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## BIOTECHNOLOGY

### BRIEFS

**TWO ENZYME GENES CLONED**--After 20 months of work, Celltech researchers (Great-Britain) have managed to clone and express the genes of preprochymosine, prochymosine and chymosine in *E. coli*. Chymosine is an enzyme secreted in the stomach of young ruminants (preprochymosine and prochymosine being its two precursors). This enzyme, which coagulates milk, is used in cheese manufacturing. Celltech believes that the development of highly specialized expression systems is of considerable importance for industrial applications; work is now in progress on the optimization of the chymosine expression rate in recombinants. At present, chymosine producers cannot meet the demand, because of an increase in cheese consumption and a decrease in veal consumption. The world market for chymosine is said to represent from 70 to 200 million dollars per year, according to an estimate by Dow Chemical (United States). (Nucl. Ac. Res., 11 April 1982). [Text] [Puteaux BIOFUTUR in French May 82 p 9] 9294

**SCOTTISH BIOTECHNOLOGY CENTER**--This project (14 million pounds, up to 22 percent of which are to be financed by the government) was developed by the Scottish Development Agency (SDA), a government-financed agency, in association with the Strathclyde and Glasgow universities. According to Dr D. Mathewson (SDA), the creation of the West of Scotland Science Park (18,000 square meter, located in Glasgow) is intended to improve relations between the industry and the universities, and to lead to the marketing of the discoveries made by Scottish university research: an effective means of providing new impetus for the Scottish industry in the fields of biotechnology and electronics as applied to the medical sciences. The Strathclyde university will provide the required technical and scientific support in the field of microbiology and fermentation. The research conducted at the Glasgow university is centered on the medical and biochemical sciences (virology, cancerology, genetic engineering, cell fusion, etc.); it is financed partly by the Medical Research Council and partly by private industry. This project has aroused the interest of the industry (pharmaceutical industry, veterinarian products, microelectronics, etc.) but no contract has been signed yet. (Information: J.G. Gleave, 120 Bothwell Street, Glasgow G27JP, Scotland). [Text] [Puteaux BIOFUTUR in French Jun 82 p 8] 9294

CSO: 3102/406

ENERGY

MANUFACTURING TECHNOLOGY WILL MAKE SOLAR POWER COMPETITIVE

Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 8 Jul 82  
p 7

[Text] In Wedel near Hamburg AEG-Telefunken AG has laid the foundation stone for a new solar center. A largely automated manufacturing plant for solar modules and specialized solar laboratories are to be built. Applying great efforts in development, in which the new solar center will also be of future assistance, the company plans to introduce new manufacturing technology after 1985 which will make it possible to produce solar generators at a cost of less than DM 5 (currently DM 25) per watt. The company will then have achieved the first major objective of development which has been under way for more than 10 years, whose aim is the competitive manufacture of solar generating plants in the range up to 1 megawatt, particularly in the Third World.

AEG also wants to use the solar center to train international partners in the area of solar technology. The company is pursuing its goal of cooperating with local partners in those countries that are particularly suitable for the application of solar energy. With Din SA, a national company has already been established in Mexico, in which AEG has a 49-percent interest. The solar center in Wedel will create 150 new jobs; in a second stage of expansion, to be completed by the end of 1985, the same production capacity of several megawatts output per year will be created and the corresponding number of jobs added.

According to its own statements, AEG has acquired an internationally recognized position as the sole European manufacturer in the field of electrical generating systems using solar energy for space travel. By the year 1985, technicians in Wedel in the area of specialization "New Technologies and Space Travel" are supposed to have completed the development of earthbound, decentralized solar plants in the range of up to 1 megawatt. In the business field of "Industrial Plants, Shipbuilding and Special Technology" there are about 100 different areas of employment. Worldwide, about 10,500 workers are employed in the business field, about 4,000 of them work in the Hamburg-Wedel area.

9581

CSO: 3102/392

## ENERGY

### FRENCH SOLAR POWER PLANT PROJECTS REVIEWED

Paris SCIENCES & Avenir in French Jun 82 pp 66-72

Text Two mirror solar power plants will be put in service in France. One of them, already storm-damaged, had its power reduced by half. The second, which calls on entirely new technologies, is also experiencing a few difficulties. And photocell solar power plants could well be strong competitors.

The first two French solar power plants should enter service this summer: Themis (2 MW) at Targasonne, Pyrenees-Orientales; and the 100 kW plant at Vignola, near Ajaccio in southern Corsica. Thus, following the United States, the International Energy Agency, and the EEC, France will experiment with these thermal stations of a new type, in which the sun's heat substitutes for combustion of oil or coal, or fission of uranium, to activate a turbo-alternator and provide kilowatt-hours to the electricity net.

It has taken more than 6 years to give substance, after sharp technical, economic, and administrative debate, to the hopes of solar energy advocates, among whom were a good number of scientists always anxious to learn the possibilities and limits of a new technology. Yet the end of that long march is reached without the expected enthusiasm: solar power plants, in which some lately saw the dawn of a new energy age, are entering modestly into their industrial phase. To the time of high hopes and militancy for a truly inexhaustible and "self-produced" energy succeeds the more prosaic and reasoned era of technical and economic verdicts reached after a period of full scale tests and experimentation.

Themis has just begun that period under very bad conditions. During a storm in the night of 28-29 November, four of its heliostats were shattered by the wind. Hardly had that first alert passed that a new torment came to break up 10 other heliostats in the night of 18-19 December. Detailed examination following those accidents revealed that in addition to the 14 heliostats broken, some 40 others were distorted, and that the concrete supports for 150 of the 200-odd mirrors were cracked. That serious development incident should not entail too great delay in putting the plant into service,

by mid 1982, but has led to reduction of the plant's capacity to 1 mW through a decrease in heliostat area from the initially planned 50 m<sup>2</sup>.

Corsica's milder climate spared such damages to the Vignola plant, which moreover has no heliostats. Difficulties were encountered, however, by the Bertin company and SOFRETES, the contractors, in perfecting the second of two 50 kW thermodynamic loops comprising the plant. In addition, the safety equipment, and that for automatic coupling with the net, to be installed by EDF [French Electricity] will not be available for several months. If the target date of summer 1982 is retained for entry into service, it is possible the plant may operate for a few weeks autonomously rather than as part of the net.

For Themis and the Vignola plant, whose prototype status has always been maintained, such incidents are in the nature of things. Above all, the cost overruns or delays they entail must not prevent attainment of the initial objectives of the French thermodynamic program. What are they?

A Council of Ministers meeting in June 1979 creating the CNESOL [National Solar Power Testing Center] at Targassonne, and more recently the orientations chosen for the 1982 Solar Energy Commission budget focus effort on research and experimentation not only on Themis and the Vignola plant, but also on Thex captors intended to produce industrial heat of approximately 250 deg. C, which are now being tested on site at Saint-Chamas in the lower Rhone valley. Simultaneously, research is being conducted on medium temperature (250-300 deg. C) materials and components, at a total cost of Fr 15 billion for the thermodynamic sector as a whole.

Beyond the indispensable apprenticeship in operation of the new equipment constituting solar power plants, and correction of possible defects which that might reveal, it is in better control of medium and high temperature materials that the key is to be found for development of an industrial application of solar electricity or heat.

Solar power plants indeed belong to the broad family of thermodynamic machines, and as such are subject to the constraints of Carnot's theorem that theoretical maximum performance equals unity less the ratio of absolute temperatures T<sub>1</sub> (of the cold source) and T<sub>2</sub> (of the hot source). Thus theoretical maximum performance is closest to unity (at which heat would be totally transformed into work) when the absolute temperature of the hot source is highest. In conventional thermodynamic power stations, the hot source is constituted by a fluid, usually water, which is brought to its operating temperature by an exothermic reaction such as combustion of coal or fuel oil, fission of uranium, or the like. In a solar plant, heat is provided by radiation concentrated on a boiler by focusing mirrors. It is transferred to a thermodynamic fluid (air, water, organic compound, etc.) which activates a motor in turn coupled to an alternator to produce electricity.

Such a basic plan allows for many variations, among which it is difficult to determine, a priori, the best choice, whence the need to experiment with various formulas.

We can first of all distinguish single-collector (boiler) plants from those with distributed collectors. In the latter, each concentrating mirror supplies its own boiler and acts as a single heat-producing module. The Vignola plant is of this latter type, while Themis exemplifies the first.

Another classification criterion, in each of the above categories, is the geometrical nature of the focus of radiation concentration: it can be a point, a straight line, or a complex (caustic) surface. The form of the focal zone bears a direct relation to the geometry of the concentrating mirrors and the procedure for aiming them. Thus a paraboloid revolution mirror (Thek) concentrates solar rays in a quasi-punctual focal zone; a cylindrical-parabolic mirror, on the other hand, presents a linear focal zone, as at the Vignola plant. The nature of the heat-bearing fluid (pressurized water, air, or melted salts), and that of the thermodynamic fluid, finally, constitutes another "degree of liberty" in solar power plant design.

Each family in this repertory has its particular characteristics. Systems with distributed collectors are well adapted to low and medium power production--a few hundred kWe. On the other hand, they have difficulty reaching high power output levels in the multiple megawatt range, for grouping of unitary modules in the heat-bearing fluid network brings technical difficulties (lack of temperature uniformity, loss of charge, etc.), coupled with rapid cost increases. We are then led to adopt a radically different technology in which the heat-bearing fluid net is reduced and collected around a single boiler. Concentration of power required to obtain needed production levels (1 to 10 mWe) then takes place at the level of solar radiation itself, by means of an oriented mirror field.

The French thermodynamic program, from this standpoint, demonstrates good coherence: apart from captors of the Thek type, intended solely for heat production, the Vignola plant appears as the prototype of distributed collector systems, whose power should at all events remain below the megawatt level; while Themis approaches--at the modest scale of 1, then 2.5 mWe--the high power range accessible only to single collector plants. These two installations thus show themselves to be complementary and non-competitive.

For this reason, the experimentation programs to follow entry into service of these first two units will be very different in nature. For a better understanding of their development and objectives, we recall the technical options adopted at each of the two plants.

The Themis plant grew out of theoretical work by a research group created in 1976 from CNRS [National Scientific Research Center] and EDF, and supported at the technical level by an industrial group, CETHEL, consisting of the firms Heurtey, Fives Cail Babcock, Saint-Gobain, and Seri-Renault. Basing themselves on experience gained from the CNRS solar furnaces at Montlouis and Odeillo, the various partners in that thermodynamic program in 1977 proposed to the public authorities--the DGRST [Delegation for Scientific and Technical Research] and DEN [Delegation for New Energies]--a first project

baptized THEM (Thermo Helio-Electric Megawatt). For budgetary reasons this is to be reduced in power and dimension; in its new form and under its new name, Themis, it was adopted by the Council of Ministers on 20 June 1979. Meanwhile, DEN was replaced by COMES [Solar Energy Commission], and this new agency, with 39 percent participation, will finance Themis together with EDF (48 percent), the department of Pyrenees-Orientales, and the region of Roussillon-Languedoc, for a total project cost of Fr 128 billion.

