of specialized technicians tours the factories to help them meet the latest standard but also to see that their needs are met at the higher echelons. "In fact, they especially convey instructions on the latest breakthroughs and on process or machine modifications. This indispensable procedure for a company with a worldwide production network has another advantage: it forces the formal transfer of knowledge from the development department to the factory." In the case of light bulbs, research and production are not directly related. Centralized development is based on the product.

The audio division is a very different case; it makes small radio-alarm clocks and other small-scale products in Singapore and Hong Kong. The conditions involve stiff competition in a rather local market.

Another factor is that the length of a model's commercial life is very short. Generally, it is modified twice a year! Philips concluded that development in this case must be done completely on the spot by the engineers working directly in the factory. However, small pre-development groups based in Eindhoven handle the liaison with faraway establishments so they are not totally cut off from the benefits of research. Such is the best use of development by geographic criteria. "Obviously, this is not possible with a complex product like the compact disc."

Integrated circuits are such delicate, complicated products to make requiring a very high level of skill since all their components (process, nature, performance, etc) frequently change and it is therefore impossible to separate development from research. Philips then makes optimal use of development through technology--it purchased Signetics, an American manufacturer of integrated circuits, 10 years ago.

Signetics, moreover, has a special place in the Philips organization. While other comparable production centers of the group have rapid access to the central research with which they work closely, Signetics is isolated both by distance and its immersion in the very active culture of Silicon Valley. Therefore, the Eindhoven research has set up a laboratory-observatory there to both assist Signetics and to put to use the latest results obtained by the group's European research. "They have a way of acting and reasoning which does not come naturally to us but we must give them leeway," noted Nico Hazewindus about Signetics' research workers.

They are fortunate. The researchers at Fairchild, a neighbor, must envy them. Their director is Schlumberger. Unlike Philips, he has been trying for years to impose his structures and concepts on the California artists of the integrated circuits. Millions of dollars were spent. But Fairchild withered, disbanded totally and has just closed its MOS [metal oxide semi-conductor] circuits workshop.

According to Philips, good management is empirical management of men based on the research of the highest degree of motivation. This guideline is applied, no matter what the problems with the Cartesian principles of organization. The structure is open to the unexpected. Thus, in a laboratory where a blind technician worked 6 or 7 years ago, his colleagues invented a synthesizer which greatly facilitated his task. When, soon after, the first vocal circuits were marketed, their experiments were the basis for the study of this type of circuit which compensated for the delay in the initial stages.

Agreements on Technological Exchanges Difficult to Negotiate

This enormous mass of available data accumulated over the decades by Philips research centers--eight today--make its agreements on technological exchanges rather delicate. According to Jacques Bonnerot, head of LEP [Electronics and Applied Physics Laboratory], the French laboratory of Philips, specialized in the study of arsenide gallium, "specific limits must be set even though it is difficult when it involves research or knowledge. It is often remarked that more is given than received." Another example of this position is the refusal to rehire a researcher who left the enterprise and wants to return. He has "betrayed," according to Philips.

All directors of Philips research agree on this point: a person does not make a career in the company's laboratories. "At the end of 6 or 8 years, a position in production is offered to the research worker, representing a promotion for him. This is normal because his in-depth knowledge can be very useful there." Can he refuse? The question astonishes. "Why would he do that? It is what he wants." The same is true at Matsushita and Sony.

In what directions are Philips' researchers moving today? The digitalization of products is clearly one of the first concerns of the group.

When a company produces thousands of products, there is much to do. Television is a special priority. First, the electronics in a television will be replaced with a few circuits, as IT&T [International Telephone and Telegraph] already does. The digitalization will no doubt be enhanced by television via satellite; its transmission frequencies use arsenide gallium, a very unstable material. At LEP in Limeil-Brevannes, there is a laboratory where the digital television directly uses the results of the circuits made in the same center.

Integrated circuits are another priority area, mainly those at AsGa, for which LEP is the specialist for the group and also one of the three or four most advanced laboratories in the world for this material of the future. Philips will also benefit from the work of Signetics and Intel under the 7-year agreement signed with the latter. The transfer will deal with CMOS [complementary metal oxide semiconductor] versions (logic for very small users) of the famous microprocessors of Intel, the world leader, which itself is in the process of acquiring the knowledge of the Harris Corporation in CMOS, the best in its field. Fortunately, this technology will also be in France because of Matra (MHS), on a similar scale.

Another significant effort deals with optical storage. This sector is almost nothing today, except for consumer uses of well-known video and audio discs.

This is a considerable matter: not only the storage systems but especially the memory discs for the small or large data-processing banks are markets for which there are presently few competitors for Philips. Even though the largest firms are interested (IMB, Kodak and Matsushita), Eindhoven's advance seems very large.

Is the reusable disc, the key to current data processing applications and the replacement for the video cassette recorders? Matsushita made a shattering announcement last April. "This is a business position. We can do it, too," calmly commented Mr Carasso, research director for optical discs. In his laboratories of Natuur-kundig Laboratorium, the group's principal center at Eindhoven, he demonstrates the work going on: "This curve indicates the variation of refraction of the material, depending on whether it is amorphous or polycristalline. This is Matsushita's solution and ours, too. We still have to find a material which is stable in the polycristalline state for more than several days. That is why people are also working on the magneto-disc, despite the fact that its reel limits quick recodring.

Is What is Good for Philips Good for Europe?

Office automation equipment, telecommunications, especially optic telecommunications require substantial investments. The Divac project proves this. It is the equivalent of the Biarritz experiment; however, since Holland is already 65 percent "cabled," the products emerging from this project must be exported. Is what is good for Philips good for Europe? No one doubts that at Eindhoven for a single minute. But Thomson, CGE [General Electricity Company], Bull, MHS, Siemens (despite the mutual esteem that these two giants have for each other, basically made to understand each other) and the English Plessey do not share this opinion. The first, Thomson, has ambitions in consumer electronics and integrated circuits; the second, CGE, is involved in office automation equipment and telecommunications; Siemens is established in industrial electronics but Philips wants to increase its own sector in this field (30 percent of its activities in 1982). Plessey is basically in the same position.

The General X-Ray Company, a Thomson subsidiary, also hopes to expand its European market shares in the medical market. Whatever happens, Philips is ahead: at Best, in Holland, 80 people are working on RMN [nuclear magnetic vibrations], which looks very promising as a diagnostic tool. The group is currently delivering its first machines, to a market estimated to need 400 systems in 1990. In the race are General Electricity, Technicare, Siemens, Philips and probably Toshiba. If it is to be profitable, a company must have 14 percent of the market.

We cannot criticize Philips for claiming to be the leading European while implementing a worldwide strategy. Although it still does 50 percent of its business on the old continent, business in the United States and Canada increased rapidly to 23 percent last year. This context must be kept in mind before claiming double-dealing.

The truth is that there will be competition among the Europeans as they grow. Competition with Thomson in video equipment is typical. The clash centers on productivity, the quality of the products, experience in the field and volume and quality of the research. For this reason, negotiations are and will remain difficult.

Ten Agreements in One Year

Philips has always maintained a sizeable portfolio of joint ventures. Never have so many agreements been signed in as short a time as in 1982-1983. Their orientation reveals the enterprise's priorities. Telecommunications, in various forms, represent an essential part. The light bulb sector was strengthened with the purchase mainly of Westinghouse Lighting. Industrial data processing and office automation equipment are also involved. On 22 February 1982, North American Philips purchased the light bulb activity of Westinghouse.

In October 1982, there was an agreement with Scientific Calculation for industrial data processing; then there was an agreement with Intel on "micro-controleurs."

In November 1982, it took over the "terminal" activity of CMC plus the household appliance sector of Bauknecht.

In December 1982, there was an agreement with Siemens on integrated circuit research; on cell radios with CIT-Alcatel and on the Minitel terminals with the PTT [Posts, Telephones and Telegraphs] (through TRT-Philips).

In January 1983, the agreement with AT&T on telecommunications equipment became official and there was an agreement on an underwater direction-finding system, in association with Racal Electronics.

In addition to these agreements which Philips itself considers the most important, we should mention that the latter signed an agreement with CDC on optical memories and purchased Valtec (optical fibers) and the Lighting Company (86 percent).

How Much Does An Idea Cost?

Whether it begins in a production division, as the audio cassette, or in a laboratory, the original idea is first discussed by the inventor and his branch chief. If it is considered worthy of study (the criteria is usefulness, a broad area, as they say at Philips), the inventor has up to 6 months to work on it. An evaluation is then made and the agreement is possibly renewed.

"A certain amount of freedom is given to the researchers to work on their ideas. The hierarchy has resources for that. From one to several men/year, the project is under the jurisdiction of local authorities. At each stage they verify the advisability of continuing the work. Beginning with 10 men/year, I make the decision," says Pieter Kramer, Philips director of research. The gathering of ideas and their progressive evaluation is very closely monitored. "At every moment, we know what a project costs."

Pieter Kramer is in a good position to know. As the group chief, he was in at the start of using lasers to read discs 12 years ago. There were three men the first year, five men the second; then the divisions involved took over with their own development departments. "When an idea originates in a division and is simple like the cassette, the development laboratories can make a product. If the idea goes beyond the framework of a division or requires state-of-the-art techniques, it goes to research."

