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SCIENCE AND TECHNOLOGY

No. 121

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## WEST EUROPE REPORT SCIENCE AND TECHNOLOGY

No. 121

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## BIOTECHNOLOGY

### FRENCH STUDY INCREASED FUNDING FOR BIOTECHNOLOGY RESEARCH

Paris LES ECHOS in French 22 Jun 82 p 2

[Article by Jacqueline Mattei: "500 Million Already Allocated and 1.2 Billion Under Consideration"]

[Text] A year ago, biotechnologies were added to the list of areas handled by CODIS (Committee for the Development of Strategic Industries). To date about 10 projects have been approved, representing an investment of Fr 500 million over the next 3 years. The beneficiaries are expected to be small to medium-sized industrial enterprises and even some companies now being formed. Among the projects approved, we should mention Immunotek's monoclonal antibody project aimed at expanding upon the research conducted in this area by INSERM [National Institute of Health and Medical Research].

CODIS is now studying the "heavy" projects that would involve the large companies, such as Rhone-Poulenc, Roussel-UCLAF, and Sanofi. In all, the projects will entail investment outlays of some Fr 1.2 billion. The manufacturing firms have the task of bringing order to the "biotechnologies" as well as reorganizing holdings which have been scattered among various divisions of the respective companies.

Rhone-Poulenc, for example, as part of a development contract now being negotiated with the Ministry of Industry, is seeking rather substantial funding for its bioindustrial activities. The Rhone-Poulenc group's projects include lysine, as well as a possible entry into seeds.

Finally, CODIS is making every effort to assist the Pasteur Institute in the establishment of a collection of microbial cultures.

The "new" bioindustry (that is, anything besides classical information products such as wine, beer, yogurt, etc.) represents a worldwide volume of Fr 90 billion worth of business. For its part, France does Fr 6 billion worth of business in this area: Fr 3 billion in the health sector (vaccines, antibiotics) and Fr 3 billion in the agro-food sector (food and feed additives, amino acids). France's goal is for growth to take place at a rate of 15 percent per year in volume, that is, somewhat faster than the world market (10 to 12 percent per year).

This policy on bioindustry has two major axes:

- To develop to the maximum degree possible those activities in which France already holds an advantage. In the forefront is immunology. France is developing second generation vaccines, meaning use of a purified viral antigen instead of attenuated whole virus.

The Pasteur Institute is making preparations to market a new hepatitis B vaccine on this principle in the near future. Also, a number of months ago, it achieved the complete synthesis of the tetanus toxin, which may lead to a new product.

- To compensate for the French industry's shortcomings by means of international agreements. This applies especially to antibiotics, concerning which France and Japan is holding talks--which will undoubtedly take some time to complete. Other sectors where France will try to catch up include amino acids and seeds (besides Rhone-Poulenc, other companies including SNEA [National Company for the Promotion of Agriculture], are studying projects in this area).

For the manufacturing firms, however, there is at least one curb on the investments in biotechnology: short-term profitability. Paradoxically, confirms Christian Langlois-Meurinne, director for chemical industries at the Ministry of Industry, "concrete projects are less plentiful than is the willingness of the government to aid them."

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CSO: 3102/368

## BIOTECHNOLOGY

### BRIEFS

GENE STRUCTURE DETERMINED--Prof. B. Jordan's team at the Marseille-Luminy Center for Immunology, INSERM-CNRS [National Institute of Health and Medical Research, National Center for Scientific Research], has just announced the first complete structure of a gene coding for a human histocompatibility antigen. Their work, carried out in collaboration with Philippe Kourilsky's group at the Pasteur Institute in Paris, culminated in isolating and determining the complete chemical structure of a gene coding for a human class I histocompatibility antigen. The most difficult step in the program was to obtain a "probe," a partial copy of the gene, which was obtained from the messenger RNA which is translated in the cell to give the corresponding protein. This step is difficult in cases where the messenger RNA in question is not very abundant in the cell, as is true of the messenger RNA's coding for the histocompatibility antigens. The work of Kourilsky's group led to a complete determination of the structure of this gene, that is, finding its sequence: the linear arrangement of nucleotides (the basic units of DNA) which make up the gene and whose order determines the characteristics of the protein whose synthesis it directs. The complete sequence, which comprises 4,100 nucleotides, has recently been published in the PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES. It represents the first complete sequence of a human histocompatibility gene. [Text] [Paris INFORMATIONS CHIMIE in French May 82 pp 130-131] 9828

CSO: 3102/364

## ELECTRONICS

### NORDIC RESEARCHERS DEVELOP CAD/CAM SOFTWARE

Stockholm NY TEKNIK in Swedish 24 Jun 82 p 3

[Article by Hans Werner]

[Text] Nordic researchers are "selling off" research results intended for Scandinavian industry.

These results are from computer work for the development of CAD/CAM programs, i.e. programs for computer-aided design and manufacturing.

Last week negotiations were held in Stockholm to discuss contracts. Project leaders from the institutes of technology in Sweden, Finland, and Norway are working together to develop programs in this area.

Representatives of the American-based international foundation Cam-I (Computer-Aided Manufacturing International, Inc.) are on the other side of the bargaining table.

#### Proposal Ready

The Nordic researchers do not intend to sell the actual software they have produced. According to the proposed contract, however, they are prepared to release detailed information to foreign companies on the basic research behind the software.

The proposed contract would make documentation of the joint Nordic GPM (Geometric Product Models) project available to Cam-I members. These include most of the world's leading companies in the United States, Western Europe, and Japan.

After the negotiations in Stockholm last week, the Cam-I management is prepared to sign a contract in mid-July. The Nordic project leaders, on the other hand, believe they will be ready to sign an agreement in mid-August.

#### Legal Problem

It is doubtful, however, that this will be possible. According to civil engineer Torsten Kjellberg, who is the GPM project leader at KTH (Royal Institute of



Technology) in Stockholm, the Nordic Industrial Fund, which is financing the project, is examining the question of who actually owns the GPN results. This is being done in conjunction with the STU (Board for Technical Development) legal advisor. This is because after 1 July the Board for Technical Development will begin financing the project and will be primarily responsible for the further development of the GTM project.

#### Discussions

"We believe in international discussions," said Torsten Kjellberg, who stated the researchers' basic position on the joint project. "We cannot go into the same degree of detail in our discussions with Cam-I, however, as we do with Swedish industries. In addition, Swedish companies have access to computer programs at cost."

#### Nordic Lead

The idea behind the Nordic GPM project is to develop advanced computer-aided design so that Nordic industries can take the lead and gain a competitive advantage.

One complicating factor is that it still is difficult to obtain legal protection for computer programs. According to prominent Swedish lawyers involved in this area, international legislation is one possible solution.

So far, however, no international regulations and no Swedish laws provide full protection for the originators of computer programs. In the United States, on the other hand, protection is available that goes beyond copyright protection. There computer programs can be protected almost at the level of a patent.