There remains, however, a delicate problem: will Themis, linked to the national electric net, be an ordinary power station, integrated as such with the EDF energy pool, or will it be considered a research prototype and managed by CNRS within a scientific program involved with COMES? A compromise was found: it gives EDF the superintendence of fabric and construction works, whereas the experimental program will be defined and executed under the joint responsibility of COMES, CNRS, and EDF. With settlement of those various preliminaries, construction of Themis began in the last quarter of 1979, and should be completed in the summer of 1982.

The technical principles adopted aim at applying innovation only at the level of solar segments, the other portions being treated according to formulas of proven conventional design. Thus the thermodynamic cycle uses water steam at 430 deg. C at a pressure of 40 bars, and the cold source is an atmospheric exchanger, which will facilitate installation of this type of power station in arid regions. The heat-bearing fluid, which transfers to the thermodynamic fluid the solar heat collected by the boiler, is a eutectic\* ternary mixture of nitrates, potassium nitrites, and sodium ( $\text{NO}_2\text{K}$ , 53 percent;  $\text{NO}_2\text{NA}$ , 40 percent;  $\text{NO}_2\text{NA}$ , 7 percent). It offers not only excellent thermic conductivity, but also good physical and chemical stability between 250 and 500 deg. C. In addition it has high calorific capacity, which can be used to advantage for heat storage to offset fluctuations or temporary absence of insolation. The storage system can contain 500 tons of melted salts, which assures operation for some 5 hours at nominal power of 2 MW<sub>e</sub>. A fuel oil boiler provides for thermic regulation, and, if need be, for night time operation of the plant.

The apparatus for solar heating of the heat-bearing fluid consists of a boiler, lined internally with steel tubes, and placed at the top of an 80 m<sup>2</sup> tower, on which converge solar rays reflected by 200 heliostats, each 53 m<sup>2</sup> in area, totaling 10,600 m<sup>2</sup> of reflecting surface. Each heliostat is aimed automatically by computer so that solar rays are constantly reflected in the direction of the boiler opening.

Entry of Themis into operation will thus, primarily, permit conduct of mechanical and optical tests, and secondly of thermic and thermodynamic tests.

Concerning mechanical tests, damage to heliostats by last winter's storms attest that the survival positioning system (mirrors flat for minimum exposure to wind) is defective, at least at the Targasonne site, despite calculations and individual heliostat testing for planned resistance to winds

over 130 kph. In optical tests, it is important to determine how the 201 heliostats will act collectively during aiming, since good results obtained individually cannot rule out strays, interferences, or parasitic oscillations which inevitably intervene when a large number of electronic circuits is integrated. The margin of tolerance here is very narrow, since aiming precision for a heliostat must remain within a milliradian (comparable to the angle at which a one-franc piece would be seen at a distance of 15 m!). What, finally, will be the fluctuations in quantities of light collected at low and medium solar altitudes--during mornings and afternoons--or after long exposure of the mirrors to dust and inclement weather.

Thermic and thermodynamic tests will permit, among other things, studies of the action of the heat-bearing fluid circuit during the takeoff phase of the plant, bearing in mind that blocks of solidified salts, which may possibly be produced during a localized cooling phase, are causes of "embolism" in the primary circuit and should be watched very closely.

In the final version of Themis, salt fusion is assisted by a group of 11 Thék captors; this process economizes "noble" forms of energy like electricity and fuel oil, but makes the first stage of Themis somewhat more complex. In like manner, only field tests will allow determination of operating cycles and procedures to be applied at the plant so as to optimize solar energy yield.

These few points illustrate but a few examples of the enormous experimental work now facing the operators of Themis. It will probably have to be extended over several years before obtaining an industrial product exportable for instant use in any sun-warmed area of the world. This period of adjustment should also profit from experience acquired by other solar plants in existence throughout the world (see box) omitted, and should make it possible to discern the most promising formula from all the possibilities explored.

Without awaiting the results of those tests in use, research laboratories are exploring the next stage. Thus the CNRS solar energy laboratory at Poitiers and Odeillo has begun study of a hot air boiler as part of the Sirocco project, which marks a new step in the progress of solar energy plants.

In Themis, as we have seen, conversion of solar radiation into mechanical work or electricity called for a series of circuits in cascade connection: a heat-bearing fluid, production of superheated water vapor, and then--a steam engine. Use of the latter is possible only up to temperatures of 500 or 600 deg. C, which limits maximum theoretical thermodynamic performance to approximately 65 percent. Moreover, the multiple circuitry reduces reliability of the system as a whole. Hence a radical solution was sought, in which the heat-bearing fluid would double as the thermodynamic fluid, and permit working temperatures of 800 deg. C or above. Project Sirocco provides an answer.

It simply uses air taken from the ambient environment, then compressed and heated to 800 deg. C by a new type of solar boiler and a heat collector at

the exhaust of the gas turbine at the end of the circuit. Heat storage is provided, in one example, by a hot air generator, fed by fuel oil, which substitutes for solar heat if needed.

In this system, the item of first importance is the boiler, whose dual function is to capture solar radiation and heat the air. Since the latter is a bad thermic conductor, exchanges between the gas and the wall are mediocre, and notably inferior to exchanges between melted salt and wall in the case of Themis. Tasks being conducted under project Sirocco concern:

Study of a boiler element allowing air heating to 800 deg C by means of a large exchange surface obtained by creation of "egg carton" alveoles cooled by air jets to the hot points. The material used is a special refractory steel supplied by Creusot-Loire-Imphy. The prototype of such a boiler element was tested from July 1979 to March 1980 at the Odeillo solar furnace, with the aim of optimizing the geometry of alveoles and injectors;

Study and completion of a demonstration thermic circuit, using the Odeillo solar furnace, with 500 kW power. The element not yet available is the air turbine, of 130 kW power. The complete boiler would use seven elements of the type tested from 1979 to 1980.

The Atomic Energy Commission's Saclay center is collaborating in thermic and mechanical studies for the captor. Tests of the complete prototype could begin as early as the summer following availability of all circuit components.

If this formula proves practicable--for there are still many unknowns concerning the materials to be used, such as ceramics and special steels--it can be foreseen that it will give rise to a new family of solar power plants much more compact and better performing than present ones of the tower type. However, the need to produce high temperatures needed for the boiler, and the latter's reduced dimensions, could lead to abandonment of the individual or small group aiming formula for heliostats as presently used with Themis or Eurelios, which can give but a rather large focal spot (50 m<sup>2</sup>, for example), owing to static dispersion of individual spots.

The process of double reflection used at the Odeillo furnace, with plane heliostats lighting, with beams parallel to its axis a paraboloid of revolution, would offer advantages in terms of concentration, and consequently of temperature, but on the other hand would limit the output of the plant by the dimensions of the parabolic mirror. Large units would then probably have a modular aspect in which the "base" plants would be linked to each other by an electric net.

Modularity is indeed a characteristic of the Vignola plant, with the exception that intermodular linkage is effected by the heat-bearing fluid circuit. The plant in fact has two groups of four cylindrical-parabolic captors, each supplying a 50 kWe turbine, for a total power of 100 kW. In contrast to Themis, the captors are immobile, and aligned in an east-west

direction. The boiler consists of a tube which moves in an axis parallel to the mirror generators, accompanying the movements of the focal axis, which are coordinated with the sun's diurnal movement. Because of a concern for simplicity of fabrication, captors are built, according to a process developed by the AEC, from parabolic profiles made of concrete, which are poured on site, and which support the sections of reflecting mirror installed along the length of the generators. Thus the collectors are not perfect cylindrical-parabolic surfaces, but approximations, by gradations, of that ideal form. The size of the gradations was carefully calculated to avoid excessive distortion of the focal line. The anticipated rate of capture is on the order of 60 percent. Here the heat-bearing fluid is a mineral oil of high thermic capacity capable of withstanding without decomposition an operating temperature set at 250 deg. C. The boilers are supplied with fluid at 180 deg. C, which is heated to 250 deg C by passage through the mirror focus. The circuit also includes a storage tank of 40 m<sup>3</sup>, permitting operation for 2 hours without sunlight.

Each half of a collector field thus feeds a turbine impelled by a heavy organic fluid, designed by the Bertin firm for this application. Its rate of electric conversion is 20 percent, thanks to its two-stage operation in which the first stage works at supersonic speeds. These high performance levels require high precision design and machining of rotating parts. Cooling is by a water jet.

In contrast to Themis, where as we have said the thermodynamic stage is relatively conventional, the Vignola plant is also innovative in this domain. A large portion of tests will in fact concern new and particularly sophisticated 50 kW turbines. Thermic and manometric reactions of the circuit, especially in transition phases, is likewise a complex area in which experience alone will permit formulation of practical rules of calculation for future installations. Resistance to frost, dust, and possible soil movements such as settling and slides, as well as changes over time in the reflection factor, of mirrors, are still major unknowns despite prior laboratory or field tests. At the overall level, operation in tandem of the two semi-stations could bring to light unsuspected difficulties. In that event, the tests due to begin in the summer of 1982 should contribute data elements unobtainable through calculation.

And so, even if the first kilowatt-hour had already been supplied to the net by the Vignola or Themis plant, we see that the road ahead is still long on the way to solar electricity of thermodynamic origin, and to the ultimate objective of robust and reliable installations, reasonable in cost and able to compete, in price per kWh produced, with fuel-fed power stations, or even in the future with photocells. These latter, in fact, have already beaten the thermodynamic sector in the low-power range (less than a few dozen kWh), with a peak investment cost per watt of about Fr 100 to 120.

If the cost reduction now underway should continue, photocell stations could before 1985, and in a good competitive position, approach the 100 kW power range, now exclusively occupied by the thermodynamic sector. Can the latter meet the challenge? This is one of the stakes in the experimental phase of the contest for ground now opening for solar power plants.