"Philips is an enterprise where success is connected with merit," explains Jacques Bonnerot, director of LEP (the Philips' research center at Limeil-Brevannes).

The Optical Disc: An Exemplary Success

The invention of the optical disc to be read by lasers is one of the finest produced by Philips research. It called upon so many skills in sectors as varied as varied as glass, micro-lithography, optics, lasers, integrated circuits, micro-mechanics and the manufacture of discs that it would be hard for anyone other than Philips in Europe to take the risk.

The adventure began in 1969 when businessmen asked Pieter Kramer, then group chief in the Eindhoven laboratories, an ordinary question: how can one image among many others be quickly located? "We first thought about using slides several square millimeters in size on a disc, with an optical head to read them. This theory was given up very quickly in favor of transforming the image into electrical signals, stored in the form of 'micro-cuvettes' read by lasers." After a year of work (three people), consultations with other research groups and discussions with the division involved, a disc was prepared with a usuable television signal. "At that moment, I realized that we really had a new product," said Pieter Kramer.

He next explained it to the board of directors, for whom, rather exceptionally, a demonstration was given. A long development period (1972 to 1978) followed when many problems were solved. That was the time Thomson took out the first licenses on the optical disc (it has about 100). In fact, in the two completely incompatible systems, the standard engraving was the same: 1.6 microns between the spires and a variation in length of the "cuvette" included of between .8 and 3 microns. Looking at the obstacles encountered by Philips during the initial production of the optical disc systems (the Magnavox videodisc, launched in the United States in 1981), we understand how Thomson lost ground with its flexible disc, all the more audacious than that of the Dutch. In addition, the manufacture of the disc requires an extremely costly, specialized factory, totally dust-free, like an integrated circuits assembly line! The engravings are in fact 5 to 10 times smaller than that of the present chips and this is on a disc 30 centimeters in diameter, sold very cheaply.

Real success came finally with the sound version of the optical disc and the compact disc. This time, all the Japanese (even Sony) are liscensees of Philips, despite the isolated, hopeless attempt of JVC-Matsushita: a magnificent revenge on the VHS video cassette recorders which have hindered the expansion of the V 2000. This is a just turn-about: Philips contributed significantly to the invention of the video cassette recorder with the invention of the cassette.

The Stirling Motor: A Costly Dead End?

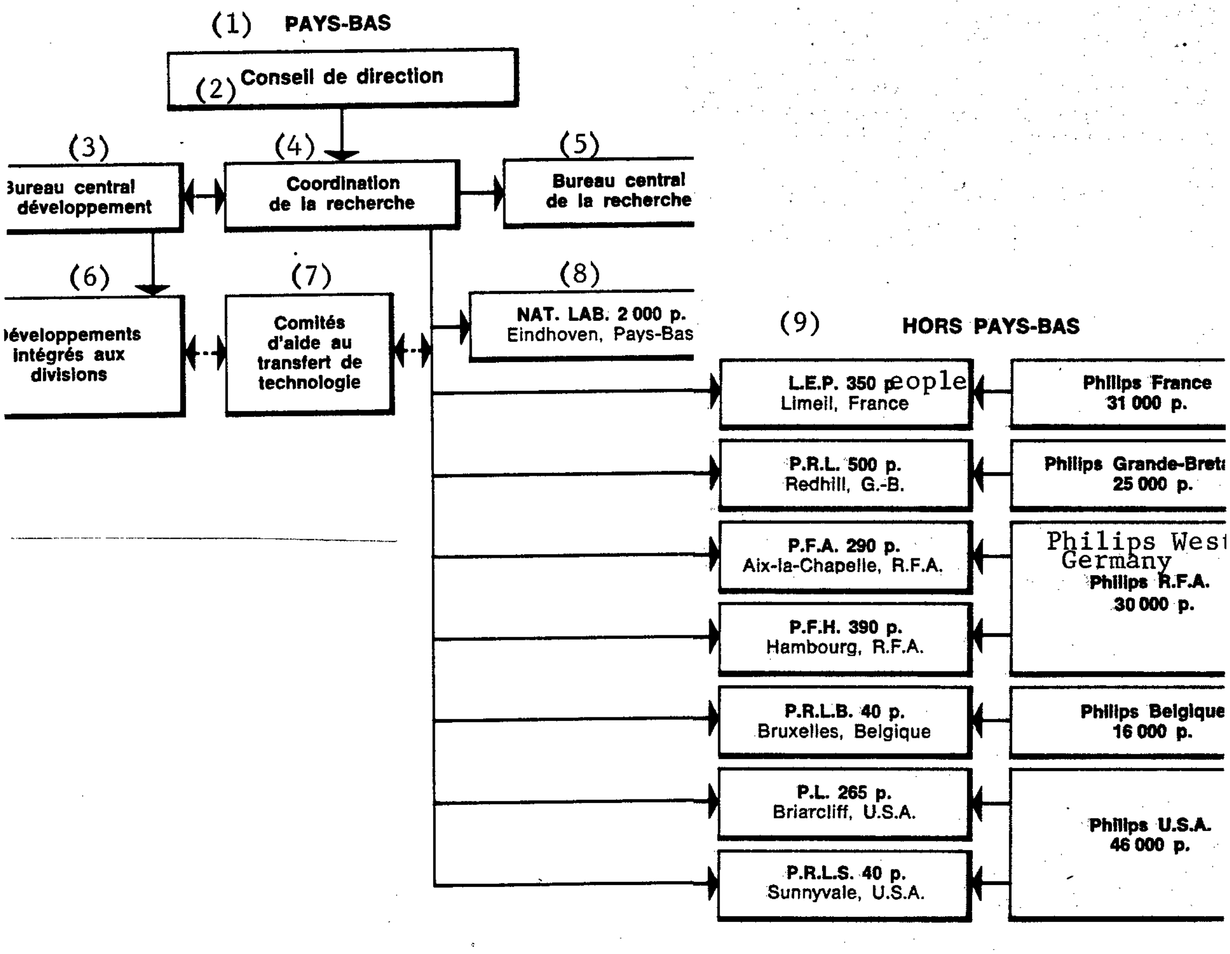
At first glance, the matter seemed like a huge marketing mistake, incomprehensible and upsetting. In fact, the research which has continued without interruption for 40 years on the Stirling cycle (from 1938 to 1978) has cost Philips a fortune and it is almost the only company in the world to believe in the future of this engine.

Yet it was perfect logic which motivated the choice of the precursors of Eindhoven. In 1938, Philips was prospering by selling its TSF [wireless radio] receivers which had been a preoccupation of the world market for a long time. Countries in warm climates raised so many technical problems for the materials then used that the best solution considered was to make small several-watt generating sets to sell by the same networks as the receivers. Studying the motors available, the Stirling stood out by its flexibility, its silence and ability to burn all kinds of fuels, having an external combustion cycle like a steam engine.

In his research on a simple machine, Harre Rinia, the researcher in charge of the project, noticed a toy based on the Stirling principle. The improved yield made him decide to pursue it. A regenerator was placed in a fluid circuit whose pressure was then increased. From an idea which had remained rather theoretical, Philips was able to invent an engine able to beat the four-stroke cycle of Beau de Rochas, at the cost of some progress made on the insulation, thermal exchanges and weight. They were far from the small six-watt generators which sparked Philips' interest in this principle.

Then came the war. Under the aegis of Frederik Philips, son and nephew of the founders, a devotee of the Stirling motor and head of the firm in Holland during the war, the research continued. "The Germans let us do it, considering this work ridiculous," he said in his memoirs. However, they left the country with the prototype in their baggage. This interest aroused that of an allied scientific commission--indeed Philips USA soon received a commission to study a Stirling engine for ships. In 1948, Philips set up Thermotor Limited with a diesel specialist and produced a 400-horsepower engine for ships, then a small 200 watt generator. It was a double failure. "It would have cost 6 million florins more (1952) to manufacture the product in large quantities," admitted Frederik Philips who was not discouraged.

In 1970, General Motors, then Ford took up the idea. Later, a Swedish company, Stirling Motors, was set up. The goal was to manufacture motors for trucks under the Philips license and Philips signed other agreements with MAN. Everyone gave up. "I am confident: this clean, economical, vibration-free motor must finally win out," Frederik Philips was still saying in 1977. Some 6 years have passed since this prophecy but the Stirling motor has not fulfilled it. Is it a fine example of perservering in a mistake or rather of clear-sightedness? At Eindhoven, obstinacy is considered a precious quality!

