JPRS-EST-86-025

29 SEPTEMBER 1986

Europe Report

SCIENCE AND TECHNOLOGY

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JPRS-EST-86-025

29 SEPTEMBER 1986

EUROPE REPORT

SCIENCE AND TECHNOLOGY

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WEST EUROPE/ADVANCED MATERIALS

FRG MICROGRAVITY EXPERIMENTS ON ADVANCED MATERIALS

Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 18 Jul 86 p 4

[Article by diplomate engineer Hellmut Droscha: "New Materials Make Products More Efficient: It Is a Matter of the Internal Structure of New Materials"]

[Excerpts] Material and Space Research

The possibilities for the technical utilization of zink-lead, zink-bismuth, and zinc-lead-bismuth alloys, which are not miscible in the liquid state, were investigated under the influence of reduced gravity or almost-weightlessness, strictly speaking "microgravity" (Berlin Technical University). The results of the first experiment showed that there is a separation of the partial melting charges under the conditions of space as well but in a completely different way, because here there is a certain force in effect that on earth is completely masked by gravity. In space, conditions that occur at the so-called "solid-liquid interface" can be observed much better. In further experiments, in which above all the manufacturers of slide bearings are interested, it is intended to investigate the dependencies of the alloy composition on temperature, volume and viscosity and especially the preconditions for an even distribution of the small drops--there are also larger drops through their coagulation.

A small facility for the heating of material samples was developed (Dornier and University of Freiburg) for material testing under reduced gravity or microgravity in space for use in "Spacelab," which came into being under the project management of the German Research and Development Institute for Air and Space Travel. It is a mirror heating facility with the abbreviation MHF, whose heating chamber is made of an internally reflected double ellipsoid. In the common internal focal point of both ellipsoids, the halogen lamps positioned opposite one another therein heat up the rod-shaped sample, which is solidly mounted axially but rotatable by motor. MHF can be linked to cooling, a vacuum, data transmission and photographic cameras. The samples are made of "doped silicon and binary semiconductors," for the scientific objective of the experiments is the improvement of the semiconductor functions with respect to the increasing degree of integration of the electronic components.

A cooling system operating with liquid helium was also developed (Berlin Free University) for experiments under weightlessness. It is a system that is used not only in space but also during certain flight maneuvers in a converted airliner of the type Boeing 707. Weightlessness is thereby achieved for periods of about 30 seconds in parabolic flight paths; the experimental system is thereby to be made to float freely in the aircraft compartment. Each time for about 40 seconds between the weightlessness phases, there is an acceleration to as much as twice the acceleration due to gravity. During a flight parabola, the aircraft climbs to an altitude of 11 kilometers, after which it then falls to an altitude of 7 kilometers. It is possible to fly 40 to 60 flight parabolas in 2 to 3 hours.

The experimental system is composed of a helium-bath cryostatic temperature regulator and an electronic cabinet. The cryostatic temperature regulator can be filled with a maximum of 3.6 liters of superfluid helium. Along with a vacuum pump, the connecting pipes, valves and transducers, it is mounted in a rack that is made to float freely in the aircraft compartment. The tests are carried out at temperatures below minus 270 degrees Celsius.

An earth satellite foreseen for scientific experiments is still in the development stage (Berlin Technical University). At the end of 1987, it is to be placed at an altitude of 300 kilometers with a Space Shuttle and ejected from a special container with spring tension. With it, it is intended, among other things, to carry out such long-term experiments under conditions of weightlessness as crystal growing and the observation of the behavior of liquids, plant growth, forest damage and air pollution.

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CSO: 3698/612

WEST EUROPE/ADVANCED MATERIALS

BRIEFS

PHOTRONICS PROGRAM FOR EUREKA--Ottobrunn--Semiconductor technology is now based mainly on the use of crystalline silicon. However, during the last 10 years, development of thin film technology with amorphous silicon (A-Si) has been initiated worldwide. Amorphous silicon is distinguished from the crystalline form by the random arrangement of its atoms. Fundamental principles in the field of amorphous silicon technology were worked out in the FRG. However, it is important to catch up to the A-Si technology in the United States and Japan, particularly in connection with pilot production series. In order to make Europe competitive in worldwide markets, a "Photronics" program has been established within the Eureka program. The purpose of the "Photronics" program is to combine all European efforts relevant to A-Si thin film technology. The designation "Photronics" includes all activities connected with development, production, and systems engineering of semiconductor components based on amorphous silicon. These components include, among others: diodes, such as solar cells and integrated solar modules for weak and strong irradiation; light detectors, color sensors, and position sensors; and diode arrays (for example, code arrays). This technology is to be developed intensively in Europe under the guidance of MBB and the French company Solems. [Text] [Munich-Ottobrunn MBB INTERNATIONAL in German Jun 86 p 14] 8622/12913