## ENERGY

### BRIEFS

FRANCE, NORWAY HYDROGEN RESEARCH--At present, the amount of hydrogen consumed in France for essentially chemical uses represents 3 million tons of oil equivalent, i.e. approximately 1.5 percent of our total energy consumption. This gas is expected to play a larger part as a source of energy in the future as it is suitable for many uses and can be stored in large quantities, like natural gas. Studies were undertaken at the time of the first oil shortage in 1973, primarily on how to produce hydrogen economically. Certain research teams hoped to arrive at a process that would make direct use of nuclear heat in chemical reaction cycles ending up with water decomposition. This process, the "thermochemical" process, had to be abandoned because of its low energy yield and high cost. On the contrary, the traditional electrolytical method was actively investigated and, in 1977, a program was set for the French Electric and Gas Company by the Hydrogen Committee created for that purpose. Two working groups were created in cooperation with French industrialists in order to design a 2-MW prototype. The pilot stage would follow, with a higher power capacity. Simultaneously, research is carried out on a more efficient but non-operational process, "advanced alkaline electrolysis"; they deal essentially with new material specifications. It is true that, at this stage, a specialized Norwegian firm of international repute introduced a proposal for an advanced electrolysis prototype facility. This proposal will be examined and compared to that of the French industrialists concerned, whose project is at an advanced stage. Besides, the efforts made on hydrogen are not restricted to its production, and the French Gas Company is now actively working on other problems: pipeline transportation, storage and uses for this product. [Text] [Paris AFP SCIENCES in French 23 Jul 82 p 11] 9294

SPAIN ENCOURAGES WIND ENERGY--The Spanish Ministry of Industry and Energy will soon publish a detailed map of the country's wind energy resources. Based on this map, the authorities will "go into action," according to information disclosed by Mr Celso Penche, head of the Department of New Energies at the Ministry, at a symposium on alternate sources of energy held in Valencia. For the moment, a 100-kW machine is being built at Tarifa, in the province of Cadiz. The Strait of Gibraltar happens to be one of the areas with the most favorable characteristics for this type of energy. There also appear to exist very good possibilities in the north of the country, in Galicia, which would be suitable for the installation of small machines to supply power to isolated homes, and in the Canary Islands, where the prospects for the installation of large machines have led to studies on the possible realization of windmill parks of up to 10 MW power. [Text] [Paris AFP SCIENCES in French 23 Jul 82 pp 10-11] 9294

FRENCH COAL GASIFICATION COMMITTEE--A gasification steering committee has just been set up within the Charbonnages de France group, with the mission of developing and proposing an on-site gasification policy and overseeing its application, as well as study and execution of resulting projects. For each project, the committee will propose the operator, which could be CDF Chimie, CHERCHAR [Charbonnages de France Study and Research Center], or a coal basin, as well as determining allocation of necessary resources. [Text] [Paris SEMAINE DE L'ENERGIE in French 15 Jun 82 p 14]

FRENCH SUBSTITUTE-FUELS COMMISSION--A Technical Commission on Substitute Fuels (CTCS) just established within the Refining-Utilization Programs Committee (COPRU) already in existence, is to initiate a procedure for grants of financial aid to projects put forward in accordance with the substitute fuels development policy. This coordinating commission will include: the French Petroleum Institute, the nationalized Elf-Aquitaine Co., the French Refining Co., Ato Chimie, Chloé Chimie, Rhone-Poulenc, Ugine-Kuhlmann Chemical Products, the nationalized Renault Co., and the Peugeot S. A. group. The Solar Energy Commission will be represented in the new commission by M J. Carre, chief of the Biomass Department. [Text] [Paris SEMAINE DE L'ENERGIE in French 22 Jun 82 p 10]

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## INDUSTRIAL TECHNOLOGY

### ASEA STRATEGY AIMS AT BECOMING ONE OF WORLD'S LEADERS

Paris L'USINE NOUVELLE in French 8 Jul 82 p 29

[Article by Michel Defaux: "Robotics: ASEA's Ambitions"]

[Text] The Swedish company has great ambitions in the fight about to take place on the robotics market. It aims at conquering one fourth of the world market, by relying on local production and, from now on, orienting itself toward flexible production automation--no longer robots only--and introducing on the market new equipment with further improved performances.

Introducing the company's latest realizations in Vasteras (Sweden), Bjoern Weichbrodt, manager of the industrial robot division of ASEA AB, did not mince his words: "We intend to become one of the world's leaders in robotics. We have the required marketing organization, know how and financial capabilities. This year, we shall produce close to 900 robots and we intend to hold 20-25 percent of the world market by 1985."

ASEA's strategy to achieve this goal is based on increasing its presence around the world; Sweden, of course, will remain the starting point (technical development, production for the European market), but for certain international markets production will take place on the spot. This is already the case for the United States (a plant is scheduled to start operating next September), Spain (especially for tax reasons), and negotiations with Japan are in progress.

Technically, the company's ambitions are no longer restricted to robots; it is now considering the whole field of flexible production automation. For this, ASEA intends to develop the range of applications now covered by its products. This is why it purchased Electrolux in 1981 and, it is rumored, is planning the acquisition of other companies. All this means that ASEA can take care of engineering, supply the robots, of course, and, increasingly, also the peripherals (clamps, tools, accessories).

#### A Carrier Market: Spot-Welding

This policy has led the company to market packages for applications such as spot-welding, arc-welding, adhesive-bead deposition, and to keep developing new

products. For instance, the IRB-90 robot which has just been introduced in Vasteras. Its capabilities are greater than those of the existing line (90 kg for the 5-axes version, and travelling distances of 2,400 mm along X and Y coordinates), thus making good one of the company's weak points. Initially, this equipment was designed for spot-welding, but it could be used for other applications (handling, deburring). "Spot-welding is a sector with heavy requirements," Bjoern Weichbrodt states. "At least until 1985."

This equipment has already been approved by automobile manufacturers and Saab-Scania has just ordered some 60 for its Trollhaetan plant. The performance of these robots is all the better as they are associated to another novelty, a control cabinet making it possible to reduce programming time by 25 per cent. The user enters the program through a portable console equipped with a syntaxer and the dialogue takes place in uncoded form, in the language of the country. It should be noted that the robot assembly can be moved around a given point (Tool Center Point), a valuable characteristic when it comes to programming the arc-welding torch position. Still using the portable console, the operator can choose a system of coordinates, refine the position of certain points during the execution of the program, and detect failures through a self-diagnostic system.

ASEA has still other projects in its files; assembly lines for instance. "In our opinion, robots should be smaller and faster than those now on the market. This type of application is still in its very first stages. It is one of the prospects we are exploring," Bjoern Weichbrodt adds, mentioning also that seven robots have just been ordered by Saab-Scania (Sodertaelje plant) for the automatic assembly of engines.

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## INDUSTRIAL TECHNOLOGY

### AUTOMATED FLEXIBLE SYSTEMS STAR AT PARIS MACHINE-TOOL SHOW

Paris L'USINE NOUVELLE in French 1 Jul 82 pp 53-54

[Article by Patrick Piernaz: "Machine-Tool Biennial Show: The Appearance of Flexible Cells"]

[Text] Machine-tools that can feed themselves, change worn-out tools, measure dimensions and adjust displacements... These machines of the new generation have just had star-billing at the Paris Biennial Show.

Production blocks, flexible cells, independent systems... Many different names can describe the ultramodern facilities introduced in June at the last Machine-Tool Biennial Show. Under this diversity, there is a general trend: machine-tools are no longer introduced as individual units. That is too common! The latest is manufacturing systems. Never mind whether they include one or several machines, as long as they can operate automatically without supervision or manual intervention of the operators to load and unload the parts.

"There is a strong demand for this type of systems to machine series of similar parts," Jean-Claude Albrecht, president of Renault-Somua, explains. We heard the same remark at Graffenstaden where, according to Lucien Schaffer, assistant manager, "manufacturers are increasingly looking for machining centers that can work at night without supervision during the third shift."

This trend affects the two main machine-tool categories: lathes and machining centers. In this respect, the machines introduced at the Biennial Show have confirmed the emerging trends noticed at the Hannover World Show. But visitors at the Paris show were surprised by the number and diversity of approaches. As far as machining centers are concerned, TMI [expansion unknown]-Forest and Graffenstaden both offered a machine with a feeding system consisting of a carousel carrying six pallets. This makes it possible to store parts on the pallets in the evening, and the carousel will present them one at a time to the machining spindle until the morning shift takes over. "But to ensure successful operation and make it possible to machine different parts, we have equipped our machines with numerous devices," Gilbert Fischer, Graffenstaden assistant manager, explains: an encoding and reading system on the pallets for part recognition, a numerical control memory that can store up to 15 different program and, above all, many control systems (Renishaw contour feelers, broken-tool detectors, power monitors to report any abnormal operation, etc.).

The same approach has been used at Sagem which has equipped its Precicenter machining center with all these devices, but has chosen an on-line approach for pallet storage. The unit, called Precitransflex, uses a transfer carriage mounted on rails, which picks up the pallets that have been arranged on lined-up contact points distributed at will right and left of the transfer line. The advantages are: modularity (the number of pallets can be increased) and ease of connection to other machines so as to form a flexible workshop.

For turning operations, too, there are many approaches to parts storage and handling. The problem is complex. On machining centers, the time per part can reach one hour (thus providing considerable independence with a small number of parts), but turning times rarely exceed five minutes. Therefore, a choice must be made: either a large storage or the presence of an operator.

Two systems introduced at the Biennial Show provide an interesting answer to this dilemma: those of Ernault-Somua and Sculfort. Ernault-Somua introduced a four-axes lathe, the FLS-40, including two built-in handling arms, one to turn the parts over, the other to load and unload them. It is original in that the parts are fed to the machine by wire-guided carriages. The parts are on pallets--each pallet containing a batch of several tens of parts--and are brought by the carriages within reach of the robot-arm clamps. This approach, which until now had been used only on machining centers (Renault-Boutheon flexible workshop), provides an automatic connection between a machine and a storage area.

Another remarkable system is Sculfort flexible cell which, to begin with, has the advantage of being for real since it is going to be installed in Renault Industrial Vehicles' Saint-Priest workshop. Its application: the machining of four different types of bearing housings with realization times of 2-2.6 minutes. Sculfort has adopted a motorized-conveyor feeding system connected to a CN-25 frontal lathe provided with an automatic feeding device, a manipulator, and a control station for automatic tool-wear adjustment, etc. "This station can test four diameters, monitor the part pick-up distance and make three decisions: to continue the cycle, to adjust the tools for wear, or to stop the machine if a part is out of tolerance," Jean Tauveron, Sculfort general manager, explains.

For all these spectacular realizations, we must not lose sight of simpler equipment which has been introduced and consists of a single lathe equipped with a loading robot that will pick up the parts placed on a carousel. Such independent lathes were introduced by Innovations Mecaniques (T9 lathe + Sim-robot), Pittler (Petra), SMT [expansion unknown]-Pullmax (Swedturn 12), Yamazaki (Quickturn), Index (GE 65), etc., not to mention Okuma, which has already sold 3 or its 4-axes LC-20 robotized lathes in France where they will operate 24 hours a day.

For these machines to operate continuously, peripheral equipment will have to be developed to ensure single-pass drilling or milling, automatic dimension control, tool management and automatic tool-replacement. Most manufacturers are now offering these options. Nevertheless, modifications keep being introduced, either in the machine structure, or in guide-way location: the flat/vertical bed is progressively displacing the flat bed so as to make chip removal

easier, but also to provide easier access for the robots. For instance, on the new Cazeneuve HB-CND shifted-bed lathe.

But changes are also made in materials. For instance, thanks to technical assistance from CERMO [Machine-Tool Study and Research Center], concrete is used more frequently instead of cast iron for the machine frame--not only for its stand--because it provides better rigidity and vibration damping. This approach has been adopted on new lathes from Innovations Mecaniques (T10 lathe) and Sculfort (CN-5 lathe) and on a beautiful production machine from Supemec Produmatic, the H-800-CNC, which can operate along five axes (two stations parallel to the spindle and one downfeed station). "The use of concrete guarantees structure stability, a good surface condition, and makes chattering extremely unlikely," Jean-Claude Cottin, Supemec technical manager, explains.

The development of independent machines must be compared to that of production cells consisting of several machines and representing a first step toward a flexible workshop. This approach is necessary whenever a part cannot be completely finished on a single machine. Thus, two lathes or one lathe and one machining station, etc., can be connected. Such cells were introduced, among others, by Manurhin and Halbronn, both using Japanese equipment. To meet this type of requirements, CECN[expansion unknown]-Industrie has developed software that can pilot two NC machines and two handling and conveying systems. "With this software, which works on a small HP-9826 computer, we want to show small and medium-size enterprises that they can acquire a flexible cell with a data-processing budget of less than 200,000 francs," Paul May of CECN Industrie explains.