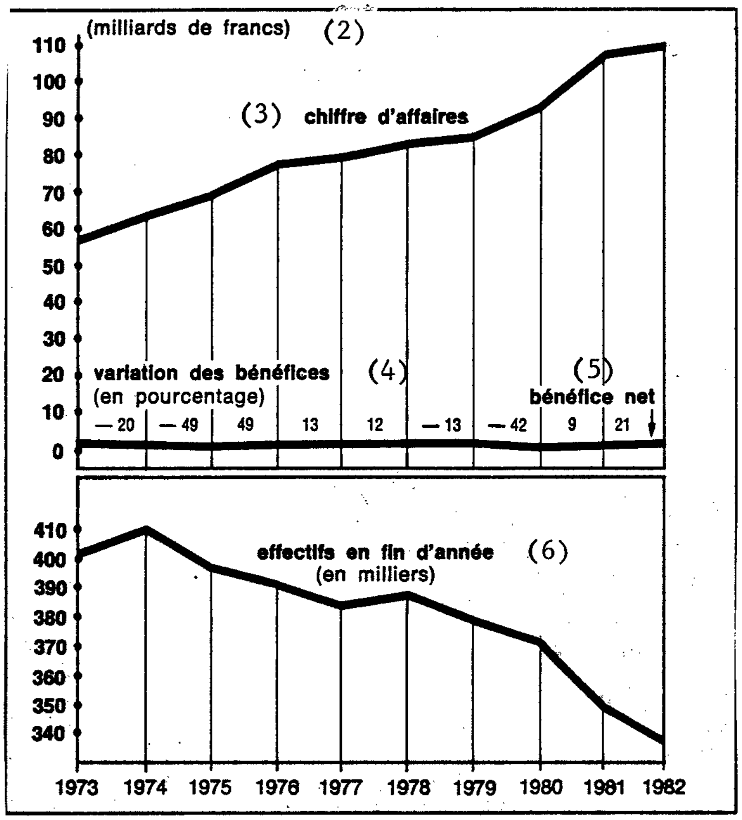


How research is organized. Committees to assist the transfer of technologies are set up whenever the complexity of a product requires it.

Key:

1. Netherlands
2. Board of Directors
3. Central Development Office
4. Coordination of Research
5. Central Research Office
6. Development integrated into the divisions
7. Committees to assist the transfer of technologies
8. National laboratory, 2000 people Eindhoven, Holland
9. Outside the Netherlands

(1) **DIX ANS D'EVOLUTION DU GROUPE**



La baisse des effectifs se poursuit en 1983. Elle touchera 10 000 personnes, surtout en Europe. Au premier trimestre, 4 000 emplois — dont 600 en Hollande — ont déjà été supprimés.

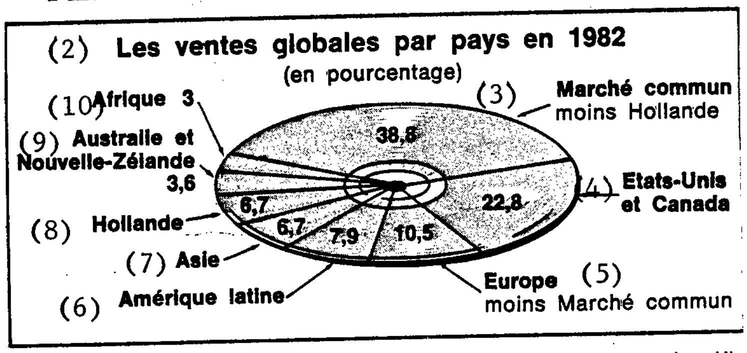
The decrease in personnel is continuing in 1983. It will effect 10,000 people, especially in Europe. In the first quarter, 4,000 jobs, 600 in the Netherlands, will be done away with.

Key:

1. Ten years of the group's evolution
2. In billions of francs
3. Turnover
4. Variation in the profits (percentage)
5. Net profit
6. Total personnel by the end of the year (in thousands)

(1)

VENTES : LA PERCEE AMERICAINE



N.B. — Les découpages sont conçus de façon à répondre aux réglementations sur la publication des résultats sans pour autant donner la possibilité de savoir ce que représentent les ventes d'un produit précis dans un pays..

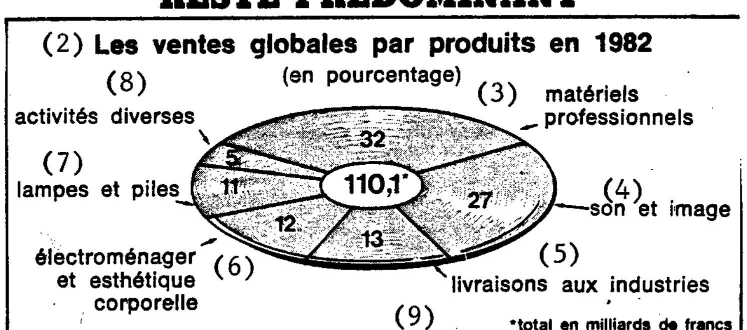
Breakdown by sales. The breakdown is done to fulfill regulations on publishing results but it does not tell us what the sales of a specific product in a country are.

Key:

1. Sales: the American Breakthrough
2. Overall sales by country in 1982 (percentage)
3. Common Market (except Holland)
4. United States and Canada
5. Europe (except the Common Market)
6. Latin America
7. Asia
8. Holland
9. Australia and New Zealand
10. Africa

(1)

LE SECTEUR GRAND PUBLIC RESTE PREDOMINANT



Breakdown by products

Key:

1. Consumer sector remains predominent
2. Overall sales by products in 1982
3. Industrial equipment
4. Audio and visual equipment

Breakdown by products

Key (continued)

5. Deliveries to industries
6. Household appliances and body care products
7. Light bulbs and batteries
8. Miscellaneous
9. Total in billions of francs

(1) PHILIPS ET LES CIRCUITS INTEGRES

1979 (2)	CLASSEMENT SELON LES VENTES (Estimation en millions de dollars pour 1983)	1983
1	TEXAS INSTRUMENTS	1 1 276
2	IBM	2 1 262
3	HITACHI	3 956
7	NEC	4 942
5	MOTOROLA	5 842
4	PHILIPS	6 805
6	NATIONAL SEMICONDUCTOR	7 783
10	FUJITSU	8 692
8	INTEL	9 655
11	TOSHIBA	10 597

Source : VLSI Research Inc.

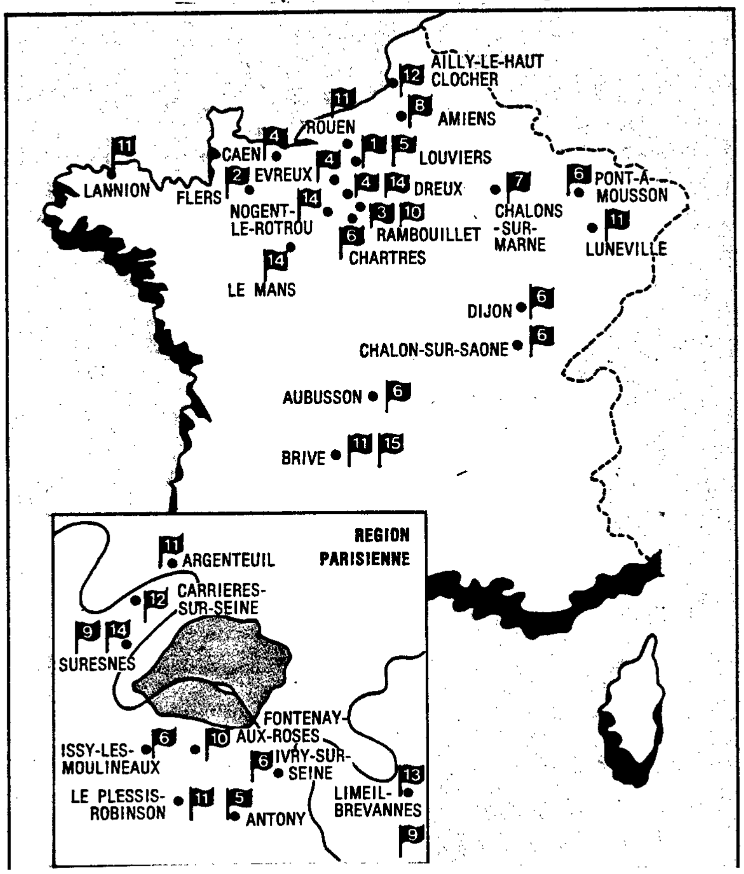
Philips' ranking among the major producers of integrated circuits in 1979 and in 1983. Integrated circuits are one of Philips' major efforts. This explains its agreements with Siemens and Intel. It indeed must react to the ascendency of the Japanese who caused Philips to drop two places in the world-wide ranking of the 10 largest producers of integrated circuits, according to a VLSI Research Inc. study.

Key:

1. Philips and integrated circuits
2. Classification according to sales (estimates in millions of dollars in 1983)

Philips' Establishments in France

L'IMPLANTATION FRANÇAISE



In France, Philips employs 31,000 people in 36 development and manufacturing centers located mainly in the Paris region. The fields covered deal with most sectors where Philips is active: lighting, computers, television equipment, x-ray equipment, nuclear applications, aerospace, components, household appliances, wielding and radio communications. This explains the turnover of 14.6 billion francs in 1982, one-seventh of the group's total.

The Electronics and Applied Physics Laboratory (400 people) handles research; applications and development employs 2,300 engineers and technicians.