#### Shelved

At the international level, the question of protecting computer programs was taken up by WIPO, the organ of the United Nations that deals with the Bern Convention. Due to a lack of resources, however, the issue was shelved in 1983.

This displeased countries such as France, Japan, and the United States, according to Erik Tersmeden of the Justice Ministry. For this reason, they have turned to another United Nations organ, UNESCO, which handles world conventions on copyright ownership.

Now the danger is that the two international organs will compete over the issue. From the Swedish standpoint, it would be preferable for one international organ to be responsible for the problem.

## Retain Protection

While the lawyers continue their studies, the researchers are waiting with interest to see how they can both cooperate on the international level and, at the same time, protect their computer programs.

For Nordic industries that do not believe it is economically justifiable to join Cam-I (at a cost of \$10,000), the danger is that they will not profit as much as they should from the impressive GPM project.

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CSO: 3102/436

ELECTRONICS

MATRA-HARRIS PROPOSES CMOS UNCOMMITTED LOGIC ARRAYS

Paris MINIS ET MICROS in French 5 Jul 82 p 13-14

[Unsigned article]

[Text] Matra-Harris Semiconducteurs (MHS) is offering uncommitted logic arrays with its CMOS technology, a technology that has already proven itself in memory manufacturing. Three circuits have been announced: MA 0400, MA 0800, and MA 1200, with 400, 800, and 1200 gates, respectively. Circuits with 2000, and eventually 5000, gates are planned.

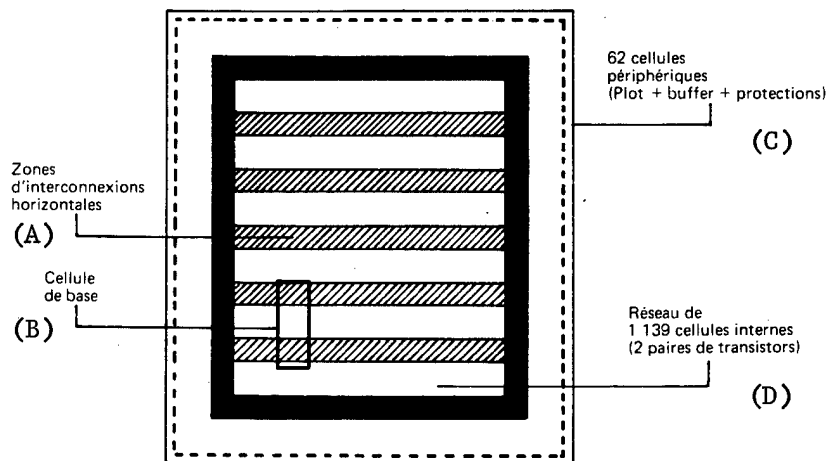


Figure 1. Organization of the 1200-gate CMOS array.

- Key:
- (A) Horizontal interconnection zones
  - (B) Basic cell
  - (C) 62 peripheral cells (plot+buffer+protections)
  - (D) Array of 1139 internal cells (2 pairs of transistors)

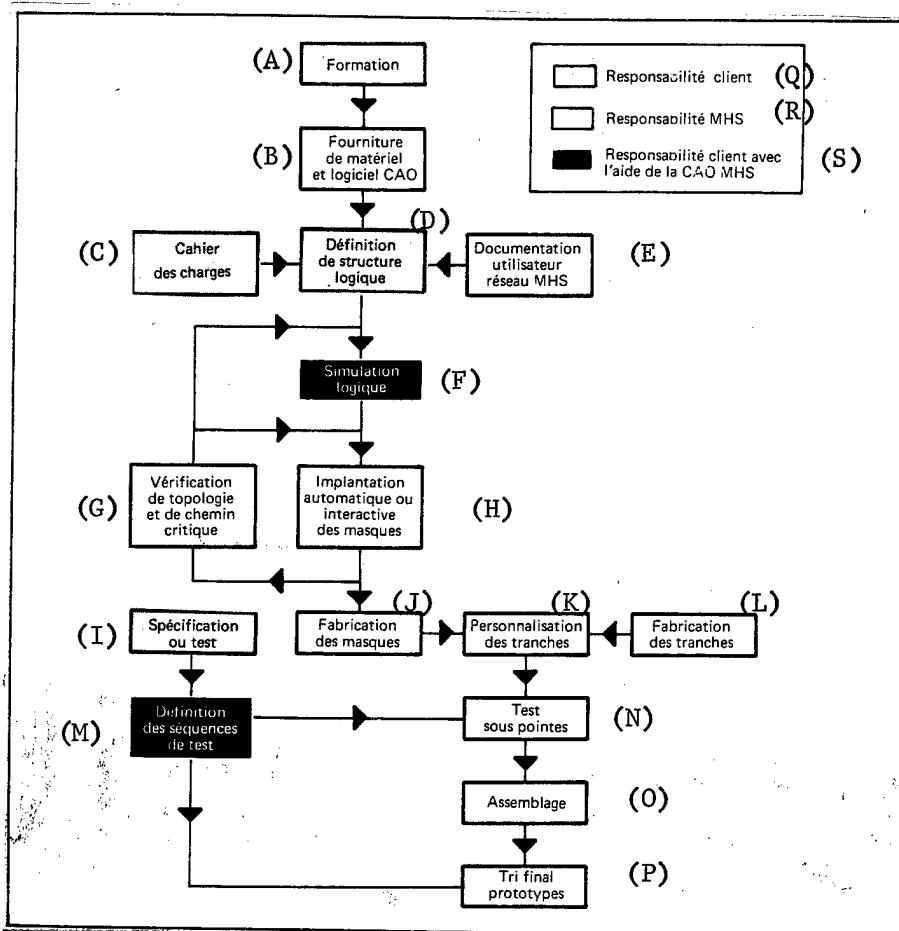
## Gate specifications

Caractéristiques techniques						
— consommation inférieure à 100 $\mu$ W/porte (A)						
— fréquence de fonctionnement 30 MHz (typ)						
Temps de propagation/porte (B)						
Type	Sortance = 2		Sortance = 6			
Inverseur	2 ns		4 ns			
Porte NOR	4 ns		6 ns			
Porte NAND	2 ns		4 ns			
Maximum ratings	(C) Caractéristiques électriques à 25°C					
	Para-mètres	Descriptions	Conditions	Min.	Typ	Max.
(D) Alimentation 5 V $\pm$ 10 %	V <sub>OH</sub>	niveau haut de sortie (G)	I <sub>OH</sub> = 500 $\mu$ A	2,8 V	4,5 V	
	V <sub>OL</sub>	niveau bas de sortie (H)	I <sub>OL</sub> = 3.2 mA		0,2 V	0,4 V
(E) Température stockage — 65 °C à + 125 °C	V <sub>IH</sub>	niveau haut d'entrée (I)	V <sub>CC</sub> = 5 V $\pm$ 10 %		1,5 V	2,2 V
	V <sub>IL</sub>	niveau bas d'entrée (J)	V <sub>CC</sub> = 5 V $\pm$ 10 %	0,8 V	1,5 V	
(F) Température fonction- nement — 55 °C à + 125 °C	t <sub>pd</sub>	temps de propa- gation moyen (K)	inverseur sortance 2 + 400 $\mu$ M (M)		2 ns	
	F	fréquence de fonctionnement (L)	bascule D en diviseur par 2 (N)		50 MHz	