"However," he goes on, "the creation of such cells from existing machines will require numerical controls that can be connected to a central computer in the direct-numerical control mode, and can take into account dimension control on the machines... Otherwise, the connection will be difficult. This must be considered at the time of purchase of new machines."

The manufacturer of the NUM numerical control studied this problem and, at the Biennial Show, next to its new low-cost 560 computerized numerical control (CNC), it introduced an automatic system for independent machines, the AM 2000, which includes all the functions required for operation without supervision, tool management, program storage, etc. The Italian manufacturer ELSAG [expansion unknown] used the same approach; all its computerized numerical controls are equipped in series with the functions required to create flexible cells: two-way computer connection (RS-132 connection), adaptive control input, possibility of entering parameters from punched tape, and entry of direct feeler-measurement data.

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## INDUSTRIAL TECHNOLOGY

### AUTOMATION TO PLAY LARGE ROLE IN FRENCH INDUSTRIAL STRATEGY

Paris LES ECHOS in French 23 Jul 82 p 2

[Article by J.M.]

[Text] Informatics and robotics are setting a trend. Jean-Pierre Chevenement has just invented a new term: "productics," which is defined as the integrated automation of the manufacturing industries. In its broader sense it means equipment (numerical control, robots, and industrial informatics), software, and engineering (flexible units, artificial intelligence). It is an essential weapon "in our present state of economic war."

All in all, productics is a genuine industry whose market in France already amounts to more than 8 billion francs, and which employs 20,000 people. Its development corresponds to a double economic wager: recovery through renewal of productive investments, and improvement of industrial productivity through automation.

If automated equipment grows at a rate of 25 percent per year--which is the government's goal--productivity should increase from 4 percent to 7 percent per year.

Jean-Pierre Chevenement does not overlook the social problems that could be created by this automation of the manufacturing industries, which employ 3,200,000 people. The workers' concern is legitimate.

However, the minister of research and industry has pointed out that "we don't choose the pace of technologic progress; it is imposed upon us." The wager now is that this progress, when properly mastered, will allow the creation of new jobs: "A rapid and well controlled automation should in the long run not result in fewer jobs." This is true as long as it encourages qualification and social mobility: "Tens of thousands of workers will change their jobs."

French industry is slowly moving into the automation era: nearly two-thirds of the French enterprises have no equipment of this type, and the machine-tool inventory has an average age of 15 years. According to some, this under-equipment represents a handicap of 5-30 percent with respect to our competitors.

In addition to the machine-tool plan, Jean-Pierre Chevenement has therefore just implemented a genuine governmental productics plan.

World production

Country	A	B	C	D	E
Japan (1)	11,000	43,000	780	2,600	3,750
United States (2)	8,130	19,000	980	2,300	3,420
Europe (3)	5,337	17,275	753	2,457	5,319
Scandinavia (4)	560	2,060	190	680	700
France	1,037	3,815	188	304	838
Worldwide	24,507	79,275	2,512	6,357	12,489

- A - Annual production (in number of robots)
- B - Cumulated production (in number of robots)
- C - Annual value (million francs)
- D - Cumulated value (million francs)
- E - Personnel manufacturing robots
  - (1) 40 percent of world market
  - (2) 30 percent of world market
  - (3) 30 percent of world market
  - (4) 50 percent of European market

It will notably depend on progress contracts between the government and enterprises, regulating mutual obligations for the rapid modernization of production tooling: investments, training, and working conditions.

Tomorrow, 5000 Robots and a Budget of 2.4 Billion Francs Over Three Years

After the electronics industry, the robotics industry. To guarantee the competitiveness of our manufacturing industries, the government deems it essential to approach robotics as a national industry: equipment, software, services. The goal of the Petiteau task force for 1990 is 5000 "true" robots, with 60 percent French contribution; this does not include "peri-robotics" (automation of production in the broad sense of the word), which represents twice or three times the market.

The stakes are large: increase the productivity of French industry by 20-30 percent during the coming years, and reduce production costs by about 10 billion francs.

Can French robotics meet the challenge? Yes, in research, where "the French scientific potential, notably in matters of language, industrial informatics, and computer-assisted design, is recognized by all, especially abroad."

No, in robot construction, where the largest French enterprise (ACMA, a Renault subsidiary) has a turnover equal to one-tenth (30 million francs) that of the world's largest manufacturer (the American Unimation, with 300 million francs). Moreover, 60 percent of this limited market (the French inventory is estimated at 850 robots) is being nibbled by equipment from Japan and the United States.

A goal of 5000 robots is an ambitious one in this context. An effort will have to be made to achieve it. In manpower: establishment of 410 researchers in three years, creation of 2000 qualified jobs in 10 years. In financial inducements: the total budget to support the robotics plan is assessed at 2.4 billion francs over a three-year period, which should be compared to the 500 million francs of the 1980-1982 period.

The Interministry Committee for Robotics will have to implement these inducements; to possibly find new formulas for financing the demand (the Petiteau report suggest the creation of a compensation chest which will allow the "automator" to benefit from the "automatee's" profits); to structure all the factors in the robotics industry; and to encourage the transfer of knowledge from upstream (research) to downstream (industry).

In the latter domain, the report of the robotics task force announces that the formation of two centers for the transfer of automated production technologies is now under study. The Besancon center would specialize in robotics and peri-robotics engineering, and the Toulouse center would be aimed at the predevelopment of products with a strong informatics orientation.

This "revitalization" of the French manufacturing industries represents an equipment market of 5 billion francs in 1985.

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CSO: 3102/396

## INDUSTRIAL TECHNOLOGY

### AUTOMATION OF MANUFACTURING PROCESSES IN FRANCE

#### Status Assessed

Paris ZERO UN INFORMATIQUE HEBDO in French 2 Aug 82 pp 4-5

[Article by Jean-Louis Cousin]

[Text] Before even beginning to formulate new measures for robotics and automation, the various teams and services of the Ministry of Research and Industry wanted to obtain as accurate an idea as possible about the present French situation. Their report is categorical: dangerous delays exist both in supply and demand. They create a double threat: undercompetitiveness and growing technical dependence on foreign sources.

One bright spot in the picture however, is the present level of our research. In the opinion of experts, this research "could continue to be competitive if its efforts are bolstered with researchers and budgets".

Still on the subject of research, the Petiteau task force comments that "the French scientific potential, notably in language, industrial software, industrial informatics, and CAD (computer-aided design), is recognized by everyone abroad. Foreign robots (Swedish and Japanese in particular) are equipped with techniques and components developed in France."

France also has a good position in automation service and engineering. The national enterprises achieve nearly three-fourths of France's total turnover in this sub-sector. Notable among these enterprises are Cerci, CGE, CGE-Altshom, Sagem, Seri-Renault, Sodeteg-TAI, and others.

The situation is far from being this good in most of the other sub-sectors.

The ministry indicates that 75 percent of the world CAD market is covered by six American companies. But it believes that several French enterprises also offer very good quality products. Among these are Assigraph, CAO 80, CECN, Dassault Systemes, Gphael, Matra-Datavision, Renault, and Secmai.

The situation is similar in graphic peripherals. In this case, the top specialists are called CSEE, Gixi, Matra-Optique, Sintra-Alcatel, as well as such innovating PMI's (small and medium-sized enterprise) as Celi, Secapa, and some others.

Robotics penetration into various sectors of the manufacturing industries  
(percent of inventory > 4 percent)

Industries	Number of jobs (percent)	Percent of robot inventory	
		1980	1990
Food/beverages	3.7	negligible	2-3
Coal, oil, chemistry	2.4	--	
Metallurgy	1.2	--	28
Metal processing	1.2	9	
Mechanical	4.7	8	
Metal processing (semi-finished)	2 to 3	1 to 2	19
Instrumentation	0.7	negligible	
Electrical	2.1	6	
Electronics	1.7	5	
Ship building	0.9	negligible	38
Automobile	2.7	58	
Aerospace	0.8	1	
Cycles and other transportation	0.9	2	
Light hand tools	0.5	< 1	12-13
Textile, leather, clothing	5.2	negligible	
Ceramics, materials	1.4	5	
Wood and furniture	1.3	> 1	
Paper and printing	2.7	negligible	
Rubber, plastics	1.3	4	
Other processing industries	0.5	negligible	

Percentage of jobs in sectors with respect to the active population in industrial sectors. Table based on Diebold information. Source: Ministry of Research and Industry.

#### American Weight

While the overall weight of the trans-oceanic companies remains significant in informatics production management, it seems to become lighter in some domains. According to experts for instance, French system analysts, engineers, and producers of software such as Cerci, Eca-Automation, GSI, Production Systemes, Sema, Sesa, and Steria, currently satisfy two-thirds of the domestic demand.

In the data-collection equipment sector, Crouzet, CSEE, Sems, TITN, and Trindel supply 50 percent of the national market.

On the other hand, only 20 percent of the French acquisitions of industrial computers are made from our own manufacturers (Sems, CII-HB, Intertechnique).

## Proportion of French PMI endowed with automatic handlers

Total: 6% of 1900 enterprises surveyed in January 1981

By size:	10- 49 employees	4%
	50- 99 employees	8%
	100-199 employees	12%
	200-499 employees	21%
By sector:	Construction materials	9%
	Foundry-metal processing	7%
	Chemistry and associated industries	3%
	Heavy mechanical industry	4%
	Precision mechanical industry	6%
	Electrical construction and associated industries	5%
	Transportation equipment	7%
	Textiles and clothing	7%
	Various industries	6%
	Wood and furniture	9%
	Paper and graphics industries	4%
	Milk and meat industries-Food products fabrication	10%

Source: Ministry of Research and Industry

The installed inventory of automatic flexible shops currently in operation is estimated as follows: 50-100 in Japan, 40-50 in the United States, 70 in FRG, 10 in the eastern countries, and only two in France (some ten projects were counted in our country).

The world supply in this domain comes essentially from American and Japanese enterprises, and the European supply from German or Italian ones. The French enterprises are Automatique industrielle, Cerci, CGA, Sagem, Seri, and Sodeteg.

While awaiting the results of ongoing surveys, the world market is difficult to evaluate. Its growth is said to be greater than 50 percent per year.

### Inadequate Supply

For "intelligent" robots of the new generation, which make extensive use of electronics, the French supply remains inadequate despite a good technologic level in research centers (Toulouse, Montpellier, Grenoble, Paris) and several national manufacturers: Acma-Cribie (Renault), Afma-Robotique (Leroy-Somer), Telemecanique, AKR (AOIP), Sormel (Matra), Scemi (BBC group), and so on.

The major foreign leaders are American, Japanese, and to a lesser extent, Swedish, followed by the Germans and Italians.

Dependence on foreign sources remains very high for equipment designed for industrial applications. Better estimates of France's contribution are currently being made.

Finally, the availability of French automation equipment, components, and devices proves to be still scattered; the financial contributions of our enterprises must be increased and their presence abroad developed.