Map Of Philips' Establishments in France

Key:

1. Produces television antennas and electrical acoustical equipment
2. Produces audio equipment (record players, stereos and hi-fi's)
3. Produces radio for automobiles
4. Produces electronic components (integrated circuits, printed circuits, cathode tubes, ferrites, rheostats, condensers)
5. Produces phonograph records and cassettes with recordings on them
6. Produces lighting (normal and special lighting, car lights, fluorescent lights, spare parts)
7. Produces arc-wielded electrodes
8. Produces washing machines
9. Is involved in nuclear applications, aerospace, instrumentation and automation
10. Produces computers
11. Deals in radio communications, radio telegraphy, telephones, telephone-access to computers, air navigation equipment and optical electronics
12. Produces X-ray equipment
13. Is involved in basic research
14. Produces televisions and "peritelevision" subgroupings
15. Produces industrial electronic tubes

9479
CSO: 3698/404

OECD STUDY SHOWS SWEDEN HAS HIGHEST ROBOT-WORKER RATIO

Stockholm DAGENS NYHETER in Swedish 18 Aug 83 p 8

[Article by Lars Dahl]

[Text] Sweden has the highest robot-worker ratio in the world. In Western Europe, Sweden has also been the leading nation in the development as well as the production and application of robots. Sweden has 30 robots for every 10,000 employees.

This appears from a study made by the Western industrialized countries OECD, and which appeared in the latest issue of the periodical OECD OBSERVER.

OECD has concentrated on industrial robots on the basis of a very limited definition. Certain studies thus show that Japan has 100,000 industrial robots. According to the OECD study, there are only 13,000.

Rapid Development

With that figure, Japan, however, clearly is the leading nation, as far as the number of robots is concerned. Forty-two percent of all industrial robots in the world are in Japan. Four percent, or 1,300, are in Sweden. Seen in relation to the number of employees, Sweden, however, is clearly the leading nation.

Calculated per 10,000 employees in industry, the numbers of robots in the 'leading' nations were as follows:

	1974	1981
Sweden	1.3	29.9
Japan	1.9	13.0
West Germany	0.4	4.6
U.S.A.	0.8	4.0
France	0.1	1.9
Great Britain	0.1	1.2

At present, the development is most rapid in Great Britain, Italy, and West Germany. The robotization in the United States, however, has been slowing down.

Largest Number in Japan

The largest numbers of industrial robots were in the following countries:

	1974	1982
Japan	1.500	13.000
U.S.A.	1.200	6.250
West Germany	130	3.500
Sweden	85	1.300
Great Britain	50	1.152
France	30	950
Italy	90	790

According to the OECD calculations, 31,000 industrial robots were in operation in 1982 in the world.

Most robots are still being used in monotonous jobs, such as spot welding, spray painting, materials handling, and machine feeding.

The differences between the various branches of industry, however, vary a great deal among the various countries.

In Sweden, slightly more than 50 percent of the robots are used within the engineering and shipbuilding industries, and only 20 percent within the transport sector.

In West Germany, nearly half of all robots are found within the transport sector and only 5 percent within the engineering and shipbuilding industries.

The earlier criticism that robotization would reduce the number of jobs has now been dying away. And the number of jobs affected is still very small.

Every Third Job

OECD believes that by 1990 only every third job in Sweden and Japan will still be affected by robotization. In West Germany 1.5 percent of all jobs and in other countries even fewer jobs.

In its study, OECD writes, among other things, as follows:

In Western Europe, Sweden has been the leading nation in robotization and is, at present, the world's third largest producer of robots. More than 50 percent of Sweden's robots are exported, and Swedish producers account for 25 percent of the European markets.

In 1981, ASEA alone accounted for 7 percent of the American robot market.

7262
CSO: 3698/414

MIDI-ROBOTS GET UNDERWAY IN SEPTEMBER; LAB-INDUSTRY LINK

Paris LIBERATION in French 22 Jun 83 p 18

[Article by Jean-Jacques Chiquelin: "The CNRS (National Center for Scientific Research) has just created its first industrial link: Midi-Robot. One way to show that production is the order-of-the-day and to establish a link between research and industry.")

[Excerpt] The newly-created Midi-Robot company, the first industrial link of the CNRS and the ONERA (National Office for Aeronautical Research & Development) (together providing 51 percent of the capital) awaits only the authorization of the Research, Budget, and Defense ministries to get started in September.

Two industrial companies (MATRA and SESA) and three financial organizations are providing the remaining 7 million of capital required. Once the company is fully established, one of the financial organizations, FINOVECTRON, is expected to release 5 percent of the capital it holds to Renault. The Midi-Robot company will operate in three areas: Robot control software, particularly for assembly operations, robot vision systems, and engineering of automated production systems. The company also intends to operate in a consulting capacity on production problems for other companies. It will later become involved in artificial intelligence and control systems. In the long run, the objective is to build up an array of products able to compete on the world market.

The establishment of an industrial subsidiary by the CNRS is made possible by the Orientation and Programming Act of 15 July 1982, which alongside their traditional activity, grants research centers a mission of valorization of their results. "In the area of valorization, the general policy of the CNRS is to proceed toward the industrialization process" observed Jean-Jacques Duby, Director of Research Valorization and Application at the CNRS. Within this general objective, the South-Pyrennees region could benefit from two factors. There are many students in Toulouse who are trained in robotics. Toulouse happens to be the only French city offering a curriculum combining artificial intelligence, shapes recognition, and robotics. Moreover, besides the LAAS (Automation and Systemes Analysis Laboratory), the city also is host to the Toulouse Research and Development Center, and the laboratories of the Paul Sabatier University, three organizations which enjoy a good reputation in international circles. This concentration of laboratories probably explains why Midi-Robot is the result of a regional initiative started by university people and researchers, rather than by industry people.

The only thing remaining was therefore to define the nature of the technology transfers and to establish limits to the responsibilities of the parent organizations (CNRS, ONERA) and the subsidiary, between the public and the private areas. "It is understood that Midi-Robot will enjoy privileged relations with the LAAS and the CERT (Toulouse Research and Development Center), but there will be no confusion of persons or places. There will certainly be links, but no mixing, we will not act as a laboratory for Midi-Robot" Georges Giralt specified. Although researchers of the Grenoble IMAG (Grenoble Applied Mathematics Institute) have crossed the Isere river to join the Meylan Zirst and create their own company, in Toulouse, we are rather reticent about this formula, compared by some to the existence of private medical facilities within public hospitals.

In fact, the structure of Midi-Robot is an attempt to put together the components of what could become a model in the area of research valorization: mixed financing with public and private capital and the participation of regional organizations, in this case a GIP (Organization for the Public Interest). This is a structure which also gives Midi-Robot its experimental character which will allow the CNRS to study the concept of an extension in a real application.

Even before being born, the company has elicited some interest in business people, and it has already received some orders for September. Researchers in the area, particularly the younger ones, are also observing the attempt closely. By creating about fifty jobs for engineers in the next two or three years, Midi-Robot will give some of them the opportunity to find jobs in the area. But for one of the possible candidates, this is not the only advantage: "Midi-Robot should enable us to carry on research activities started in the laboratories. From this point of view, Midi-Robot offers more guarantees on the kind of job we will have, than traditional industry." The pleasure of finally implementing something which really exists.

6445
CSO: 3698/413

BRITISH INDUSTRY BALKS AT PROGRAM TO ENCOURAGE USE OF ROBOTS

Paris ROBOTS in French Feb 83 p 7

/Text/ British industry's reluctance to equip itself with robots worries the UK government. Indeed, the 60 million pound robotics support program launched by the Ministry of Industry in March 1982 has not been as succesful as anticipated. Up to now, subsidies totaling 4 million pounds have been granted: to contribute to financing of preliminary studies, as in 44 cases; to facilitate acquisition of robotics systems for 46 projects involving a total of 97 robots; or, in 18 cases, to complete robot building projects.

Moreover, certain British builders of specialized robots--among them REMEK (Milton Keynes, which builds the PAM robot for loading, assembly, and packing)--are experiencing difficulties not only because of that reluctance, but also by reason of British industry's apparent preference for Japanese robots. According to that firm, the government is deliberately seeking close cooperation with Japan in high technology, including robotics. Among other agreements which have resulted are those between Sykes and Dainichikiko, 600 Group and Fujitsu, and more recently GEC and Hitachi, for building Japanese robots under license in the UK. And this has caused British industrialists to lose sight of important technological developments which have arisen in that field in their own country.

According to the British Robot Association, Britain's professional group in the field, the number of robots in service in Britain now exceeds 1,000. The stock or robots reportedly grew this year by 50 to 80 percent, and such growth is likely to continue.

6145
CSO: 3698/412

LAMBERTON ROBOTICS DEVELOPS NEW ROBOT TO HANDLE HEAVY LOADS

Paris ROBOTS in French Feb 83 p 8

/Text/ A huge industrial robot, probably the largest of its kind, has just been installed at the Cameron steel mill in West Lothian, Scotland. It will handle very hot steel ingots weighing up to 700 kg.

The robot, which can position ingots in a stamping press within a margin of error of + or - 0.75 mm, was perfected by Lamberton Robotics after a two-year development program aimed at the "heavy" sector of the robot market, and particularly at uses which exclude mobile robots because of the nature or weight of loads, the range required, or the difficult environmental conditions involved, such as operation at high temperatures.

The new robot will be able to accomplish tasks which up till now have been done by remote control manipulators, which are extremely nimble, but which require the constant presence of an operator in order to function.

By providing the manipulator with a computerized control system, Lamberton Robotics has transformed a system which needed an operator into a fully programmable industrial robot. And the system can be used as an automatic and programmed robot, as a manually controlled handler, or in a combination of the two modes.