- Key: (A) Technical specifications : consumption less than 100 microW/gate operating frequency 30 MHz (typ)
- (B) Propagation time per gate  
Sortance = fanout  
Inverter, NOR gate, NAND gate
- (C) Electrical characteristics at 25 degrees C
- (D) Supply
- (E) Storage temperature
- (F) Operating temperature
- (G) Output HIGH voltage
- (H) Output LOW voltage
- (I) Input HIGH voltage
- (J) Input LOW voltage
- (K) Average propagation time
- (L) Operating frequency
- (M) Inverter fanout 2 + 400 microM connection
- (N) D-type flip-flop in divide by 2

Figure 1 shows the organization of a 1200-gate array. It consists of 17 rows and 67 cells, each cell being composed of two transistor pairs, to form 1139 internal cells. Input/output is provided by 62 input, output, or input/output cells.

## Circuit development on logic array



- Key:
- (A) Training
  - (B) Supply of CAD equipment and software
  - (C) Specifications
  - (D) Definition of logic structure
  - (E) User documentation MHS array
  - (F) Logic simulation
  - (G) Verification of topology and critical path
  - (H) Automatic or interactive mask implantation
  - (I) Specification or test
  - (J) Mask fabrication
  - (K) Wafer personalization
  - (L) Wafer fabrication
  - (M) Definition of test sequences
  - (N) Probe testing
  - (O) Assembly
  - (P) Final prototype testing
  - (Q) Customer responsibility
  - (R) MHS responsibility
  - (S) Customer responsibility with MHS CAD assistance

MHS has developed a selection of elementary functions (AND, NAND, NOR logic gates, flip-flops), complex functions, (counters, registers, and so on), and input/output functions. The inputs are TTL- or CMOS-compatible, and the outputs TTL-compatible. The arrays are expected to replace 15 to 30 conventional circuits.

Five packages are possible:

Dual in-line ceramic package;

Same package in plastic;

Leadless chip carrier ceramic package;

Electrically tested chip placed in a carrier circuit;

Electrically tested and cut slice.

The packages have 16 to 64 pins, providing an input, an output, a bidirectional input/output, and a supply connection.

The attached table presents some gate specifications. The speed of the gate can be selected as a function of the necessary fan out, from 2 to 6 ns for a fan out ranging from 2 to 6. A D-type flip-flop can typically switch at 50 MHz.

As for all uncommitted arrays, a close collaboration must exist between customer and manufacturer. Figure 2 shows the circuit fabrication sequence, as well as the respective responsibilities of the customer and of MHS. The figure also points out the importance of the customer's responsibility for logical simulation of his product (verifying that the proposed design properly satisfies the desired functions), and for establishing test sequences to test the circuit.

MHS plans a CAD (computer-aided design) center in Nantes, accessible through the network (at 2400 baud), that includes two Harris 550 computers; a VAX 780 computer for simulation, mask generation, and verification; two Calma graphic editing systems; as well as tracers and graphic terminals. The company has software for logic simulation, for interactive or automatic mask generation, and for electrical and topologic mask verification. An average of 13 to 15 weeks are needed to obtain circuit "prototypes" after the first data is introduced into the CAD system.

Nantes 8086's

The first batch of 8086's came off the line on 20 June at the Nantes plant of MHS. Produced in HMOS version with Intel technology (the agreements between the American company and the Matra subsidiary are well known); these first 16-bit Nantes microcircuits showed that mass production is possible immediately, and that deliveries could begin in September. They also showed that the technology transfer from Intel to Matra-Harris proceeded very well.

This first stage proves to be very encouraging for MHS, which had predicted that the CMOS 8086 version would be introduced at the beginning of next year. The schedule is obviously being maintained, and everything leads to believe that it will be respected since the company has not stumbled until now. In a future issue after the vacation season, we will again discuss the prospects of Matra-Harris Semiconducteurs.

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CSO: 3102/439

## ENERGY

### BRIEFS

SOLAR RESEARCH--Paralleling the work being done on photoelectric conversion, which does have the serious handicap of problems with storing the energy produced, research on solar photochemistry is progressing. The work being done at the organic and physical chemistry laboratory in Strasbourg offers the hope of being able to produce and store a fuel obtained from solar energy in a single operation. The research is concentrating on the irradiation of carbon dioxide and water under an ultraviolet light, which produces a synthetic  $H_2 + CO$  gas with a high caloric power, composed of carbon monoxide and hydrogen,  $H_2$ . In addition, this gas is a source of carbon molecules which the chemical industry can use to replace the molecules obtained in petroleum derivatives. At present, the efficiency of the operation must be improved, and the reactions involved in this conversion must be fully analyzed. While it is not yet possible to predict the industrial spinoffs of this research, it is as important as the work being done on water photolysis, which separates hydrogen and oxygen by the action of sunlight. This research may be the start of an energy "chain reaction," which, starting from the sun's light, may lead to a fuel cell whose energy will be available at any time. [Text] [Paris ELECTRONIQUE INDUSTRIELLE in French 15 Jun 82 p 18] 7679

DUTCH COAL CONVERSION--The Dutch company Nederlandse Gasunie has postponed until year-end its decision on the construction of a coal gasification plant at Emshaven, which would cost \$720 million. In justification of this delay, Gasunie cites the drop in oil prices and the substantial increase in investment outlays required. The initial project called for a unit with a production capacity of  $1 Gm^3$ /year using the Lurgi process, on which construction had been scheduled to begin in 1983 with startup planned for the beginning of 1986. Gasunie also points to the problem that the proposed participation by the Dutch government did not measure up to its expectations (25 percent in tax abatements authorized instead of 40 percent). Apparently the final decision depends greatly on what takes place with the petroleum market in the coming months. The project could be canceled or postponed until the end of the 1980's. [Text] [Paris SEMAINE DE L'ENERGIE in French 22 Jun 82 p 10] 9828

CSO: 3102/368

## INDUSTRIAL TECHNOLOGY

### VOLVO PLANT PRODUCES, SELLS INDUSTRIAL ROBOTS

Stockholm SVENSKA DAGBLADET in Swedish 17 Aug 82 p 20

[Article by Nils-Erik Lindell]

[Text] Olofstrom--Volvo's Olofstrom plant now is providing its competitors throughout the world with equipment that will permit them to produce automobiles faster and cheaper.