French situation

Sociétés (A)	Type de robot (B)	Production annuelle (C)	Production cumulée (D)	Production cumulée H de G > 150 KFF (E)	Valeur moyenne en KFF (F)	Valeur annuelle en MFF (G)	Valeur cumulée en MFF (H)
Acma-Cribier	Soudure et peinture	60	200	200 (E)	500	30	100
Afma	Pick and Place	100	300	50	125	12,5	37,5
ACS	Télemanipulateur	30	95	100	1 500	45	145
			5		10 000		50
AKR	Peinture	15	17	17	600	9	10,5
AML	Pick and Place	15	27		30	0,45	0,81
Barras	Télemanipulateur	60	150	150	750	45	112
Billaud	Pick and Place	25	50		35	0,875	1,75
Cerci	Assemblage	1	1				
Climax	Pick and Place	200	600		50	10	30
CSEE	Télemanipulateur	20	48	48	500	10	24
Lacalhene	Télemanipulateur	45	85	85	150	6,75	12,75
Languepin	Soudure à l'arc	12	30	30	400	4,8	12
Sciaky	Soudure par point	4	7	7	400	1,6	2,8
Sormel	Pick and Place	300	700		20	6	14
Supemec	Pick and Place	150	1 500		45	6,75	67,5
TOTAL	Soudure, peinture, télémanipulateur, assemblage, Pick and Place	1 037	3 815	687	180	188	620

- Key: (A) Companies  
 (B) Type of robot  
 (C) Annual production  
 (D) Cumulated production  
 (E) Top of the line production > 150 KFF. Price greater than 150 KFF. Japanese classification probably C-D-E.  
 (F) Average value in KFF  
 (G) Annual value in MFF  
 (H) Cumulated value in MFF  
 Soudure et peinture = welding and painting  
 Telemanipulateur = remote handler  
 Peinture = painting  
 Assemblage = assembly  
 Soudure a l'arc = arc welding  
 Soudure par point = spot welding

The major companies in this sector, with more than 1000 employees, are CGA (CGE), Crouzët, Merlin-Gerin (Empain-Schneider), and Telemecanique.

They are followed by about 15 other firms with 200-1000 employees, among which Cerci, SAP, and Sodeteg-TAI (Thomson). But more importantly, there are also some 1200 enterprises with less than 200 employees, a large number of which could be profitable.

Large Growth

The top of the line robot market was assessed by the Ministry of the Industry at 150-200 million francs in 1981. The peri-robotics market is estimated to be two to three times larger.

## European situation

Pays (A)	Production annuelle (B)	Production cumulée (C)	Production cumulée H de G > 150 KFF (2) (D)	Valeur moyenne en KFF (E)	Valeur annuelle en MFF (F)	Valeur cumulée en MFF (G)
Scandinavie	560	2 060	1 600	340	190	700
RFA	1 600	4 800	1 200	100	160	480
Italie	1 300	3 900	1 000	150	195	585
G-B	80	300	30	80	6,4	24
Suisse	800	2 400	—	20	16	48
France	1 037	3 815	687	180	186	620
Europe	5 377	17 275	4 517	142	753,4	2 457

- Key: (A) Countries  
 Scandinavia  
 FRG  
 Italy  
 Great Britain  
 Switzerland
- (B) Annual production  
 (C) Cumulated production  
 (D) Top of the line production > 150 KFF. Price greater than 150 KFF. Japanese classification probably C-D-E.  
 (E) Average value in KFF  
 (F) Annual value in MFF  
 (G) Cumulated value in MFF

Source: Ministry of Research and Industry

Between 1980 and 1985, experts predict growth rates in these markets of 30 percent per year for Europe and 16 percent for France.

The predictions for the 1985-1990 period are +39 percent per year for Europe and +64 percent for France.

The Petiteau task force thus notes: "The market explosion must result from the entrance into robotics of a new generation of manufacturers with diverse activities, which will compete against the monopoly of the major machine-tool makers. These manufacturers will play a double role, which will first of all lower equipment prices, and secondly, result in a quantitative development of the market by a factor of one to eight, the latter effect to be achieved by a more sector-related and localized service to the user."

### Tactics Planned

Paris ZERO UN INFORMATIQUE HEBDO in French 2 Aug 82 p 5

[Article by JLC]

[Text] Support for equipment, regional centers for financing, training, and information, larger research effort, inducements for demand. These are the major orientations of the forthcoming government program of action in robotics and

World situation

Pays (A)	Production annuelle (1) (B)	Production cumulée (1) (C)	Production cumulée H de G > 150KFF (2) (D)	Valeur moyenne en KFF (E)	Valeur annuelle MFF (F)	Valeur cumulée en MFF (G)	Effectif construisant les robots (H)
Japon (40 % du marché mondial) 130 constructeurs	11 000	43 000	4 750	70	780	2 600	3 750
Etats-Unis (30 % du marché mondial) (Unimation 75 % du marché US) (US 30 % du marché européen)	8 130	19 000	3 800	120	980	2 300	3 420
Europe 30 % du marché mondial	5 377	17 275	4 517	142	753	2 457	5 319
Scandinavie 50 % du marché européen	560	2 060	1 600	340	190	680	700
France	1 037	3 815	687	180	188	304	838
Monde	24 507	79 275	13 067	102	2 512	6 357	12 489

Key: (A) Countries

Japan (40% of world market, 130 manufacturers)

United States (30% of world market, Unimation 75% of USA market,  
USA 30% of European market)

Europe (30% of world market)

Scandinavia (50% of European market)

France

World

(B) Annual production (in number of robots)

(C) Cumulated production (in number of robots)

(D) Top of the line production > 150 KFF. Price greater than 150 KFF.  
Japanese classification probably C-D-E.

(E) Average value in KFF

(F) Annual value in MFF

(G) Cumulated value in MFF

(H) Personnel building robots

Source: Ministry of Research and Industry

automation. This program will rely very strongly on the work of the Petiteau task force. In what follows, we publish the essential features of the nine proposals made by the task force.

"We are certain that we are in the presence of a new form of thinking and working, which will develop only with the participation of all the social partners, and which will be the achievement of team work," comments Maurice Petiteau in a foreword to the nine proposals advanced by the task force which he headed.

Each word of this sentence has a manifest importance. The task force suggests the installation of a certain number of elements which in its opinion will create an environment suitable for the growth of new concepts, both in terms of ideas and future products.

World market (in million dollars)

Year	World market
1978	45
1979	68
1985	218
1990	700

Source: Ministry of Research and Industry

All these suggestions have attached figures. The whole would require a government contribution of the order of 2.4 billion francs for the next three years.

#### Productivity Increase

"How often have we seen the launching of such large operations which in fact involve so little financial risk?" asks Maurice Petiteau in his presentation. According to him, their implementation will rapidly result in annual productivity increases of the order of 10 billion francs per year for our manufacturing industries.

Herewith are the nine proposals of the Petiteau task force.

Create an Interministry Committee for Robotics (CIR)--This committee would expand the functions and actions of the Codis-Robotique group. It would coordinate the implementation of the government's policy and of allocated credits in various ministry departments. As already mentioned, it would have a budget of 2400 million francs (1982 value) over a three-year period, distributed as follows: 235 million francs for equipment, 1940 million francs for concerted actions, program contracts, and development aids, and 225 million francs intended for subsidies.

#### Advanced Regionalization

Specialized Centers--The task force chose to support at present, and as an example, two experimental centers in Besancon and Toulouse, where existing structures provide the necessary potential, distributed among the following organizations: Adepa (National Agency for the Development of Automated Production), engineering schools, technical centers, laboratories, as well as manufacturers and users.

The Besancon center would specialize in light and peri-robotics. It could be established as an Institute for Automated Production, responsible for certifying and qualifying components.

The Toulouse center, named Midi-Robots, would be responsible for predeveloping robotic products with a strong informatics and software orientation.

The means required for these centers are 75 million francs per year.

Major manufacturers

Étranger (A)			
Constructeurs (B)	Année (C) de création	Parc installé (D)	CA MF 81 (E)
Unimation	62	4 000	300
Asea	74	1 500	250
Kawasaki	68	700	200
Trallfa	69	900	150
Cincinnati	75	500	200
Yaskawa-Electric	78	500	180
Star Seiki	72	800	68

Key: (A) Abroad  
 (B) Manufacturer  
 (C) Year of creation  
 (D) Installed inventory  
 (E) 1981 turnover in million francs

Note: Unimation is 10 times as large as the largest French manufacturer

We might point out that Adepa has planned to open between now and 1985, some ten "heavy" centers (see 01 HEBDO, No 702), endowed with the equipment necessary to raise the awareness of company leaders about automation methods. In addition to Besancon and Toulouse, the opening of such centers is planned for the Paris region, in Nancy, Strasbourg, Aix-Marseille, Tarbes, and Nantes. At the same time, lighter weight installations would be made in all the other regions of France.

Research and Development--The task force plans research efforts on five major topics:

Automation and advanced robotics (ARA), with inroads into artificial intelligence (budget requested: 80 million francs over a three-year period);

Components (150 million over a three-year period), with efforts being directed toward the following areas: sensors, motorization, peripherals, tooling, kinematics, and industrial informatics;

Economic and social sciences: study of the consequences of automation on employment (5 million francs over a three-year period);

Automation of continuous processes (20 million francs);

Liaison with other disciplines (45 million francs), notably informatics, electronics (specific integrated circuits action), mechanics (machine-tool plan), and optics (laser club).

Industrial Development First

The task force believes that the essential development effort must be directed toward industrial development.

Productics in France	French market in 1982 (MFF)	Of which importation (%)
Total machine sector	20,000	55
of which:		
Advanced design machines	5,000	60
Robots	300	50
Industrial informatics	1,200	60
CAD/CAM	300	90
Systems engineering	1,500	80
Total productics	8,300	65

Source: Ministry of Research and Industry

It suggests that a certain number of specific topics in particular should be explored as part of the development aid actions launched by the Ministry of Industry, Anvar (National Agency for the Valorization of Research), ADI (Data Processing Agency), and others.

Among these topics are the impact on quality improvement, implantation into production processes, mobile robots, and so on.

In addition, ad-hoc actions should also be planned. The total budget of this R&D is thus set at 1400 million francs over a three-year period.

Pilot Operations--The task force also proposes the implementation of pilot projects in flexible assembly shops for the manufacturing industries (for instance automotive accessory electric motors, components, electronic cards and circuits, instrumentation, and so on).

The budget forecast for these pilot operations is 258 million francs.

Robotics Training--It was not deemed necessary to create a school specializing in robotics, but it was proposed to use existing resources (robotics option) in present universities, engineering schools, and research laboratories. The budget allocated for this is 30 million francs over a three-year period.

Information and Promotion--Information channels among various private and public organizations will be organized on the basis of existing structures:

Afri (French Association for Industrial Robotics) will receive aid and its activities will be expanded in the dissemination and promotion of information on robotics applications in France;

The learned societies Afcet, ISF, and SEE will increase their activities.

#### Journal and Expositions

Among the planned actions are the formulation of files (components, research efforts, and so on), the implementation of an observation and forecast system, the creation of a journal, expositions, and so on. The necessary credits will be 20 million francs over a three-year period.

Qualification of Components--In this area, 60 million francs over a three-year period will be necessary to evaluate robot and peripheral components, robotization needs, quality assurance, formulation of standards by Afnor, and so on.

Industrial Structures and Organization--The task force also plans to strengthen the equipment of Adepa regional centers. Other suggestions are: need to foresee specific financing for actions concerning all the factors involved in the robotics industry, creation of societies for service and advice on robotics (SSCR), assistance in creating enterprises with robotics competence, and organization of consulting/distribution networks. The total budget for these actions is assessed at 120 million francs over a three-year period.