The latter formula is applicable in cases where, for example, variations occur in the cadence of production or in the shape of a component, so as to require interruption of the automatic cycle to allow scope for human judgment. The operator may need to examine the load, evaluate changes, or make necessary adjustments.

In such cases, the equipment again becomes a remote control manipulator, and once the problem is solved--assuming the component which had interrupted the normal cycle was the sole exception--the equipment is reconnected to the programmed system.

In automatic cycles the system guides and controls all the robot's movements. The operator may conduct a series of simulated operations to optimize efficiency before shifting to the automatic mode. He may also record several programs, choose the best one to use, and erase the others.

Lamberton offers a range of robots or manipulators which can handle loads from 50 to 1300 kg and have a reach of at least 6 m.

Since the equipment is modular, each robot can be built to meet special needs. Computerized control is by an Intel 8080 system.

All versions of the equipment comprise a massive column and a rotation ring, but the buyer may choose a straight arm or an articulated arm with vertical movements on the column. The straight arm version is particularly suited to conditions requiring high entry and exit speeds up to 5 m/sec. The articulated arm offers a more extensive operating range, but at slower speeds.

Among the principal characteristics of the control system should be mentioned the 10 programmable registers which can be linked to the main program or to an external entry source, the 20 programmable inputs, and the 20 programmable exits or linkages.

In contrast to the usual robots seen in automobile assembly plants, with their visible wiring circuits, Lamberton robots are enclosed in a metal housing which protects them from dust.

6145
CSO: 3698/412

BRIEFS

ASEA INDUSTRIAL ROBOTS FACTORY--ASEA has made the decision to set up an industrial robot production unit at Persan, in the Val d'Oise area. Within the framework of European cooperation pursued by the ASEA group, this unit will handle, in 1983, the mechanical assembly of robot systems. The motors and ball-bearing screws used in ASEA robots all over the world are of French production (CEM motors, Technique Integrale ball-bearing screws). The new Persan unit will be responsible for the merging of the robots with their control systems. Each robot will also be subjected to an extended 150-hour reliability test. A complete ASEA technical system is thus being structured for French robotics. It comes in addition to the development unit (application and feasibility) and to the important maintenance complex already existing within ASEA Service. With a capability of one hundred units per year, the new Persan robot production center confirms ASEA's determination to develop new jobs in a promising area: 3 positions in 1981, 20 in 1982, and 40 planned for 1984. [Text] [Paris ROBOTS in French Feb 1983 p 2] 6445

THORN-EMI ROBOTICS--London, 2 Aug (AFP). Thorn-EMI, the number one general electronics firm in Britain, has established itself in robotics by announcing Friday its repurchase of the total capital of Hazmac, Ltd., which employs 100 persons near London in the manufacture of automated handling equipment. By taking control of Hazmac, whose customers include the major European automakers, Thorn-EMI announced its intention to make it the base for development of its operations in the robotics sector, while pursuing its activities in automation. Thorn-EMI, it will be recalled, recently signed a distributor agreement with Yaskawa Electric, the major Japanese builder of industrial robots. /Text/ /Paris AUTO INDUSTRIES in French 2 Aug 83 p 7/ 6145

CSO: 3698/412

BANK OFFICIAL ON VENTURE CAPITAL IN EUROPEAN HIGH-TECH FIRMS

Paris BIOFUTUR in French Jul-Aug 83 pp 5-8

[Article by Pierre Palasi, assistant manager of the Compagnie Financiere: "What are Venture Capital's Chances in France and Europe?"]

> [Excerpts] In its issue No 14, BIOFUTUR published a special report on the part played by venture capital in the development of high technologies in the United States. In the following commentary, Pierre Palasi, assistant manager of the Compagnie Financiere, explains what he considers to be the necessary requirements for success of venture capital investment funds in France.

At a time when the French Government is about to create venture capital investment funds (FCPR), a new investment vehicle designed to provide start-up capital to small high-tech firms, and now that in England for the past 2 years there has been a growing number of new businesses modeled on American-style venture capital, it is appropriate to examine the chances this financing concept has of playing a major role on the European industrial scene.

The approaching establishment in France--probably in the latter half of 1983?--of venture capital investment funds is prompted by the government's desire to free a certain number of PMI [small-and medium-sized industries] from the vicious circle of running into debt and then borrowing to pay those debts. These new funds are designed, therefore, to bolster a PMI's assets without which it has been shown that such firms cannot launch any sizable high-tech business whose growth rapidly consumes working capital.

Indications are that these FCPR's will be capitalized at 50 to 100 million francs and will have to invest at least 40 percent of their assets in securities of unlisted companies (to the strict exclusion of such nontechnological sectors as trading and real estate, for example). Under current plans, shares of the FCPR's will normally be negotiable after probably a period of 6 years. To succeed where the SFI's [innovation financing companies]--formed probably 10 years too early--failed, namely in creating any real momentum for large-scale innovation, FCPR's as a whole would have to raise at least 300 to 500 million francs per year in each of the next 5 years thanks to:

1. Tax incentives for institutions--50 percent depreciation the first year--and individuals as well.

2. The effect on potential investors of publicity about venture capital success stories emanating mainly from the United States, Israel, and possibly more recently from England.

Assuming that this problem of raising the minimum "critical mass" of necessary capital is solved both in France and on the European level--which is far from being the case in a country like Germany--let us then examine the principal obstacles to expansion which venture capital still has to overcome. Jean Comar's editorial in issue No 14 of BIOFUTUR contained a very accurate list of a few of the current sociocultural and other obstacles. Although it is not very clearly noticeable, some of these obstacles are in the process of being removed. Using the size of Europe's inordinately fragmented markets as an excuse or pretext looses its validity when, for example, we examine the phenomenal success of the Israeli company Elscint--an out-and-out product of venture capital--in the medical imagery field, a field in which CGR [General Radiology Company] partially failed despite a protected national market. There is no lack of examples of high-tech businesses, and not the least important, that were first successfully launched and expanded in Europe before tackling the American market. The best known example is Commodore. This firm was a forerunner in the development of microprocessing equipment in Europe before invading the American market where it was completely unknown 3 years ago and now has sales of more than $1 billion. Sirius was one of the first companies in Europe to introduce a 16-bit microcomputer before becoming Americanized under the name Victor and being listed on U.S stock exchanges. We could also mention such other examples as Sinclair or Rodime in England and Biogen in Switzerland. A growing number of American venture capital specialists believe it has become simpler today to start a high-tech business in Europe within a competitive environment that is not as harsh as in the United States where it is not unusual to see simultaneous formation of 10 or 20 biotechnological or robotics companies offering closely related products. On the other hand, once a business gets underway in Europe it is essential for it to quickly establish a large subsidiary in the United States to season itself to competition.

Dozens of venture capital specialists I have met and an even larger number of American entrepreneurs all assured me that American venture capital's recipe for success is still disconcertedly simple and can be duplicated in different parts of the world:

1. Have a quality product;

2. Assemble a team capable of producing this quality product in quantity;

3. Have abundant capital and assets without being obliged to obtain a return from them for 2 or 3 years (exclude any running into debt);

4. Establish stock option plans for large-scale distribution of shares of stock among company personnel.

Items 1 and 2 of the recipe need no comment and we will not consider them insurmountable, as demonstrated by the operation of plants established and managed by the Japanese in England or France for example. Item 3 continues to pose a problem in Europe and it will be a few more years before interested European entrepreneurs have access to the same large influx of capital as their American counterparts. It should be noted that it is common practice today for a biotechnological firm with earnings of not more than $500,000 to raise $10 million (20 times its volume of business) that will be used roughly as follows:

1. A sum of $10 million will be deposited in a bank for 6 months at the highest interest rate and thus generate funds of the same order of magnitude as the company's volume of business;

2. A sum of $5 million will then be used to pay for industrial facilities;

3. A sum of $5 million will be kept in reserve to meet future working capital requirements.

Stock Options

I have kept item 4 of the recipe--the well-known stock options--for the last because the inadequacy of our legal and tax systems definitely makes such options a real obstacle in Europe to the creation of new enterprising companies.

I shall first briefly describe what is involved in this option to purchase shares of company stock. When a company is formed, provisions are made in its charter to reserve a certain percentage of its capital--generally 10 to 20 percent--for its personnel, based essentially on an employee's merit and definite contribution to the company's success. Specifically, the company will offer management personnel or other employees the option of purchasing a specified number of shares of company stock under a contract signed, for example, in June 1983 at a price close to that prevailing when the options are issued. But a person participating in such a plan will choose not to exercise his option to buy and, therefore, pay for his stock until some years later--generally 3 to 9 years later--on condition that in the meantime he has abided by the terms of the contract and, of course, has not resigned from the company, in which case the stock option would revert to the company which could then, for instance, make it available to his replacement. Under most European laws, and particularly in France, this deferred purchase option is considered compensation for work and is, therefore, taxable as regular income, thereby negating all of the system's advantages inasmuch as the moment he exercises his stock option the participant would owe revenue authorities an amount of tax that would oblige him to mortgage his property or resell up to two-thirds of his shares, whereas this is precisely what the stock option system is meant to avoid. In the United States, the profit made by exercising stock options is considered a capital gain and taxed at the lower rate of 20 percent since 1981. Today, approximately 50 percent of new high-tech companies formed in the United States offer their employees a stock options plan, whereas just 10 years ago only a very small percentage of companies had such plans.