The tool shop in Olofstrom expects to export goods this year worth over 200 million kronor of a total gross of 290 million.

Volvo has had its greatest success with the so-called "doppin" robot, a feed attachment that makes body presses completely automatic. Over 700 of these robots have been sold--the first were sold to Saab--while over 100 are in operation in Volvo's own plants.

Volvo also has begun to sell assemble equipment for passenger car bodies. Recently an order worth 400 million kronor was received from a European automobile industry. So far, this is Olofstrom's largest order.

Volvo also is selling a newly developed spot welding gun. It is 60 percent lighter than conventional welding guns. This means that it can be operated not only manually, but also be a robot. Previously, this has been impossible. Ford, GM, and Citroen are testing the device, as is the Olofstrom plant, of course.

### Furious Pace

Developments have proceeded at a furious pace. In 1978 orders for mechanized equipment totalled 11 million. In 1979 and 1980 the figure was about 30 million kronor. The 1981 prediction was 38 million kronor, but doppin robots actually were sold for 160 million.

It appears that the product developers and salesmen in Olofstrom are much more successful than the prognosticators.

But executive vice-president Anders Hansson takes the blame.



"I believed that our predictions should be cautious. Kjell Claesson, our purchasing and sales manager, was much closer to the truth."

When Kjell Claesson now says that sales this year will be at least as high as last year, however, Anders Hansson agrees--and the figures for the first 7 months are favorable. During that period, doppin robots were sold for over 80 million and contracts valued at 10 million kronor are practically complete. In addition to this, assembly equipment worth 60 million kronor will be sold this year.

"Still, we have only scratched the surface of the market," Kjell Claesson said.

#### Crisis In United States

Now Volvo is coldly counting on the crisis among American auto manufacturers. While Volvo, Saab, and BMW are selling more cars in the United States than ever before, domestic manufacturers have had to cut back considerably.

With full capacity, an American manufacturer could run a press line to produce the same part all day long. At present, the production program must be changed during the day and this requires mechanized handling. In the long run, 300 press lines in the United States must be rebuilt. This means investments of 3 billion Swedish kronor per year for 3 years.

"We are hoping realistically for 1 billion," said Anders Hansson, "and since we are a leader in this field we should be able to capture a sizable share of this market."

Expectations concerning the United States are so high that Volvo's salesmen have not yet dared approach the Japanese auto industry. There the market is even larger.

"There our robots could be used not only in the auto industry, although it accounts for 99 percent of our sales there," Kjell Claesson said. "They can be used equally as well in the household appliance industry, for example. Along with press manufacturers in Tranemo, we will be represented this fall at the large household appliance fair in Chicago, as a first step into this market."

Volvo faces strong competition in Europe, the United States, and Japan in the areas of mechanized equipment for presses and assembly equipment for automobile bodies.

#### Own Needs

"The interesting thing is that robots are made mostly by machine manufacturers and assembly equipment by welding companies," vice-president of sales Bertil Edlind said. "Our advantage is that we produce equipment primarily to meet our own needs and we can test it in our own shops. Our customers need not

break in new technology. The automobile manufacturers know this and this is one of the main reasons Ford and GM are major customers."

It was the need for a safe working environment that made Volvo the leader in this market. During the late sixties, personnel turnover was high at the Olofstrom plant--up to 80 percent in some sections. A survey showed that working on the press lines was especially unpopular. Feeding was done manually and there were many accidents.

Olofstrom studied plants throughout the world, but none had solved these problems, so the company's own designers were presented with the task. In 1971, 1 year after Volvo purchased Olofstrom from Alfa Laval, a prototype had been constructed and it was so highly acclaimed that its inventor, Arne Ronnback, received the Gustaf Dahlen Medal.

The Volvo Olofstrom plant has a total of 4,000 employees. The workshops that produce tools and materials handling equipment have only 350 employees, 80 of whom are designers.

#### Small Group

"By international standards, this is an extremely small group," Kjell Claesson said. "This is because much of what we do is a spinoff of our main task--pressing automobile bodies for Volvo."

This work could not be done without extensive training. The company's own school trains personnel of all categories--from blue-collar workers in the shop to designers and technicians.

This school also has become profitable for Volvo.

"After personnel turnover had been reduced, our capacity was too high," said Ake Westin, who is in charge of the training. "Now we train personnel from small companies in southern Sweden, as well as personnel from foreign automobile industries that purchase equipment from Olofstrom. This year we expect to sell training abroad for 1 million kronor."

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## INDUSTRIAL TECHNOLOGY

### BRIEFS

CARBON FIBER PLANT--The British company, RK Textiles, one of the four principal suppliers of carbon fibers to the British market, intends to start up the largest production unit in Europe for this fiber before the end of the year. This plant, which will cost approximately 2 million pounds sterling, will have an initial capacity of 100 tons per year which can be doubled when market possibilities allow it. It is located near Inverness in Scotland and will constitute a real challenge to the Americans and the Japanese who, until now, have dominated the world market and the applications of this highly refined product. RK Carbon Fibres, a subsidiary of RK Textiles, which is building the unit, thinks that the latter will make a significant contribution to the possibilities of this fiber which is 50 times stronger than steel. Until now, it has been used principally in the aeronautical and automobile industries, but its qualities open the most diverse outlets for it, particularly in high-technology industries where qualities are more important than price. The carbon fibers are obtained by high-temperature treatment of a plastic, polyacrylonitrile. The Inverness plant will produce continuous filaments by a process perfected by the company thanks to a new design for oxide kilns, carbonization kilns and a special surface treatment. The company will produce two types of fiber at first. [Text] [Paris LES ECHOS in French 16 Aug 82 p 7] 9969

CSO: 3102/425

## SCIENCE POLICY

### 'SUPER MINISTRY' OF RESEARCH, INDUSTRY CREATED

Paris AFP SCIENCES in French 1 Jul 82 p 1

[Text] The creation of a "super ministry" of research and industry was announced on 29 June by the Elysee Palace. According to observers, this decision demonstrates President Mitterrand's intention to spur on French industry through investment, despite the present climate of austerity.

This new ministry will be headed by Jean-Pierre Chevenement, 43 years old, who until now has been minister of research and technology. The decision to create this new super ministry, modeled on the Japanese MITI [Ministry of International Trade and Industry], does not come as a real surprise: the idea had been around for several months, and had cropped up at each rumor of a cabinet reshuffle. Mr Chevenement will, with this move, have his duties expand to cover the field occupied until now by Pierre Dreyfus, who is 73 years old.

After the major industrial restructuring which has been going on for the past year in traditional industries, such as steel, chemicals, textiles, etc., Mr Chevenement will now be able to turn his attention to the industries of the future, where he will be able to put in practice some of his favorite ideas: to emphasize research in order to emerge from the crisis, and above all, to define the left's new industrial policy, which has been awaited for a year.