Implementation of Procedure for Equipment Financing--"It would be interesting," states the report, "to establish solidarity between automator and automatee," in order to encourage the former toward his best efforts. It is thus suggested that a financing procedure be established, which will extend aid through ADI or as part of the Meca procedure.

According to the robotics task force, government aid for the new "productics" action must be extended to consolidate existing programs.

Codis (Committee for the Development of Strategic Industries) aid: 110 million francs of diverse support for the last two years, given to robot-producing industries and users of flexible shops.

Meca (Advanced Design Machines and Equipment) procedure to aid the promotion of advanced design machines and equipment: 110 million francs of aid will be distributed in 1982 by Adepa.

DAP procedure of public aid for production automation: 20 million francs awarded in 1982 by ADI.

Launching of the ARA program by Cnet (National Center for Telecommunications Studies), involving 300 researchers.

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## INDUSTRIAL TECHNOLOGY

### FRENCH COMPANY MARKETS ADAPTIVE-CONTROL EDM SYSTEM

Paris L'USINE NOUVELLE in French 3 Jun 82 pp 63-64

[Article by Patrick Piernaz]

[Text] To take 10 percent of the French market for electrical discharge machines (EDM) by 1983: that is the goal which the CFMEE [French Electrical Discharge Machines Company] has set for itself. Next week the CFMEE will introduce two advanced technology machines at the Stokvis display area at the machine tool exhibition in Paris. This is both a commercial and technical event. The French market, which is about 250 machines a year, has until now been entirely dominated by foreign companies such as Charmilles, ONA, Agie, Ingersoll, etc. The French companies, such as Ernault-Somua and Languépin, had one after another thrown in the towel.

The CFMEE decided to take part of this market because it does have some technical advantages enabling it to compete, in terms of productivity, with some of its solidly established rivals in this field.

The CFMEE's strong point is its digital system for processing electrical signals by a microprocessor, called the Memopulse. "This is a true adaptive-control system which analyzes in real time the machining parameters and automatically adjusts the series of discharge pulses in order to achieve optimum efficiency," explains Thanh Ngo Ky, the electronics engineer who designed the generator. The advantages to the user are: the total elimination of the risk of electrical arcing--one of the nightmares of people involved in this field, for arcing damages the electrode--an improvement in productivity of about 30 to 40 percent, and the possibility of using a less highly skilled labor force.

Several large companies have already expressed some interest, including Renault, the SNECMA [National Aircraft Engine Study and Manufacturing Company], Legrand, Matra, etc. But the Memo-pulse, which is available in three versions (75, 100, and 150 amps) on the MA 6 machine, is not the only machine which the CFMEE is going to present at the Paris exhibition. It will also offer a bottom-of-the-line machine, the MA 3, with a choice of three generators (25, 38, or 50 amps). Two versions of the MA 3 have an APS [Automatic Adjustment System], which automatically determines the machining parameters after the operator introduces the nature of the metals in the part, and the electrode, plus the rugosity desired. "We hope to be able to cover 80 percent of the market needs, with competitive prices: under 200,000 francs for the MA 3 and about 400,000 francs for the MA 6 in the 75 amp version," says Claude Jacquelin, the technical director of the CFMEE, who thinks the company will soon begin to reap the fruits of several years of research and development. For he is certain of the technical success of the machine. One model has already been in operation for a year at a company that manufactures molds for plastic parts and containers, the Moules J. firm at Caudan, near Lorient. The company operates at the intensive rate of 16 to 24 hours a day, and there have been no problems with the machine during the year it has been in use.

#### Personal Investments by the Company's Employees

"Our biggest problem has been moving to the phase of industrial development, which required a major investment," explains Claude Jacquelin. The first machine was built by a mechanical subcontracting company with 50 employees, Mecato Alberici, located at Meaux. The company could not completely finance its industrial development. So in December 1981 the company's employees decided to invest personally in the establishment of a corporation, the CFMEE, with a capital of 1.1 billion francs. The Soginnove, a subsidiary of the Societe Generale, holds a 28 percent share in the company.

The confidence shown by this bank (the Societe Generale) and the solidity of the project recently enabled the firm to receive more aid from the ANVAR [National Agency for the Advancement of Research], the CIDISE [expansion unknown], and a loan from the CEPME [expansion unknown]. "With this aid we were able to start a series of 10 machines, to prepare our facilities, and buy a computer and a device to test electronic circuits and racks," says Claude Jacquelin.

The CFMEE handles the complete manufacturing of the electronic part of the machines, subcontracts the mechanical work, and does the final assembly. To handle sales, the CFMEE has signed a distribution contract with Stokvis, which will contribute its knowledge of the electrical discharge machining market and a sales force with a product manager and 12 sales representatives. The CFMEE also plans to export to Belgium (it has displayed its products in Brussels already) and to Italy, where it will take part in the next exhibition in Milan. After that it will move into Switzerland and Germany and expand its export market there.

7679

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## INDUSTRIAL TECHNOLOGY

### FRENCH MAKERS OFFER SEVERAL PATTERN RECOGNITION SYSTEMS

Paris ELECTRONIQUE INDUSTRIELLE in French 1 Jun 82 pp 33-35

[Article by Gerard Bidal: "Pattern Recognition Systems"]

[Excerpts] A \$30-million market in 1981 (according to an American study) that could increase tenfold in 5 years! These are the market facts with regard to pattern recognition systems. As of now, several companies are already working on "universal" systems of visual inspection by video cameras, designed to be inserted into automated assembly lines or robots.

The recognition of patterns has left the laboratory and has arrived in industry. Although most of the applications have until now been the object of studies and of specific actualizations, it is the "universal" type of visual inspection system, designed to be inserted in automated production lines or in robots that, only recently, has begun to be marketed. At present, the possibilities of this type system are still limited to "bidimensional" applications, such as the inspection, the sorting of parts (generally flat ones), the on-line dimensional checking or the automated semi-random pick-up of components. More complex problems, however, such as the following of spot welds in the process of arc welding, are on the verge of being resolved; also, the capacity of these systems for accepting several video camera inputs offers a way of approaching the problem of tridimensional inspections by increasing the number of different camera viewing angles.

By far the greatest interest in this market is being manifested in the United States, with the creation of many companies, such as Machine Intelligence, Object Recognition Systems, and Solid Photography, all specializing in the industrialization of artificial intelligence, without overlooking companies like General Automation, General Electric and Automatix, whose systems are being marketed in France.

#### French Firms

Renault has already put into service several load-unload type robots equipped with a tridimensional recognition system using a video camera and ultrasonic

depth-sensing. However, the firm has no immediate plans for marketing separately either its vision system or its recognition algorithms.

Adersa Gerbios markets an image-digitization peripheral, the NIM 628, which differs from previous systems in that it works on the basis of 4-bits-per-pixel coded images. Moreover, it features, besides [gray-scale] thresholding, the full range of manually variable or self-adaptive-programmably-variable coding. This feature helps overcome the problem of relatively dim lighting with all the methods being marketed to date (The lighting throughout must be relatively stable and homogeneous, and the problems of shadows and parasitic lightings are still only poorly resolved).

Built around two Signetics 8 x 300 fast microprocessor cards, the NIM 628 is available in a stand-alone version enabling simple robotics applications (comparisons of contours, relative localization), or as a peripheral connected to minicomputers (Mitra or PDP-11) or to microcomputers of the Apple III type.

Adersa Gerbios also offers basic softwares (outline histograms, multi-window acquisition, high-definition multipass acquisitions to 128 shades of gray, sorting algorithm) and is currently developing applications. The Association is especially busy, under an ADI [Data Processing Agency] contract, on a program for classification and inspection of bovine carcasses, and on the identification of persons by readings taken on the iris of the eye. The NIM 628 is being offered at a price under 25,000 francs in the OEM [expansion unknown] version including the two basic cards, and at around 50,000 francs in the version mounted in a 19-inch rack.

Lastly, it is to be noted that the Bertin company has also developed an object recognition system by video camera, which resembles the American systems but is more oriented toward the sorting of parts.

[Boxed insert]:

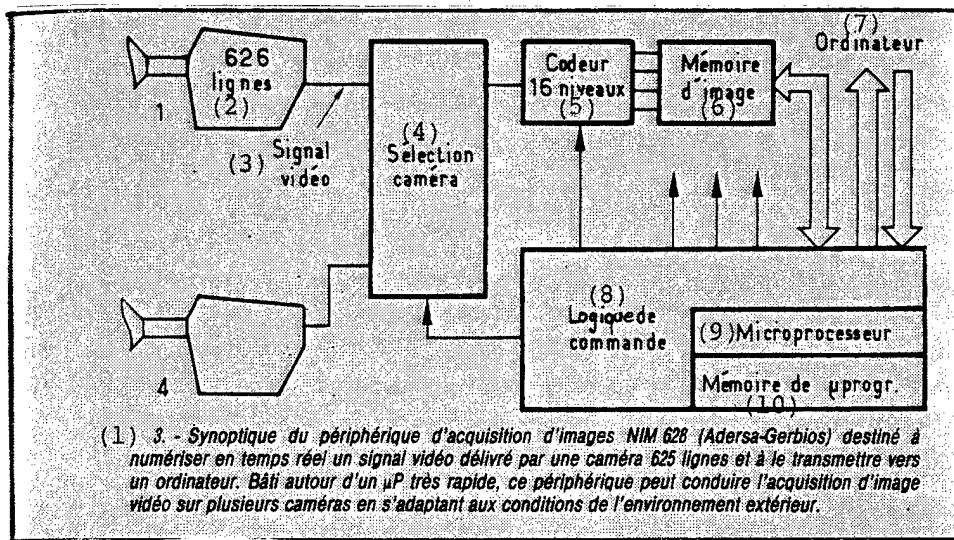
With Pattern Recognition, Advent of the Second Generation of Robots

The system developed by Renault can be considered the first industrialization of a robot capable of random pick-up of nonplanar parts in three-dimensional array.

Developed by Renault's DTA [Directorate of High Technologies], these robots, which are capable of reacting according to their environment by way, in particular, of an image analysis performed by video cameras, constitute truly the second generation.

Using a standard video camera, the pattern recognition system analyzes a square image 1 meter on a side in terms of 256 x 256 shades of gray. Then by calculating its barycenter and finally its angle orientation, it recognizes the face on which a nonplanar part is resting. The picking up and then the positioning of the part on a machine become functions of this image. For simplicity, we can say that the technique involved is one of measurement of characteristic sizes followed by comparison of the results with the different shades of gray learned for each size in each possible position.

The pattern recognition system in operation in several Renault plants enables the random pick-up of non-isolated parts by different robots. A case in point is a pick-up robot that feeds a machine tool from a 3-orthogonal-axes stack of parts. The pattern recognition system operates in two stages: First it isolates each part in the stack and correlates the image data by means of an ultrasonic telemeter to determine the height of the top of the stack; then, the contours of the part having been isolated, its position is determined by the method described above for the recognition of isolated parts.



Block diagram of the (Adersa-Gerbios) NIM 628 image acquisition peripheral designed to digitize in real time a video signal delivered by a 625-line camera and transmit it to a computer. Built around a very fast microprocessor, this peripheral can perform the image acquisition function via several cameras, adapting itself automatically to the conditions of the external environment.