If Eurpean legislation were to permit adoption of such a system, this would unquestionably make it possible to overcome the handicap, at least in France, of the sacrosanct patrimonial concept of the business concern, a concept which actually always results in limiting growth because owners of companies naturally prefer to opt for systems of indebtedness or "participative" loans, even at the expense of profit margins and certainly of profit plowback. "Participative" loans, a French invention, are the most perverse in that they are classified as assets which, therefore, allow a firm to run into debt even more.

On the other hand, within a system of widespread and substantial employee profit-sharing as in the case in the United States, it goes without saying that it is in everyone's interest to strive for the company's continued growth and for greater productivity, because that is the best way of quickly increasing the value of their stock options to the maximum. Admittedly it must be realized that the rule of the game is that under such conditions the company belongs much more to the management team and possibly to outside stockholders--venture capital investors, for example--and no longer to the head of the firm or the family owning a controlling interest, as in Europe. This rule of the game is all the less disputed in the United States because in a very great majority of cases when a firm was formed its founders did not have to furnish any money inasmuch they were given stock options from the very beginning in exchange for their contribution of technological expertise.

In our view, the stock option system is altogether indissociable at the present time from the start-up of a so-called high-tech business. If it were a question of starting an auto parts distributorship or a chain of restaurants, use of the rather complicated stock option system could be useful but not indispensable. On the other hand, if it is a matter of very rapidly recruiting--as necessitated by competition and technological obsolescence--specialists which our educational systems continue to train and produce in homeopathic doses, then the problem rapidly becomes insurmountable within the framework of our existing wage and grade scales for conventional recruitment.

The founder of a highly successful American software business recently said that by expanding his stock options plan from 25 percent to 80 percent of his employees, he had succeeded in reducing his company's personnel turnover rate to less than 10 percent--the normal rate in high-tech firms is reportedly 20 percent--and that in any case he had no choice because previously he used to spend three-fourths of his time in recruiting tasks at the expense of his firm's growth.

Search for a European Model

We are thoroughly convinced that American-style venture capital is entirely suitable for application in Europe. Provided the rules essential to its success are adhered to, it is not too late to give it a chance instead of criticizing it or being jealous of it. For more than 10 years now, France has mistakenly exhausted itself in a fruitless search for a more original model of economic development, but with the unavowed temptation to draw part of its inspiration from the Japanese model. We are convinced that the latter will never be applicable, either closely or remotely, to a country as individualistic as France where sociocultural differences are really too great. Moreover, in our opinion, this Japanese model is no longer the best with which to face the technological acceleration of the next 20 years. The Japanese have won the textile, steel, and automobile battles but are losing the microcomputer and software battle inasmuch as the Americans, because of their standards, actually have a near monopoly of operating systems and languages.*

This comes back to the problem of choice, of true priority (or better of nonpriority), and of political courage. No country can continue, without growing poorer, to place the bulk of its financial system at the service of the large companies--nationalized or not--(how much did the French Government give Usinor or Manufrance on the one hand and Sofinnova on the other?), an excessively large number of which invest in assets that Asiatic or American competition quickly undertakes to remove from our national patrimony by reducing their economic value to zero. If in France we persist in adding to the army of wage earners protected by increasingly rigid laws and regulations, if we neglect our PMI's severely buffeted on every side, then the warnings given by the SFI's will have been wasted on us, warnings telling us that the problem today is not one of finding capital but rather entrepreneurs and management personnel motivated to work 60 hours a week and not 35. France will continue for a long time to be respected throughout the world for its ideas, the quality of its research and its scientists whose published works are highly regarded abroad, but likewise as a country that is as awkward as ever in concretely implementing its ideas and research efforts.

* The MITI [Japanese Ministry of International Trade and Industry] tried to launch a Japanese version of Cobol and it failed. The ministry has now assigned manufacturers the goal of developing a Unix-type Japanese standard operating system within the next 5 years.

8041
CSO: 3698/420

EC LAW WILL FAVOR SMALLER COMMERCIAL AIRCRAFT

Stuttgart FLUG REVUE in German Aug 83 pp 27-28

/Article: "Euro Signal - Future Opportunity for Commuters"/

/Text/ The EC ministerial Council has sent out an economic message: After 1984 the monopoly of state-owned airlines in European transportation will be abolished.

At EC Commission Headquarters in Brussels, prospectuses have already been sent out which solicit smaller-sized machines from the aircraft manufacturers. Not that the top officials of the European Community now want to set up their own airline, rather this is the reaction to an act of the EC Ministerial Council, the decision-making body of the EC. In June the Council resolved to clear the path for establishing air routes between regional centers inside of the EC. Excepted is Greece where Aegean transportation will still be monopolized.

The new EC law will become effective on 15 October 1984. A study carried out in France under an EC-Commission contract figures that by 1985 11 new regional routes can be established. By 1990 airline traffic growth will make 11 more routes profitable. The study considers only medium-sized airports, probably because of doubt in the profitability of flights between smaller regional centers. EC Commission Headquarters in Brussels is convinced however that regional passenger airlines make sense because businessmen from medium-sized and other businesses have a personal interest in them.

The study assumes that 3 categories of airplanes will be used on such routes: 15 to 20, 40 to 50 or 60 to 70 seats. In each case, seating capacity will be tailored to fit demands. In applying the profitability test, three types of lines were postulated: 1) Lines shorter than 500 km which will move at least 4,000 passengers per year during 5 operating days a week, resulting in a seat occupancy of 56 percent; 2) Lines up to 700 km carrying 9,000 passengers per year with a seat occupancy of 43 percent and lines of unlimited length carrying at least 14,000 passengers per year with a seat loading of 45 percent.

Of course the profitability depends on the type of aircraft used: The Parisian study paid for with EC funds was based on three types of aircraft used in Europe:

-- The Swearingen Metro II. This machine from the United States, several of which are already in operation in Europe, would be profitable on routes shorter than 400 km.

-- The Fokker F 27.200. This successful Dutch airplane known worldwide is profitable for routes of at least 700 km and a duration of 2 hours.

-- The Fokker 28.1000. It is considered to be a profitable machine for the third, or unlimited range, category.

It turns out that EC Commission Headquarters in Brussels has received responses from only England and France. France's Aerospatiale submitted its ATR 42-100 (moves 42 passengers 1,300 km in 4 stages) and its ATR 42-200 (moves 46 passengers 1,760 km in 6 stages), an impressive proposal. England's British Aerospace responded immediately with 5 off the shelf machines with the following seating capacities: the Jetstream 31, 18/19; the Super 748, 48; the ATP, 64; the BAe 146-100, 88 and the BAe 146-200, 106.

What comes out of the new EC Council law depends critically on the products offered by the airplane manufacturers. It is hoped that they will fall in line and plan for the future of regional aviation.

The contents of the EC specification are straightforward:

The new routes between regional centers inside of the EC have to be at least 400 km long and only machines with a maximum of 70 seats and a maximum take-off weight of 30 tons can be used. The law applies only for connections between Category II and III airports. This includes all except the large international airports like Frankfurt, Paris, London and Rome.

The national aeronautical regulatory boards can turn down route applications when certain specific conditions are or are not fulfilled: For instance, if a regional line is already operating between the two points or the technical prerequisites--mainly for flight safety--of an airport under consideration are not up to the required standards. Also, the application can be rejected if indirect services are already offered which require only one transfer not exceeding 90 minutes. This still holds when the existing indirect line costs less than 50 percent more time than an additional direct connection would.

Important for the new regional airlines is the EC requirement that they have to be profitable under their own power without subsidies. This is a heavy burden alongside the nationalized airlines which are still heavily subsidized in some cases. Indeed, much depends on the airplane manufacturers and their offerings.

9160
CSO: 3698/408

BRITISH LEYLAND DESIGNS CAR WITH ALL-PLASTIC BODY

Helsingborg PLASTFORUM SCANDINAVIA in Swedish No 1/2, 1983 pp 52-53

[Article by Per Rydgren]

[Text] How long will we have to wait for "no-rust" plastic car bodies? Until 1985-1990, in the view of British Leyland which recently presented its experimental plastic car, ECV-3 [Energy-Conservation Vehicle], which has remarkably good operating characteristics. Leyland has been working for a long time on a successor to its smash hit, the "Dog Kennel." If the firm is the first to come out with a plastic car it deserves congratulations. What about 0.35 liters a mile at 90 kilometers an hour in a car that seats five and has big car comfort?

Every month reports stream in to the editors on the increased use of plastic in automobiles. When it comes to plastic in car bodies, all the manufacturers seem somewhat wary. They are evidently concerned about investing capital in plastic presses, reduced turnover due to plastic's longer lifetime and the lack of experience in polymer technology and in the use of plastic techniques in this context.