For the upturn in consumption which began at the start of President Mitterrand's 7-year term has hardly helped industry at all; industry continues to limp along. It is known that Mr Mitterrand has decided to rely on the public sector, which in the past 6 months has seen the addition of five new groups, to spur on the economy. Investments in 1983 should amount to 25 billion francs.

Mr. Dreyfus, who was in charge at 101, Rue de Grenelle for 12 months, and who is widely respected in industry, will still keep an eye on French industry. He will return to his post as an adviser to Mr Mitterrand, a post he held in the first Mauroy government.

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CSO: 3102/440

## SCIENCE POLICY

### DRAFT OF FRENCH CIVILIAN RESEARCH BUDGET DISCUSSED

Paris LE MONDE in French 31 Jul 82 p 13

[Article by Maurice Arvonny, "Conforming to the Orientation and Programmation Law, the Budget Draft for Civilian Research Shows a Strong Increase"]

[Text] "The means are there, but not the positions." That would be the first and quick analysis that could be made of the civilian research budget as it appears in the figures indicated to research organizations.

The orientation and planning promulgated in mid-July for France's research and technological development announces two key figures: 17.8 percent for the average annual rate of increased funding--in volume, which means accounting for inflation--and 4.5 percent average annual increase in positions. Applied to the budget adopted for 1982, and accounting for the inflation rate of 8 percent on which the budget draft for 1983 is based, that leads to 2,575 positions created and 32.3 billion francs for all of the ordinary expenditures and program authorizations. This last figure is basically the sum that will figure in the 1983 budget, but the total number of positions currently planned only slightly exceeds thirteen hundred, or half of what could be expected.

But this total is not necessarily final. Without changing the total budget, it is still possible, by transferring approximately 250 million francs from equipment expenditures to ordinary expenditures, to create the missing positions by designating them basically for the integration of personnel working on temporary jobs and by recouping them through the funds that remunerate these jobs.

The ordinary expenditures (formerly operational funding) were 12.7 billion francs in 1982. Since they cover essentially salaries, their increase is practically imposed. They will be nearly 15 billion francs next year.

The program authorizations that will make it possible to equip laboratories were supposed to exceed 17.4 billion francs. But this figure includes 0.5 billion for CII [International Data Processing Company]-Honeywell-Bull in the framework of a mobilization program for the "electronics industry" and 1 billion for the La Vilette museum of science and technology, in the framework of a mobilization program for distributing scientific knowledge. These

funds did not figure in the preceding research budget. If they are discounted, there are still 15.9 billion, compared to 12.7 billion in 1982, or an increase of 25 percent in current francs. Although it is less than what could have been hoped for, this increase is still much higher than what researchers have known in the past, except last year.

The government will to promote strongly several mobilization programs is going to be reflected by a great contrast between the fundings for organizations. Some will be favored, but not necessarily in all areas.

#### Exceptional Effort in Data Processing

Thus, in the area of positions, the National Institute of Health and Medical Research (INSERM) with 230 positions created, should see its employment increase by almost 6 percent, while the 540 positions granted to the National Center for Scientific Research (CNRS) and the 210 that will go to the National Institute for Agricultural Research (INRA) correspond to rates of increase of 2.3 and 2.8 percent respectively.

For program authorizations, the National Center for Space Studies (CNES) has an increase of 30 percent and the INRA of only 15 percent, while as currently allocated the Atomic Energy Commission (AEC) shows a decrease of 8 percent. But this percentage is not meaningful, since the 1982 and 1983 figures do not cover the same types of expenditures. The diversification of AEC activities could allow it to find non-budgeted financing for some of them.

The greatest increase is for the project to computerize the former Ministry of Industry. The program authorizations are to go from 640 to 1,360 million francs. With the funding for CII-Honeywell-Bull and the 370 million francs that are going to the Data Processing Agency and the National Institute for Data Processing and Automation Research, that is a lot for data processing.

Another figure is written in the law, or at least in the report appended to it which indicated that "the funding devoted to fundamental and cognitive research, whose recovery must be ensured, should have an overall and regular increase from now until 1985 at an average annual rate of 13 percent by volume." It is only when a more detailed allocation of funding has been done that the portion going to fundamental research can be evaluated, but it already appears that the CNRS, which does fundamental research almost exclusively, will only receive a smaller increase. Its program authorizations are increasing by 23.5 percent, or 14.3 percent by volume, but three quarters of this organization's budget is in ordinary expenditures, whose increase is definitely not as rapid.

The fact remains that, while certain research organizations can envy their neighbors, while certain directors will have to proceed to difficult arbitration, the civilian research budget will have a great priority, since the entire national budget was only to increase by 4.1 percent by volume (LE MONDE 30 July).

## TRANSPORTATION

DAIMLER-BENZ, VOLKSWAGEN R&D EXHIBITED AT HANNOVER

Duesseldorf VDI NACHRICHTEN in German 14 May 82 p 10

[Article by Wolfgang Pester]

[Text] Automobile Research--A Magnet: Passenger Car With Hydrogen/Fuel Operation--Mechanical Charger in the "Auto 2000"

The Daimler-Benz and VW exhibits exerted a magnetic attraction. They exhibited things like electrocars having a nickel-iron traction battery and also exhibited engine developments for hydrogen operation which have been extensively researched. That there are still reserve potentialities in the Otto engine [internal combustion engine] is shown by the 1.06-liter four-cylinder battery for the little "Auto 2000"; its charging is taken over by a mechanically driven charger.

Hannover Fair. Innovation Market Exhibit Hall 7. An address firmly noted by visitors as it appears. For this market has a power of attraction which makes it one of the most visited displays. In this mirror of innovation there are two automobile manufacturers who cannot ever be omitted; they have written automobile history in research and development and in fact have written technological history: Daimler-Benz and VW.

The broad spectrum of engineering activities often even overwhelmed the visitor. Thus in the case of Daimler-Benz the abundance of research and development aimed at preserving individual transportation induced an interested expert to raise the question: "Why are so many [varied] efforts being made to achieve independence from petroleum fuel? Wouldn't it be better to choose from the available synthetic Otto engine or diesel engine fuels, alcohols, liquid petroleum gas (LPG), synthetic natural gas (SNG), hydrogen and electricity one alternative to be followed up consistently?" "What we are doing reflects the fact that we do not know how the energy situation will develop!" This reply from an expert speaker--Prof Dr Eng Hubertus Christ, chief of vehicular research in the Stuttgart firm--makes clear the range of decisions required in this domain. Because it is necessary to meet market demands on a worldwide scale over the long term it is necessary today to carry out research with regard to all possibilities.