Key:

1. [See caption above].
2. 626 [as published] lines.
3. Video signal.
4. Camera selection.
5. 16-level coder.
6. Image storage.
7. Computer.
8. Command software.
9. Microprocessor.
10. Microprogrammer storage.

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## INDUSTRIAL TECHNOLOGY

### RESTRUCTURING OF MACHINE-TOOL INDUSTRY UNDERWAY

Paris ELECTRONIQUE ACTUALITES in French 11 Jun 82 pp 1,5

[Article by G. Bidal]

[Text] At the opening of the 12th Machine-Tool Biennale on Friday 11 June, the industrialists will undoubtedly hang on every word of Mr Dreyfus, Minister of Industry. However, they will have to wait several weeks before they receive the details of the government plan which will lay the foundations of France's automation strategy.

Still, one thing is certain: the two major groups being formed in the French machine-tool industry are controlled by public capital.

Visitors and exhibitors would have strongly wished that the government had selected the occasion of the opening of this 12th Biennale to present the final version of its machine-tool plan. Their impatience is easy to understand: the plan, which is not merely a rescue action since it stipulates more than 4 billion francs of public funds, of which 2.3 billion of direct aid, will radically reshape the appearance of an entire industry, with which we should point out, electronics will necessarily have increasingly closer contact.

Their impatience will be remain mostly unsatisfied because the definitive plan will not be finalized and made public [translator's note: material missing in original].

#### Heavy Machinery Group

As expected, the first group will be gathered around Line, with Berthiez--subsidiary of SNECMA (National Aircraft Engine Study and Manufacturing Company)--Saint-Etienne Machine-Outils, and TMI-Forest.

This new company would specialize in heavy machinery, milling machines, lathes, and machining centers, and in the production of very large parts for aeronautics, electrical construction, and the automobile industry. It should therefore come as no surprise to find among the nine enterprises which will participate in its capital, the steel producers Sacilor and Usinor, the large aircraft firms Dassault, Aerospatiale, and SNECMA (National Aircraft Engine Study and Manufacturing Company), the auto manufacturers Renault and Peugeot, as well as the large electrical construction firms Alsthom-Atlantique and Empain-Schneider.

[Translator's note: material missing in original] preponderance of a very concentrated market, and of customers demanding a large number of custom products, made it easier to establish the group. We should also note that for this type of machinery the intervention of the electronics industry carries little weight in structural matters; in most cases, machine automation is initiated by the buyer, who generally has the means for studies and development.

#### Machining Centers Problems

The situation is entirely different for the second restructuring group, which primarily concerns machining centers: these machines, which are also aimed at an average market, become true basic cells in automated production. On the other hand, it is for these types of less specialized machines, which end up as catalog products, that the competition was keenest among French enterprises.

It is almost a foregone conclusion that this group will gather Hure, Graffenstaden (subsidiary of CIT-Alcatel), and HES (Ernault-Somua of the Empain-Schneider group). And while public funds will also be in the majority here (undoubtedly about 60 percent), other problems remain to be solved: the selection of standard basic components (this is one of the plan's important goals), which could definitely favor one given manufacturer; the fate of agreements that are underway (particularly that of HES and Toyoda, who are jointly building machining centers in France); and the policy toward manufacturers which will not be formally associated with this group (Sagem comes to mind). On the other hand, the new structure will be faced with electronics problems: not only in numerical control--for which no restructuring will be necessary, NUM remaining the only French manufacturer--but also in "communications" electronics, where standards will very soon be indispensable and will not be able to wait for the studies being conducted on the topic by CERMO (Machine Tool Study and Research Center), CETIM (Technical Center of the Mechanical Industries), and ADEPA (Association for the Development of Automated Production).

Finally, we need not mention the difficulties associated with the inevitable personnel cutbacks, cutbacks which actually concern the sector as a whole and not only the machining center group.

#### Orders From the Ministry of National Education

Yet one of the essential short term points of the machine-tool plan has just had an effective start with the orders for machines that the Ministry of National Education has just given to about ten enterprises, among which Cazeneuve (for 30 million francs), Ramo (10 million francs) and Innovations Mecaniques. The total orders from the ministry will add up to 430 million francs for the year, and 550 million francs per year are planned for the next three years. It is even conceivable that a third group, for smaller size numerical control lathes, could form around the major enterprises that are benefiting from these measures: Cazeneuve, Ramo, and I.M. on one hand, and Dufour and Vernier on the other. And the list is undoubtedly not finished.

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## INDUSTRIAL TECHNOLOGY

### COLOR SCREENS DISPLAY PLASTICS-PROCESSING FUNCTIONS

Paris L'USINE NOUVELLE in French 1 Jul 82 pp 56-57

[Article by Pierre Laperrousaz: "Plastics Processing on a Color Screen"]

[Text] Color-screen animated display of injection press operation, rapid change of molds, automatic control of parts, increasingly diversified unloading and insert-placing robots: all these developments introduced at the Europlastic Show will soon change the face of plastics processing.

The control of injection presses has just taken a new step forward. At the last Europlastic Show, two French companies, DK-CODIM [expansion unknown] and CPI [expansion unknown], introduced control cabinets equipped with color screens to display in graph or table form the adjustment and operating parameters of machines.

Thus, on the CPI-60 screen, displaying an animated graphic representation of the machine, the user can follow the progress of a cycle (weight feeding, injection, opening, ejection). Also, the condition (heated or not) of the various zones of the heating element is indicated by a color (red or blue) on its image. Of course, actual temperatures as well as set values are also displayed. DK-CODIM's Module 6 offers similar services. In both systems, the operator enters the set values through a very simple keyboard and draws the curves (injection pressure, holding pressure) directly on-screen, as bar graphs.

These systems would be mere gimmicks if they were not backed up by sophisticated closed-loop microprocessor controls for the main machine functions (injection, holding, heating, etc.). In addition, both systems are the only two on the market to offer self-adaptive closed-loop controls: a real-time computing loop modifies adjustment parameters during injection, as a function of the viscosity variations and thermodynamic characteristics (pressure, density, pressure-volume-temperature curve, etc.) of the material.

At a time when electronic computer games are invading our daily life, such a trend should not require too great an effort of adaptation on the workers' part. Nevertheless, some manufacturers are expressing skepticism at what they believe is technological escalation. "Does this really meet the processor's requirements,"

Philippe Pertuis (SMTP-Billion) asks, and he adds: "After all, we have sold 150 Visumat, whereas that new system has been on the market less than 2 years." For its part, DK-CODIM has received an order for nine Module 6, and CPI has sold an LPI-60 to a processor, to be mounted on... a two-material Billion press. Like SMTP-Billion, most other manufacturers are now offering screen displays, but in the now traditional form of "pages" (closing, heating, injection, etc.), where all the data are "written" in uncoded form. In particular, Battenfeld is offering its new CNC-80/85, a numerical control where almost all parameters are regulated in a closed loop.

#### Automatic Fluid Connection

Today, most manufacturers are offering centralized control systems for groups of machines. Some of these systems are no longer merely collecting data: they also take over production management tasks. This is the case with Ordimat (SMTP-Billion) which operates on a Digital Equipment PDP-11-34 minicomputer. The software developed by the Oyonnax company enables the user to check many functions instantaneously on his screen: review of the workshop technical facilities, schedule, order file, workload planning, production follow-up, statistics and adjustment programs.

Secondary injection functions are also getting automated. At Demag, the deviation between the actual injection pressure profile and the set profile is used as a criterion to distinguish good parts from the rejects, which are automatically removed after ejection. An increasing number of manufacturers are offering automatic mold-changing systems (Battenfeld, SMTP-Billion, Demag, etc.). The first two use molds, the two halves of which are attached to preparation platens which also carry quick-connecting elements for the fluids (water, oil, electricity). As a result, even old molds can be used with this system.

Fluid connections, which are the most time-consuming manual operations, are made automatically. In Battenfeld's Mouldfix, the mold is assembled in two steps: it is first attached to the nozzle platen by means of hydraulic clamps, then to the mobile platen, after the press is closed. The connections, too, are made in two steps. In Billion's system, the mold is lowered from the top and is hanging from the upper tie-bars of the press. When the press is closed, the connections are made simultaneously for both mold halves, and the (central) ejector pin is hitched up. Since Billion presses are equipped with an automatic thickness adjustment device, this operation does not cause any problems: it takes less than two minutes to change a mold!

#### "Programmable" Manipulators: More Extensive Capabilities

Manipulators and loading/unloading robots are about to become indispensable features in the processing workshop. The last Europlastic Show only confirmed this trend with an extremely varied range of equipment, from the simple sprue-removal device to the palletizing robot. Among the less sophisticated systems, a newcomer, Chaveriat of Lavans-les-Saint-Claude, introduced a three-axes robot (with a wrist rotation) for 100-500 ton presses. This device, the motions of which are regulated by limit switches, is purposely intended for simple part-unloading equipment. More complex, "programmable" manipulators also offer more

extensive capabilities: quick change of production line through the selection of a program stored in memory beforehand, variety of motions thanks to the numerical control of one or several of the axes. For instance, on SEPRO's [expansion unknown] PIP robot, the lateral displacement is digitized, thus making intermediate stops possible to execute secondary tasks (sprue-removal for instance). The programs are entered by the user through a keyboard (up to 15 can be stored in memory). SEPRO is studying a robot with a digitized vertical axis for palletization.

Other foreign manufacturers (Kueffner, Remak, Colortronic) are also offering manipulators with one or several digitized axes. "The market is in full expansion," according to Bernard Elineau (SEPRO). "We shall probably sell 50 units in 1982, and 1000 within the next five years."

Applications for insert-placing are less common than for mold unloading. We must say that the precision of pneumatic motions is inadequate. This is why the Mercure 82 robot of Roboplast (Amiens)--which uses an electric screw for its lateral motion--uses linear amplifiers deriving their power from the machine hydraulic system for the other two motions (vertical and horizontal). These amplifiers, manufactured by SIG [expansion unknown], a Swiss company, include a stepping motor piloting a servovalve which, in turn, supplies power to a hydraulic jack with mechanical counter-reaction. This integrated device provides great ease of control (thanks to the stepping motor) and a high precision, with respect to both speed and position. "We can reach 5/100 of a millimeter," they say at Roboplast, "which makes it possible to place inserts. In particular, we are thinking about fusible inserts, which would simplify the tools." The Mercure 82 robot, which received a prize from ANVAR [National Agency for the Valorization of Research], is considered for use on 200-ton presses.