But everyone understands that the day "no-rust" cars start to sell, it will be vital to be part of the market. In Germany we know that developmental work has been done by Volkswagen and Daimler-Benz with the aim of evaluating plastic car bodies. Just before Christmas I was called to London for a presentation by ICI, Ltd., where they displayed BL's [British Leyland's] new experimental car, the ECV-3, with a completely plastic body, except for the roof which is made of aluminum. Without having any special expertise in car design, I knew instinctively that the idea of the ECV-3 was right. The car has a bearing framework, a skeleton, of light metal. The plastic parts are mounted on that. By changing parts, they could produce other variations such as sports cars or transport models, etc. The plastic parts were manufactured primarily from RRIM, in other words fiberglass-reinforced polyurethane. The engine hood and the inside of the rear doors were molded from fiberglass-reinforced polyester of the SMC type.

ECV--Energy-Conservation Vehicle

A few years back, British Leyland made the mistake of resting too long on the laurels of its "Dog Kennel." When the car became outdated, they had nothing to come up with in its place. The result was a crisis in the company and enforced reconstruction. In connection with this, an independent development firm, BL Technology, Ltd., was formed for the purpose of developing automobile technology under the conditions permitted by other technologies. In other words, the technicians at BL Technology were not limited to existing technology but were given free rein to create the very best.

The basic requirement was energy conservation in all areas. Thus the cars developed should be cheap to operate and require as little energy as possible to manufacture. Therefore the project was called ECV, Energy-Conservation Vehicle.

Experimental cars ECV-1 and ECV-2 provided experimence for the car being presented now, ECV-3. British Leyland believes the technology built into ECV-3 will be commercial in the last part of the 1980's. What is it that we have to look forward to?

Record Low Wind Resistance

Through the plastic body, they have achieved a wind resistance of only 0.25, which is a record for a family car today. In comparison the Ford Sierra has a wind resistance of 0.33 and the new Volvo 760 has one of 0.4.

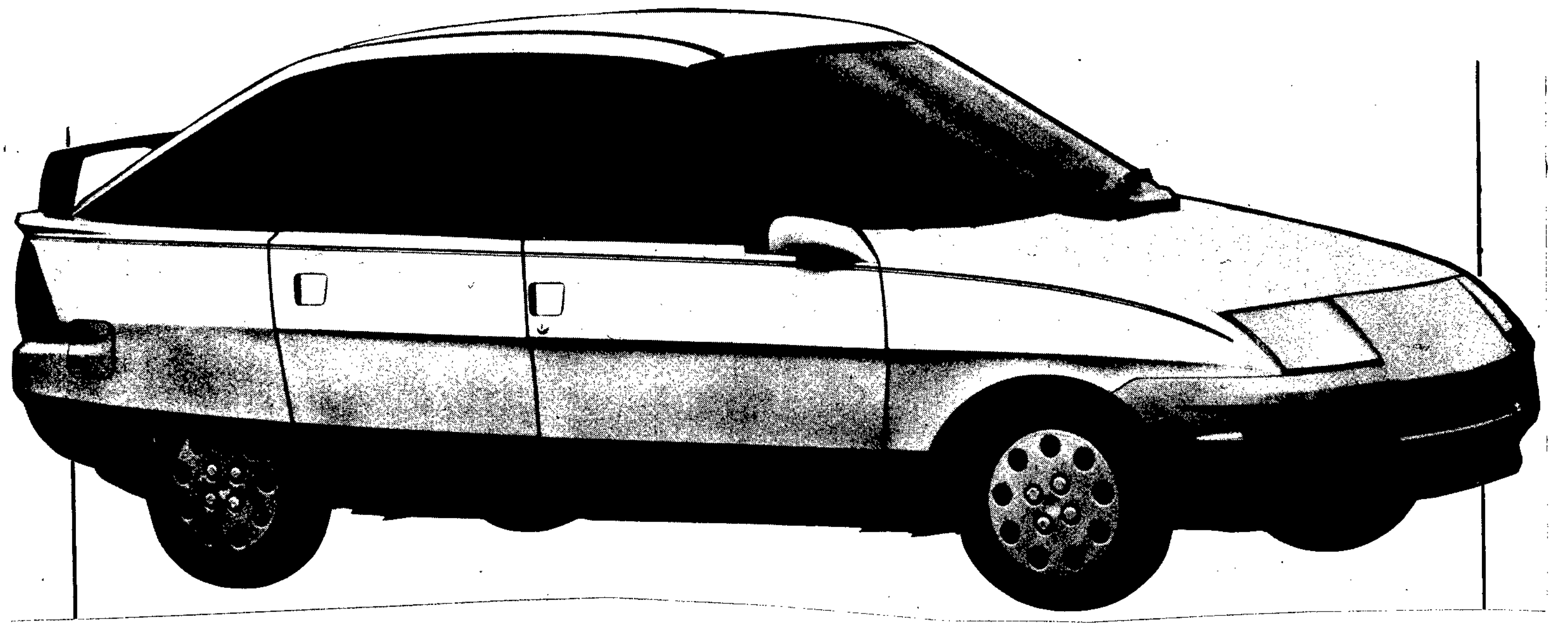
With the increased use of plastic in the ECV-3 the car's total weight has been kept at two-thirds of normal car weight, e.g. 664 kg.

These two factors in combination lead to remarkably low gasoline consumption, 0.35 liters a mile at 90 km an hour and 0.58 liters in city traffic.

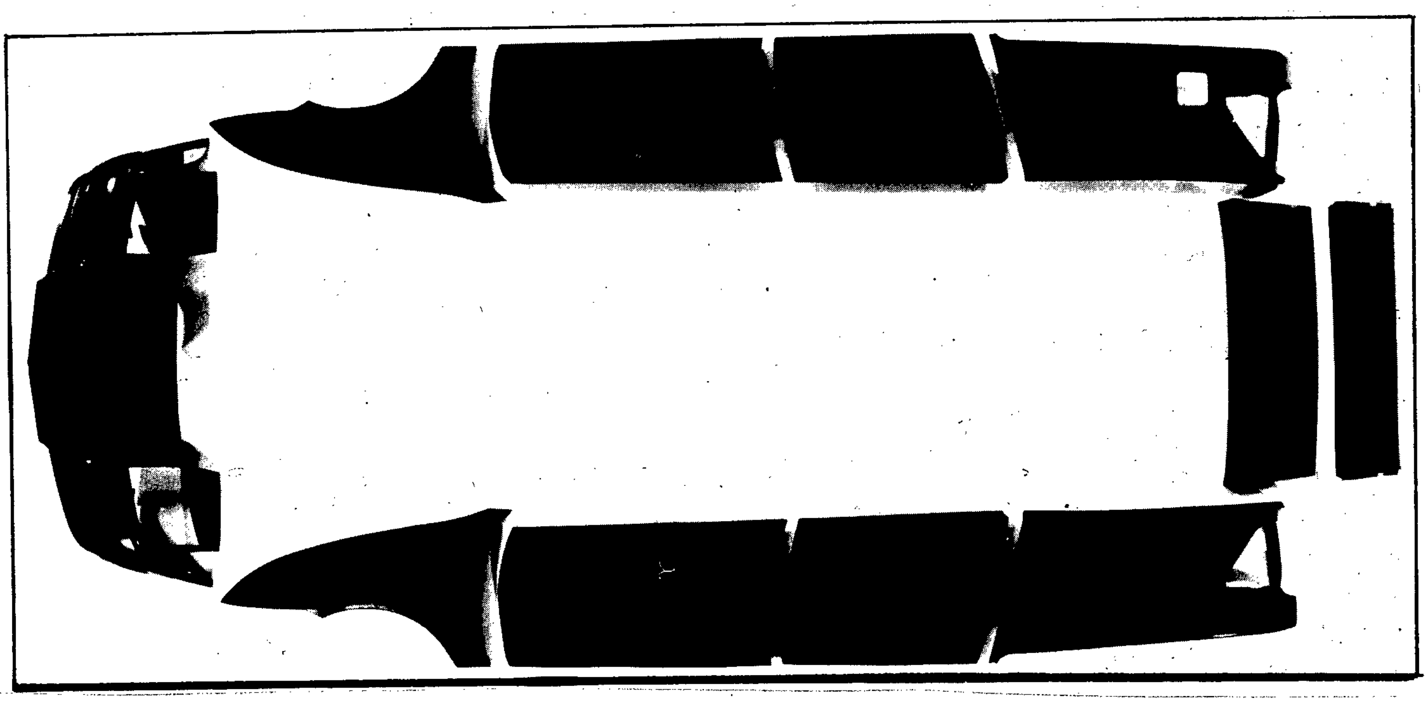
The experimental car does not just contain plastic innovations. The engine is also a new development. It is made of light metal and weighs only 84 kg. The three cylinders have a total volume of 1,100 cc and a compression of 9:1. The effect is 72 horsepower at 5,500 rpm. The power package gives the car an acceleration from 0 to 100 km an hour in 11 seconds. The top speed is over 180 km an hour.