Seen from this point of view many different developments receive an emphasis proportionate to their possible importance. This is true, for example, regarding an electric car based upon the T-model Mercedes, with which experimental data is being collected in street traffic which may be considered realistic up through 1983. The research vehicle attains with its short-term 32-kw electromotor (25-kw steady power) a maximum velocity of 80 km/hr and travels a distance of 100 km. If the driver should no longer be capable of feeding the dc electronically guided auxiliary engine with battery current because perhaps he underestimated the length of his trip, a small two-cylinder Otto engine assures him of getting to the nearest domestic wall plug (220 volts/16 amps) which may be over 50 km away.

The nickel-iron traction battery now being displayed for the first time is a joint development by Daimler-Benz and the German Automobile Society (Daug) and has a mass of 600 kg. Although the "energy package" fills up the storage space of the T-model almost up to the side window frame and puts the car into a "weight class" above 2 tons nevertheless the riding and operating comforts should match "Mercedes quality."

The same comfort and somewhat more luggage space and certainly also a little less weight have been provided by a T-model which in a fleet of 15 cars as of the beginning of 1983 will be subjected to typical everyday operation testing while using hydrogen drive. The hydrogen car is based upon essentially new developments which are being investigated in Berlin and Stuttgart in test driving; the cars include 10 with pure hydrogen drive and 5 using hydrogen mixed with another propellant.

The hydrogen drive is based upon "low-temperature metal hydride storage" which is constructed in the form of tubular heat exchangers. They are fed via water with engine heat taken from the exhaust. This yields the pressure required for operation of the hydrogen engine; the pressure can be kept constant by regulators.

The storage system employed makes it possible to tank up the hydrogen-driven car in less than 10 minutes. With the technology known hitherto this process could take as much as 2 hours. Cold starting is troublefree down to  $-20^{\circ}$  C.

For operation exclusively with hydrogen the engineers modified a 2.3-liter four-cylinder injection engine which deviates from the mass production drive particularly in the mixing process and in the injection of water into the intake pipe.

In the case of the mixed drive power plant the people in Stuttgart turned to a 2.8-liter six-cylinder injection engine which was developed in cooperation with the University of Kaiserslautern by Institute Prof Dr Eng May. The engine is in this case simultaneously supplied via an electronic regulator with hydrogen and Otto engine fuel; when the load increases the Otto engine fuel percentage in mixed operation increases from 0 percent (no load) to 100 percent (full load). The partial replacement of the fuel by hydrogen assures better exhaust values in terms of  $\text{NO}_x$  and CO as well as securing a reduction

in fuel consumption amounting to as much as 20 percent (referred to the heat value of the fuel employed).

With its "Auto 2000" research car Daimler-Benz rounded off its collection of research data in this domain. That an equally high level of importance is attached to the "Auto 2000" in the research and development projects of VW is proven clearly by the Wolfsburg Firm at this innovation exposition: the "bug metamorphosis" for tomorrow occupied the foreground.

In Volkswagen's exposition of innovations a premiere appearance was made by the Otto engine drive design of the "Auto 2000" which gets its improved engine performance data by means of a mechanically driven charger. Already announced at the IAA 1981, the engineers worked at high speed and the last screws were tightened by the assemblers on the eve of the exhibit opening.

The main criteria of the drive design were that the vehicle should simultaneously attain high riding performance and low fuel consumption and that at the same time the relevant specifications regarding noise and pollutants should continue to be met. The engine nominal power was set at 55 kw. At this power the vehicle weighing 780 kg and presenting a wind-resistant surface of only  $0.465 \text{ m}^2 (c_w \times F)$  should obtain a peak velocity of 180 km/hr and an acceleration time of 12 seconds from 0 to 100 km/hr.

The starting point was a four-cylinder series engine with 1.06-liter displacement. The charging power source is a mechanically driven rotary piston blower of the Roots type with a continuously variable gear ratio drive and a switch coupling which is controllable as a function of the load.

The mechanical drive of the charger by the engine drive shaft and the possibility of permitting, via the variable gear ratio in the lower rpm range, the charger to rotate more rapidly all make possible a high turning moment even at small engine rpm's and also in nonstationary operation. Via the electromagnetic coupling the charger is first switched on above the power range of the basic intake engine so that in partial-load operation there is no additional consumption of fuel for driving the charger. The adaptive knock-limit regulation developed by VW research secures the relatively high compression ratio of 9.2:1. The core of the arrangement is a control computer which in conjunction with the stored ignition angle characteristic data and the information provided by the "knock sensors" in the engine block guarantees an individualized operation along the knock limit. A reduction of the no-load rpm to 700 rpm supported the efforts to minimize the fuel consumption and emission of pollutants. Each cylinder obtained a separate injection nozzle. The regulation is taken over by an electronic guidance device which for each operating point, depending upon the engine rpm and the airflow, liberates the optimum quantity of fuel for "injection." The good mixing of air and fuel is guaranteed by air-mantled injection nozzles. Here also the optimization of the characteristic parameters is accomplished in terms of riding behavior, fuel consumption and pollutant emission.

Driven with a 3-E switch-drive the "Auto 2000" when operated at 100 km in "condition 3" [Drittelmix] (city driving, constant 90 km/hr and 120 km/hr)

consumes only 5.7 liters of fuel. Since the originally planned development of a four-stage automatic drive with converter had been red-pencilled it was decided in the interest of higher riding comfort to use a conventional three-stage automatic gear shift with overdrive; thus the listed favorable values of the 3 x E switch-drive are not fully attained.

The exhaust gas emission values were measured as 27 g in the CO test and 19 g in the HC/NO<sub>x</sub> test. Thus this research car achieves the legal limit values which are to be prescribed in the future in Europe; however, in mass production use, especially in the case of the HC/NO<sub>x</sub> emission, it would be necessary to maintain a wider safety distance from the limit values and it would be possible to accomplish this only by increasing the fuel consumption. The engineers emphasize this latter fact.

To reduce external noise the engine space was fully encapsulated. The riding noise when measured according to the ISO specification amounts to 73 db (A) and thus is consistent with legal specifications.

Although the other innovations being offered made the interested visitor curious (such as driving without a driver, synthetic speech as a new information medium in an automobile, energy scenarios and energy strategies or particle filters for diesel exhaust and also the use of vehicle gas turbines as in the case of Daimler-Benz) nevertheless the conversation always came back to charged engines. Three-cylinder diesel engines with exhaust turbochargers or with pressure-wave chargers in the VW exhibit showed what it is possible to achieve with them. Those questions remained unanswered which related to new developments of mechanical chargers usable also for Otto engines. Their possibilities are thought to be greater than those of the previously mentioned chargers and also greater than those of the Roots blower. However, one thing may be assumed with certainty: At one of the next Hannover fairs such a development will certainly be found in the innovation market.