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CSO: 3102/410

BRIEFS

MACHINE-TOOL DEVELOPMENT CONTRACTS--In his opening remarks for the Machine-Tool Biennale on 11 June, Mr Dreyfus, the minister of industry, confirmed that all the provisions of the machine-tool plan will be applied. He stated that 20 enterprises are currently negotiating with the government for development contracts, a number of which should be closed "within two to three weeks." Among the enterprises involved, the minister named Num (whose name is mentioned for the first time in the machine-tool plan), Rouchaud, Vernier-Dufour, Clement, and Amstutz-Levin-Gabin. Mr Dreyfus also confirmed the practically completed creation of a "heavy machinery" group, gathering together the activities of Berthiez, TMI, Line SA, and Saint-Etienne Machine-Outil. Regarding the action of the government in robotics, the minister mentioned the development contracts issued by Codis (Committee for the Development of Strategic Industries) to CEM, Prodel, Trefileries and Atelier de Commercy, Afma-Robots, CFC (Compagnie Francaise des Convoyeurs), and Automatique Industrielle. As for Codis' flexible shop pilot projects, Mr Dreyfus disclosed that about ten new projects were being prepared and documented, not including the projects currently being implemented (PSA-Citroen at Meudon, SNIAS-Sagem at Chateauroux, Messier-Hispano at Molsheim, and Poclain at Saint-Etienne). [Text] [Paris ELECTRONIQUE ACTUALITES in French 11 Jun 82 p 5] 11,023

AERONAUTICAL COMPOSITE-MATERIALS COMPANY--Aerospatiale, Avions Marcel Dassault-Breguet Aviation and SNECMA [National Aircraft Engine Study and Manufacturing Co.] have just signed a draft agreement for the creation in Corsica of an aeronautical composite-materials company (see LES ECHOS 21 Jul 82). Although the future company, Corse Composites Aeronautiques, has not yet been incorporated, the project is progressing rapidly. This new enterprise could create some 100 jobs, most of which would go to islanders; it would be located on a 3,000 square meter plot in the Ajaccio industrial park. It will use advanced technologies to manufacture composite-materials parts for aircraft, helicopter, missile and reactor structures. A large initial investment, close to 25 million francs, will be required. National development and regional employment subsidies could be granted, at a rate not yet disclosed. At the regional prefecture in Ajaccio, it is rumored that the file is handled in Paris exclusively, because of the size of the investments involved, and that the final decision will come from "higher up." At the Ajaccio Chamber of Commerce, the opinion is that the decision on public subsidies for Corse Composites Aeronautiques will be made by the future president of the Corsican Assembly, to be elected next August according to the proportional representation system, under the special status bill. [Text] [Paris LES ECHOS in French 22 Jul 82 p 10] 9294

## SCIENCE POLICY

### FRG'S RESEARCH BUDGET FOR 1983 OUTLINED

Frankfurt/Main FRANKFURTER ALLGEMEINE in German 21 Jul 82 p 26

[Text] The budget outline for 1983, recently passed by the cabinet, provides for an increase of 7.3 percent from about DM 6.6 billion to DM 7.1 billion for the Ministry for Research and Technology (BMFT). (The entire Federal budget increased by only 1.9 percent to DM 250.5 billion.) The high rate of increase is partly based on the fact that DM 120 million had to be absorbed additionally into the budget for the two advanced reactors lines, the fast breeder and the high-temperature reactors, because of cost increases, and more than DM 60 million have been set aside for the Gorleben final storage project. The largest entry in the budget is energy research, with DM 2.7 billion, followed by space research and technology (DM 920 million) and basic research in physics and chemistry (DM 624 million). In addition, DM 576 million have been allocated for general support of science and DM 499 million for "Technology for Health, Nutrition and the Environment."

According to medium-term financial planning, the budget was to be DM 200 million larger in the coming year. The cuts principally affect large-scale technical expansion of coal technology, for which only DM 164 million are included, instead of DM 211 million, as intended earlier. Development work on coal conversion will not be abandoned. The BMFT wants to maintain the continuity of its support of basic research, but some major projects, such as the Hera storage ring for Desy in Hamburg and the spallation neutron source, will have to be postponed temporarily. Only construction of the X-ray satellite, Rosat, which has been ready for a long time, can begin in the coming year.

The clear areas of emphasis (as a percentual increase, even if not in the absolute amount) turn out to be support for innovation and support of the establishment of new technology oriented companies (up 35.7 percent to DM 38.6 million) and electronics with the boosted special program "Applications in Microelectronics" (up 27 percent to almost DM 30 million). The decline in expenditures in oceanic research (down 13.4 percent to DM 185 million) has various factors as its cause, the completion of the polar ship and the postponement until 1984 of the start of construction of the new "Meteor." Funds for "Information and Documentation" (down 10.7 percent to DM 73 million) can be reduced, because the specialized information centers, expanded in recent years, are gradually transferring to other sources.

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## TRANSPORTATION

SNECMA WITHOUT PARTNER AS ROLLS-ROYCE, PW PLAN CONSORTIUM

Paris L'USINE NOUVELLE in French 3 Jun 82 pp 62-63

[Text] The first U.S.-British steps have been taken toward the development of a jet engine for a future 150-seat plane. Pratt and Whitney, the American firm, and Rolls-Royce, its British counterpart, have just announced that they are planning to form an international consortium by summer to develop a jet engine for 150-seat planes.

For 2 years the British company has been working in cooperation with three Japanese firms (Ishikawajima Harima, Kawasaki, and Mitsubishi) on a similar project, the RJ 500, which has allegedly cost 220 million francs in investments to date. The U.S. company, Pratt and Whitney, with its PW 2037 project, an engine of the same class, has been working with MTU in Germany and Fiat Aviation in Italy. In the first phase, this is the group of industries that would form the nucleus of the international consortium just announced. But the group would not stop there: the Swedish firm, Volvo Flygmotor, is reported to be interested in the project.

What class of engine will be developed? Will Rolls-Royce be willing to abandon its RJ 500 project? Or will Pratt and Whitney agree to drop its program? There are a great many unknowns, which the SNECMA [National Aircraft Engine Study and Manufacturing Company] is interpreting as insurmountable obstacles.

This is a very understandable reaction, as at the end of last year, Rolls-Royce had told Charles Fiterman, France's minister of transport, that it was interested in a tripartite cooperation with the SNECMA and the U.S. firm, General Electric. So there is great disappointment in French industry. And it is hard to see how in the future SNECMA can engage in such a program alone,

after the U.S.-British partnership, even if General Electric does agree to provide technical assistance, if not financial aid for the project.

The matter is one of considerable importance. Developing a new aircraft engine carries a price tag estimated now at \$1.5 billion. This means that few companies in the world can even attempt to take part in such a program. After the Pratt and Whitney-Rolls-Royce agreement, is there still room for another consortium? SNECMA has not answered that question.

These maneuverings seem to have left the Airbus Industrie group undisturbed. It has stated that its program for the small Airbus A 320 of 150 seats, whose market is estimated at 1,000 planes, "is continuing normally." There was great appreciation in Paris for the recent statement by Chancellor Schmidt at the Hanover Salon, when he spoke of his support for the A 320 program, "assuming that firm orders do materialize."

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## TRANSPORTATION

### DE HAVILLAND OF CANADA TO PARTICIPATE IN A-320 PROJECT

Paris LE FIGARO in French 27 Jul 82 p 7

[Article by "P.B."]

[Text] Is Canada's aircraft industry, which has hitherto operated as an extension of the big American manufacturers, reaching toward Europe with an eye to diversification? That was the question that M. Bernard Lathière, general manager of Airbus Industry, was pondering on his return from Ottawa, where he had gone to deal with his Canadian counterparts over their participation in the program to build the 150-passenger aircraft known as the A-230.

Under the terms of the memorandum of understanding signed last week, Canada's De Havilland would shoulder a 10-percent share of development and manufacturing costs for the new aircraft; a final decision will be taken before the year is out. While the Canadian government has expressed its agreement in principle to such collaboration on both sides of the Atlantic, it expects to secure some guarantees as to the project's viability. Mainly, it seeks dollar-and-cents commitments on economic fallout from the program, especially for Quebec, where De Havilland contemplates building a new plant.

"We aren't going to be satisfied with just rolling sheet-metal," warned one Canadian minister a few days ago. As for Prime Minister Trudeau, who originally urged just such diversification, he has made it quite clear that Canada was not about to get itself into hot water with its American partner, Boeing, which is Airbus Industry's competitor.

While the step just taken in Ottawa may not be decisive, it is nevertheless a most encouraging sign. Financially, it means that, if the deal goes through, the Canadians are ready to underwrite a tenth of development and investment costs, estimated at \$1.5 billion.

That is the sum both Boeing and Airbus Industry had to put out to launch their two competing aircraft, the B-767 and the A-310, respectively.

The Canadian decision to participate would be the more welcome now that the Germans, who played a role as important as France's in the A-300 and A-310 programs, are not quite so sure that the time is ripe to go ahead with the A-230. They could reduce their share in this project to 10 percent or so. While the British and the French seem prepared to take on 30 percent of the load, they will have to cast about for other partners in the Netherlands and perhaps here in France as well.

Canada's evident interest in the A-320 at this juncture is good news. The more reason Airbus Industrie has to hope, the more reasons Boeing has to worry. The American firm, which does not, for the moment, contemplate starting production on a 150-seat aircraft, is betting on a stretch model of its B-737 powered with new Franco-American CFM-56 engines. Some think that this 140-seat aircraft, which would be available within 2 years, could fill the size gap at lower cost. Meanwhile, the American builder certainly finds little cause for rejoicing in its Canadian partner's flirtations, especially right after Airbus Industry triumphantly waved an order from Brazil for nine of its A-310s under Boeing's nose.

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## TRANSPORTATION

### BELGIAN PRESS COMMENTS ON CANADIAN A-320 PARTICIPATION

Brussels LE SOIR in French 29 Jul 82 p 7

Text The European consortium that builds the Airbus and Canada's De Havilland company announced last night that they had signed a memorandum of understanding, under whose terms the Canadian aircraft builder will participate in development and production of the new A-320 transport. The new plane is a single-aisle twin-jet plane that can carry 150 passengers on medium and short flights.

De Havilland plans to take as much as a 10 percent share, and thus to become an associate partner in the European consortium, along with Fokker (Netherlands) and Belairbus (Belgium). Under the terms of the MOU, the Canadian builder will be responsible for development, production, and delivery of the parts and component it makes. These have not yet been defined, and several options are being studied.

To John Sanford, president of De Havilland, "this agreement is a major milestone in De Havilland's history, because it will allow us to take our place among the builders of civil air transport aircraft designed to meet the needs of all the world's airlines."

And in fact until now De Havilland has built only 50-passenger regional transport planes -- the Beaver, Otter, Twin Otter, and Dash 7 -- plus two military transport aircraft -- the Caribou and the Buffalo.

#### Distance Doesn't Count

Once the agreement is fast, the Canadian firm intends to build a new plant, because the Airbus is going to bring in a lot of new business, even as it will for most of the 900 companies that work for De Havilland.

Bernard Lathière, managing director of the European consortium, who signed the MOU, said he was "proud to be able to profit by the Canadians' experience," and added: "We have already got into the habit of working at the trans-national level. Now cooperation in Airbus becomes truly transatlantic. In any case, these days distance no longer makes any difference. De Havilland's early decision will allow us to factor in its requirements from the very start, even before any final decision as to production distribution is made. This will enable Airbus to draw without restriction on the Canadian industry's resources and thus -- among other advantages -- to avoid duplications in production."

#### Nine A-310s for Brazil

Brazil's domestic carrier, Vasp, has just placed an order for nine A-310 Airbuses, thus becoming the first Latin American customer for the new European passenger transport liner. These Airbuses will be powered by Pratt and Whitney jets and can accommodate 214 passengers in first class and tourist sections.

The Airbuses are to replace the old-generation Boeing 727s and 737s on the company's system. Initial delivery is planned for January 1983, and the ninth Airbus will go into service in 1986.

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