Renaissance for Bearing Frame

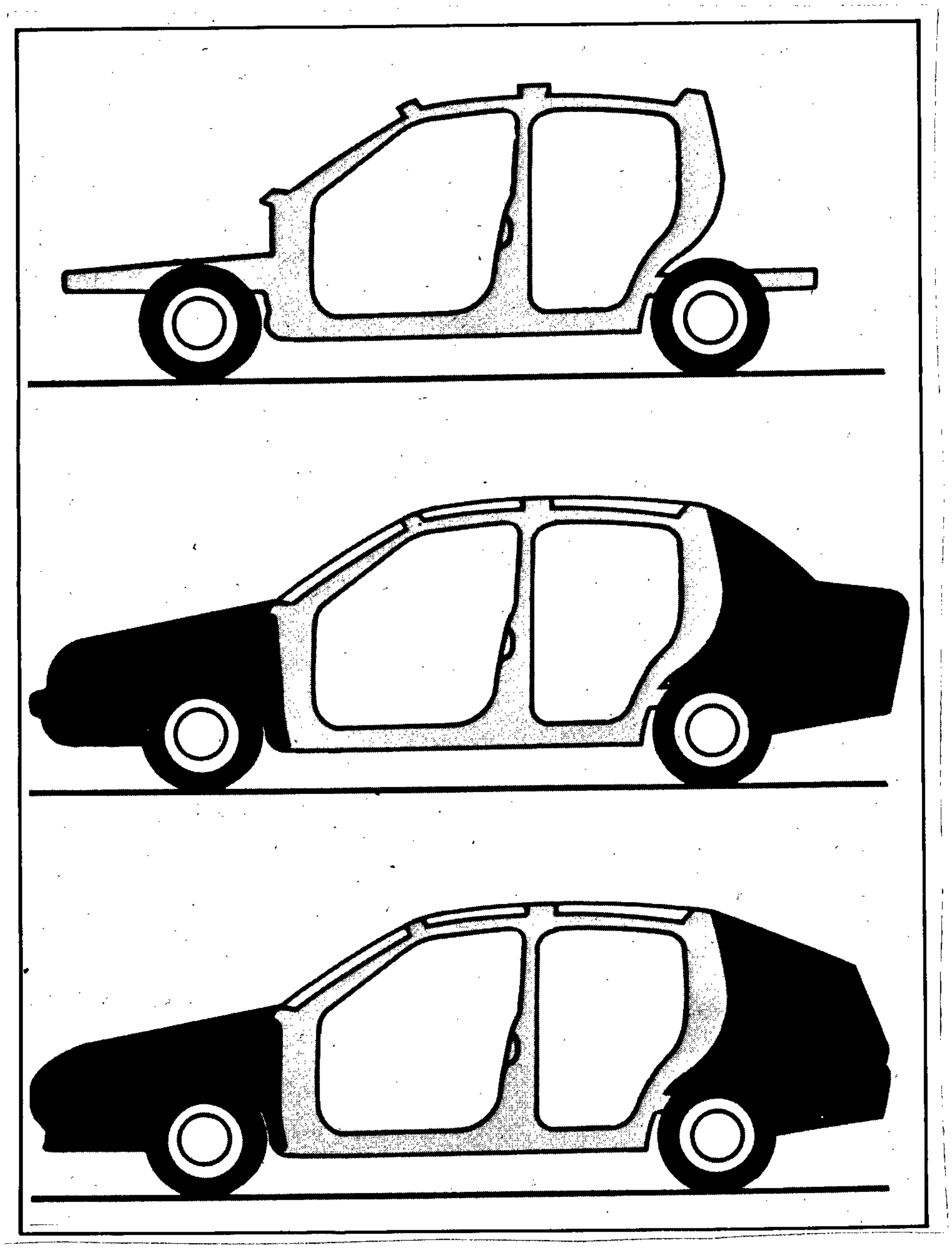
The construction principle of a bearing frame is a return to older automobile technology. The skeleton of the ECV-3 is made of aluminum and was computer-developed from the point of view of strength.



This is a plastic technician's dream. The entire body is of plastic with the exception of the roof. The engine hood and the inside of the rear doors are made of SMC and the rest of the body parts are made of RRIM. The car cannot rust and it can tolerate minor collisions without sustaining damage. It uses about as much gasoline as a moped!



All the body parts for the ECV-3 that are made of RRIM polyurethane.



By mounting different body elements on a standard frame, the appearance and function of the car can be changed.

With the plastic parts installed (doors, screens, etc.) the whole body weighs 138 kg, which is about half the weight of a normal car body. The RRIM material can tolerate minor collisions without showing marks. If larger dents occur, the damaged body element can simply be replaced.

BL's idea with the metal framework is to be able to use it for several different variations, 3-door-, 4-door, 5-door, sports and transport models, etc. Changes in the different varieties are effected simply by changing the plastic elements.

The tires are of a special type with a low turning resistance. Dunlop has been responsible for the development work on the tires. On all four tires they have cut 33 kg in comparison with a normal tire set-up with rims.

Production Starting in 1985

The ECV-3 is not intended for mass production. The car will be used to evaluate the construction elements. BL Technology feels it is very probable that the concept will go into production either wholly or in part starting in 1985.

6578
CSO: 3698/407

SNIAS: SALES SLUMP, DEFERRED PROGRAMS, TOO MANY EMPLOYEES

Paris LE FIGARO in French 3 Aug 83 p 7

[Text] Among the many problems the new president of the Aerospatiale Company, Henri Martre, already has to solve, that of company overstaffing is not the least troublesome, particularly since it involves the everyday life of salaried personnel

Before leaving the presidency of SNIAS on 21 May, Jacques Mitterand had warned: "While waiting for the business recovery which will occur at the earliest, in 1985, we will have an imbalance between the backlog and the production potential. In order to face the problem, it will be necessary to develop solutions that are both acceptable and accepted."

Aerospatiale personnel numbers 36,500 employees. Today around 4,500 are in excess. Three of the four areas of the company are impacted: aircraft, helicopters, ballistic and space systems. At the present time, the tactical weapons division alone is operating at full capacity.

The Airbus sales slump, caused by the difficulties encountered by commercial air carriers and the slowdown in helicopter orders, has reduced the backlog of these two divisions which, last year, contributed 56 percent of the total sales value of equipment delivered by Aerospatiale, over a third of which for export.

The problems also experienced by Dassault-Breguet, are not without their consequences for Aerospatiale which produces systems for the Mystere executive aircraft, as well as for the Mirage combat aircraft as a subcontractor.

Finally, the decisions taken by the government to limit or delay, if not to eliminate some programs, have lowered the anticipated workload of the ballistic and space systems division. This is the case for the Military Reconnaissance and Observation Satellite [SAMRO], the SX missile intended to replace the weapon currently buried in the silos of the Albion Plateau, and for the follow-up, in about 10 years, to the M4 rockets which equip the nuclear submarines.

Whether or not they were anticipated, these events did not prevent Aerospatiale, last year, from hiring new personnel, as other nationalized companies such as Air France and the SNCF [French Railroads] had to do. Today, these three companies are experiencing a slowdown in business, or are no longer progressing. How, then, will Aerospatiale adapt its workforce to a reduced workload?

For Henri Martre, there is no question of laying off personnel. In fact, the president of the SNIAS intends to solve the problem he has inherited by bringing back in work previously farmed out to vendors (1000 hours), reducing the work week to less than 37 hours, balancing workloads between plants, (84,000 hours), and offering early retirement incentives.

Whereas these measures will certainly prevent layoffs, they will do nothing to improve the Aerospatiale's competitive position on the international market, particularly for helicopters. Is it possible to be philanthropic, that is to let production costs rise inevitably, while preserving, and even improving the company's posture on external markets? In fact, these two problems seem difficult to reconcile, as shown by the attitude of the competitors, and sometime partners, of the SNIAS.

In the United States in the last 20 years, the workforce at Boeing has varied up and down like sawteeth according to the state of the economy. Last year and this year, the Seattle firm laid off 18,000 workers, who will be rehired as soon as the economy picks up.

In the U.K., British Aerospace, which employs 57,000 workers, intends to lay off 3,500 workers next year. Finally in Germany, MBB, which also suffers from the Airbus sales slump, is adapting its workforce to the requirements: to the 1,500 layoffs which took place last year, will be added another 3,000 this year.

As we have shown, the French answer is different. It is to be hoped that it will at least preserve the design laboratories which have been painstakingly put together and which it would be very difficult to recreate after what Henri Martre calls the "crossing of the desert." At least, two oases are appearing in the distance, but they might as well be mirages, considering the extent to which they are discussed without really appearing: the launching of the European 150-seater Airbus project, and the French-German antitank helicopter. In the case of the first, a favorable decision may be available before year's end; as for the second, although "things have been moving" recently, it is still only a project.

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CSO: 3698/405

TRANSPORTATION

BRIEFS

MBB COMPOSITE VERTICAL STABILIZER--MBB developed the vertical stabilizer spar for the A300-600 and A 310 commercial aircraft. It has a height of 9 m and root and tip chords of 3.1 and 1.4 and is the largest primary structural component built to date using carbon filament composite construction. In addition to a weight savings of 150 kg, with a new total weight of 500 kg, it was also possible to reduce the parts count from 2072 to 96. The savings in assembly time compensates for the high cost of the carbon filament material. The new part is built up with carbon prepreg cloth; the strength of the part results from orienting the prepreg-cloth plies at +45, -45 and 0 deg. The material which is soft and tacky during working is hardened at a temperature and pressure of 120 deg C and 8 bar. [Text] [Stuttgart FLUG REVUE in German Aug 83 p 60] 9160

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