8008

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## TRANSPORTATION

### ENGINEER ASSESSES FUTURE OF ALTERNATIVE AUTOMOBILE ENGINES

Stockholm MOTOR in Swedish 18 Jun 82 pp 28-29

[Article by Iva Maasing]

[Text] Recently various types of future or alternative engines have been discussed in the mass media. The Kronogard gas turbine was shown on television, the Stirling engine was mentioned on the radio, and the piston engine developed by Lars Hedelin was described in a newspaper article.

But what are the prospects for the future of these engines? Can they become alternatives to existing automobile engines?

MOTOR's technical expert, civil engineer Iva Maasing, had the following thoughts on such engines.

#### The Kronogard Gas Turbine

In theory it is undeniably elegant, with three separate turbine wheels whose axels are connected by gear wheels, so that enough driving power is generated that no transmission is needed. The use of ceramic material in the turbine wheels and in the surrounding walls that come into contact with the hot combustion gases makes it possible to operate at high gas temperatures which, in turn, improves efficiency.

In other words, more useful energy is obtained from a given quantity of fuel.

The three small turbine wheels also reach a high speed quickly when the driver depresses the gas pedal. Thus, this engine has a faster response than previously designed experimental turbines.

But it is difficult to have several turbine wheels and guide blades operating reliably in the hot environment.

The American companies that are experimenting with gas-turbine automobiles, including Ford in conjunction with the world's largest gas turbine producer, Garrett, have decided to reduce the number of components in the hot portion of the engine.

The Ford-Garret turbine, called AGT 101 where AGT stands for Advanced Gas Turbine, has only one turbine with its axel in the hot section. To improve efficiency and reduce the response time, it has movable guide blades, but these are in the cold portion of the engine near the compressor.

Thus, the question is whether or not Kronogard's complicated turbine, with many components in the hot section, can perform reliably in the long run.

Finally, we must ask whether or not the gas turbine can compete at all with the more developed gasoline and diesel engines now produced by engine manufacturers throughout the world. These engines are fuel-efficient and have a quick response. They can be mass produced with existing machinery and we know that they are reliable.

### The Stirling Engine

In the same town in which Kronogard has its experimental workshop, Malmo, another company is working on an engine of the future, namely United Stirling.

The Stirling engine also appears attractive from a theoretical standpoint. Like the gas turbine, it can run on various fuels, it can be made extremely quiet, and it can be made to run clean more readily than most other combustion engines.

Just like the gas turbine, however, it has problems that prevent it from competing with conventional engines.

First of all, the Stirling engine is more complicated in design and requires expensive, extremely heat-resistant materials to achieve high efficiency.

This means that production costs would be much higher than for conventional engines.

In addition, its speed regulating system is considerably more complicated than in conventional engines--which also is true of the gas turbine.

The future of the Stirling engine is to be found only in highly specialized fields. For example, it can be used as an engine driven by solar energy. In this case, the "heat pan" of the Stirling engine simply is placed at the focal point of a large parabolic mirror that concentrates the solar rays on the heating tube. Thus, no fuel is needed to start the engine--but much sunshine and a clear sky are required.

Thus, it could be used to drive a generator or to operate water pumps in the desert.

### The Hedelin Engine

This engine also looks good in theory. By varying the shape of the camshaft, the valves of the engine can be opened and closed at various times and a

movable control piston in the cylinder head varies the cylinder volume and the compression.

These two features make it possible for the engine to adjust well to different acceleration rates and speeds. In theory, it could be adjusted so that it always operated at the low end of the fuel consumption curve.

But it is a long way from the elegant theory to daily practice. This has been discovered not only by individual inventors such as Lars Hedelin, but also large manufacturers of engines who have been unable to make the new technology operate reliably in everyday driving--although hundreds of millions of kronor have been invested in this technology.

I could simply mention Ford's unsuccessful experiment with Proco combustion, called laminar-charge combustion in scientific terminology.

At present, BMW seems to be having serious difficulties with its new direct injection diesel passenger car, designed by an Austrian professor of engine design.

This engine has many new design features, such as a cylinder head and block in one piece with no head gasket in between, a sound insulating "outer skin" around the entire engine, and a camshaft-controlled injection pump and fuel injector in one unit for each cylinder. It appears that this latter feature is causing the most serious problems.

Several years ago another Swedish inventor presented his so-called Alvar engine with a divided crankshaft that could vary the cylinder volume and the compression according to operating conditions. This project, which was simpler than the Hedelin engine, also failed to make the transition from basic experimentation to everyday driving conditions.

#### Electric Car A Flop

Electric cars also are having a difficult time making a breakthrough, even though they have no problems with "hot zones" or untested technology.

There simply are no batteries capable of storing sufficient energy. From time to time the mass media report the discovery of a new, more energy-dense battery, but so far none of these experimental batteries have been installed in an electric car. Some of these batteries hardly could be used in automobiles, since they operate at temperatures of several hundred degrees when they deliver their energy. The idea of driving around in traffic sitting on heavy batteries operating at 300 to 400° is not especially pleasant!

The General Accounting Office, which is the equivalent in the United States of our Accounting and Auditing Office, recently reported that it considered the large-scale state program to develop electric cars to be a flop!

Only when a better, i.e. more energy-dense, battery has been developed will this epithet be removed! It is hopeless to drive 50 to 60 km per charge,

which has been done in everyday traffic, and then have to wait 8 to 10 hours while the batteries are being recharged. Swedish authorities, who have tested electric cars on a small scale, also have noted that the range is shorter than originally promised. Just ask drivers of cars belonging to the Telecommunications Service what they think of electric cars and their range!

9336

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TRANSPORTATION

AIRBUS PRODUCTION RATE INCREASED BY USE OF NC MACHINES

Paris INDUSTRIES & TECHNIQUES in French 20 May 82 pp 48-49

[Article: "At Aerospatiale-Nantes: A Line of Four Milling Machines"]

[Text] In line on a 57-meter bed, the milling machines operate in masked time. Productivity gain: 39 percent.

The growth of the Airbus large transport aircraft program has led to a significant acceleration of manufacturing schedules. To help production keep pace with the increased workload, the need for investments in the area of numerical control milling machines quickly became apparent.

With the main goal being to limit these investments, a study was conducted to establish the parameters which would hinge on a particular action, with a view toward improving the productivity of the so-called new generation machines. With the previous equipment, the time spent in machining under numerical control represented only 36 percent of the total available time. The new specifications required that the work be done in masked time on machines with aspirated removal of cuttings and with either long tables or smaller tables arranged on a common bed of great length. The new specifications also called for lateral movement of the cutting heads and automatic tool height adjustment.

Parts 18 to 54 Meters Long

Aerospatiale [National Industrial Aerospace Company] decided on a milling line having four gantries traveling over a single bed. Each machining group was equipped with accurate servomechanisms connected to a programmable TSX 80 robot. The installation was built by Intertec.

Considerable time savings were achieved: while one piece was being machined, the operator could be setting up the next one on the work table or removing the preceding one. As a result, the time savings have risen to 28 percent of the operating time. These savings involved mainly the preparation of the work, mounting and dismounting of workpieces and tools, adjustment of tools, changing of sequences, and stoppages for repairs, the majority of which are performed while machining proceeds under robotic control. The working surface was made smaller by eliminating side tracks, and the length of the installation made it possible to machine parts with large dimensions.



The installation consists of four modular gantries, each with a heavy-duty Polytrace structure equipped with three cutting heads; the gantries move back and forth on a bed with a working length of 54 meters, motion being transmitted by unilateral drive mechanisms. Each of the gantries has a longitudinal traverse of 18 meters, and overlap over two stations is possible. The transverse axis, with an available traverse of 2.3 meters, permits the cutting heads to be set with interaxial spacings of up to 700 or 1,200 mm, depending on whether the machining is done with three or two cutting heads. Finally, the traverse along the vertical axis is 500 mm.

The longitudinal and transverse feeds in the machining mode are adjustable in a range from 0 to 2,500 mm/min, and a rapid traverse feed of 5,000 mm/min is available during other operations. Along the vertical axis the work feed is adjustable between 0 and 1,500 mm/min, and the rapid traverse speed is about 1,500 mm/min. The motor of each cutting head develops 22 kW of power at 6,000 rpm, and the speed range extends from 750 to 6,000 ppm.

These technical characteristics provide considerable machining capacity. It is possible to machine parts which measure up to 18 meters on one gantry, and up to 30 meters with two gantries. The total length of the parts could even be as large as 54 meters, using all four milling units. To take full advantage of these features, some carefully chosen special features on the stations supplement the general system, to enable work to be done in masked time. Thus the operations of consulting the instruction records displayed on the CRT screen, preparing for setting up the workpieces, and clamping them in place are done in a time period distributed half during the milling cycle and half while the relevant machine is stopped. The length of the tables and the overlap of the longitudinal traverses of the gantries permit the operator to perform the entire mounting and dismounting of the workpieces and tools while machining is proceeding under numerical control.

The same is true for installation and removal of the cutting tools, including selecting the proper tool, removing the tool protector, and checking the tool diameter. The tools are prepared and pre-positioned during productive time on a trueing system, to be ready for the next machining sequence. The cutting tools are changed from the side, by virtue of the fact that the transverse carriage is offset beyond the table and the fact that the cutting tool, opposite the operator station, can sweep across the entire width of the table. Furthermore, the tool height is adjusted automatically, which saves time in executing these operations. These phases of the operation take place in complete safety; the tools, arranged in an inclined rack, cannot be released until a locking mechanism is released.

These various features are an outgrowth of the ergonomic design of the operator station, set up so that the operator does not have to make inconvenient and tiring trips back and forth on the table.

The height adjustment is obtained on contact pins (proportional to an adjustment pin through the cutting tool) located at the operator station. This version was the subject of a prize awarded by the Fund for Improvement of Working Conditions. It should be pointed out that with the three cutting

heads, the lateral movement of the cutting head and automatic height adjustment require only 2 minutes 15 seconds for the entire procedure, including the 34 seconds required for the adjustment.

The feeds are controlled by silent motors powered from rectifiers, drawing 25 kW per unit, serving to advance the cutting tools. The rectifier type of converter was chosen because of the energy savings it offered relative to the power consumption of a synchronous converter.

Each gantry operates under numerical control from an NUM-460 computer linked with a video console. This permits a detailed and differentiated examination of paths of operations in progress on the machine. With this equipment, the corrections for tool diameter and corrections of the part programs in the course of proving operations are possible, and so are application of specialized subprograms, entry and display of screen data, and input of maintenance programs.

After a number of months of industrial use in the Nantes factory, it has been confirmed that the progress obtained in the area of working conditions and the gains in productivity greatly exceed the requirements of the specifications.

9828

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## TRANSPORTATION

### COMMENTS ON STATUS OF AIRBUS A 320 PROGRAM

Paris LE NOUVEL ECONOMISTE in French 2 Aug 82 p 42

[Article by Ph. G.: "Canada Votes for Airbus"]

[Text] De Havilland Canada, a world specialist in short-range takeoff planes, is joining the small world of large aircraft manufacturers by deciding to embark on the A 320 operation along with Airbus Industrie. This new program for a 150-seat short- and mid-range "small" twin jet is to complete the Airbus line which already includes the A 300 (260 seats) and the A 310 (200 seats). It should fly in 1987, provided that companies other than Air France say within the next few months that they will buy it.

A former subsidiary of the British manufacturer of the same name, taken over by Canadian public funds in 1975, De Havilland Canada is located in Ontario at Downsview, just outside Toronto. It is there that the regional transport Twin Otter planes (which serve the mountain airports in Savoy, for example) and the Dash 7, as well as the Buffalo military transport planes, were designed and mass produced. But a substantial portion of the activity of De Havilland (which employs 4,200 persons and has sales of close to 2.2 billion francs) consists of subcontracting work done primarily for the large American manufacturers.

Therefore, John Sandford, the president of De Havilland Canada, and his top managers want to substitute a real partnership for this subcontracting; "We intend to manufacture elements of mass-produced planes for which we will have full responsibility," he explains. By becoming a partner of Airbus Industrie for the 320 and, why not?, for other later programs (300-seat, super-Airbus or long-range four-jet plane), the Canadian firm is counting on playing a more "constructive" role and, by allying itself with the European aircraft manufacturers, it is engaging in "the third option" recommended by Pierre Elliott Trudeau to free itself a little of the economic domination exercised by its powerful neighbor.

According to the protocol of an agreement signed several days ago by Sandford and Bernard Lathiere, owner of Airbus Industrie (with the backing of the federal government, several weeks after conversations carried out on site by Charles Fiterman, the "first communist minister to tour North America"), this participation could reach up to 10 percent. It would involve a capital outlay

on the order of 1.2 billion francs by Canada as well as, in all probability, the construction of a plant in Quebec. For Airbus Industrie strategy, having a partner in Canada and, consequently, thumbing its nose a little more at Boeing, is one of the "nonnegligible new elements."

It remains to be seen how and when the Airbus 320 operation will be completed. At the moment, the division of industrial responsibilities has not yet been made. As for the development budget, the French would be disposed to guarantee about 30 percent, the British nearly as much (or 10 percent more than for the A 310), the Germans only from 18 to 20 percent, Spanish, Belgians and Dutch approximately 9 percent all together. As for the Italians, they had said they were ready to take 10 to 15 percent. That would already exceed 100 percent...!

In the meantime, Airbus Industrie is filling out its sales scorecard: nine A 310's sold to VASP, the domestic Brazilian company, by Jean-Yves Richard, sales manager for Latin America. To replace Boeing 727's and 737's....

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