CSO: 3698/M194

WEST EUROPE/AEROSPACE

DEVELOPMENT OF EUROPEAN UNMANNED SPACE PLATFORM REPORTED

Munich-Ottobrunn MBB INTERNATIONAL in German Jun 86 p 8

[Article: "EURECA and Long-term Missions: Commercialization in the Foreground", first paragraph is MBB INTERNATIONAL introduction]

[Excerpts] Bremen--The development and production program for the European unmanned, retrievable platform EURECA (European Retrievable Carrier) is proceeding at MBB-ERNO (primary contractor for the European Space Agency) according to schedule. All milestones are oriented toward a 1988 starting date. The experimental development is going on simultaneously with hardware production and with the first integration stages. The "hot" stage of the EURECA program will start in mid-1987 with experimental integration.

During its first mission, EURECA will carry into space 12 pay loads with a total weight of 1 metric ton. After release from the cargo bay of the orbiter at an altitude of 300 km, the platform, controlled from the ground and equipped with all operating systems and its own power plant, will reach its operational altitude of approximately 500 km. The mission, scheduled to last 6 months, will end with a rest phase, followed by the platform's return to earth by the orbiter.

Astronomy, earth reconnaissance, and materials research are the main fields of application during the first phase of EURECA. In addition, technologies relevant to future space stations will be tested. The industrial portion of the total cost of DM 547 million is DM 260 million.

EURECA's design and use are oriented toward commercialization. As a result, during the development and production phase of the first platform other fields of application are already being examined and the possibilities of subsequent productions are under discussion. Marketing and operation of an additional EURECA platform could be undertaken by industry, with the constant close cooperation of the European Space Agency.

However, the first step has been to study further missions with modified tasks. MBB-ERNO has done studies on the projects SOPHYA (Solar Physics Adaption) for solar research and GRETEL (Gamma-Ray EURECA Telescope) for gamma ray investigations and has specified the required modifications.

At the same time, steps for further development and improvement of the platform have been studied. They concern refueling operations and the exchange of pay loads during a mission.

Both MBB-ERNO plants are engaged in important contributions to the EURECA program. Project management has its base in Bremen together with general management and individual system tasks; essential systems are developed and assembled in Ottobrunn.

PHOTO CAPTION

Full-sized model of the first European platform for long-term missions in MBB-ERNO's assembly hall.

8622/12913
CSO: 3698/M193

WEST EUROPE/AEROSPACE

FRG NONSUPPORT FOR DOMESTIC LAUNCH VEHICLES DEEMED UNWISE

Vienna INDUSTRIE in German 25 Jun 86 pp 26-27

[Article by Adalbert Kukan: "No Liftoff for FRG Launch Vehicles"; first paragraph INDUSTRIE introduction]

[Text] Its antecedents and early beginnings promised a great deal. Even today, the FRG's OTRAG, the well-endowed organization engaged in rocket research and production, displays some moderate optimism, modified slightly by bitterness over a lack of interest on the part of some government agencies.

OTRAG manages to operate without government support, and it carries on an indefatigable and tenacious fight (without any particular encouragement by the FRG Government in Bonn or the Bavarian Government) to regain the traditional position of German rocket production for peaceful purposes at the international level. Non-technical preconditions for this are not necessarily in existence. The Ariane complex, or at least German participation in this project, has indisputable primacy among all FRG administrations, whatever their political color.

OTRAG, the Orbital Transport and Raketen AG, is located in the "Bavarian Silicon Valley," in the forward-looking town of Garching near Munich, half of which appears to be occupied by the Munich Technical University. It was founded in 1974 by 1,400 stockholders, and leads a scarcely deserved and certainly not self-generated life in the shadows.

This undesirable situation has in the meantime caused some discussions about transferal to another, possibly overseas country, which would include a merger with an active, but not dominant, partner. This would undoubtedly mean an irremediable loss for the FRG, which has lately been forced to accept a few other prestige-damaging transactions favoring foreign enterprises (Thomson-CSF, Philips) though within the EC. Most of them were in the field of electronics (Telefunken, Grundig).

Still, things got off to a good start. On 19 September 1983, OTRAG, in close collaboration with the DFVLR (Deutsche Forschungs- und Versuchsanstalt fuer Luft- and Raumfahrt [German Research and Testing Institute for Air and Space Travel]) successfully launched a single-stage altitude research

vehicle, carrying two scientific payloads of the Munich and Aachen Technical Universities from the European Space Agency's Esrange launchsite in Kiruna, Sweden.

No Launch Date

Following this, OTRAG formed an agreement with the DFVLF to send other commercial launches with scientific payloads and to perform flight testing of a two-stage carrier vehicle. But this could not be carried out because OTRAG was not provided with the required launch dates.

What are the capabilities of the presently available and operationally ready OTRAG rockets? While the single-stage model, carrying a 200 kg payload, has a ceiling of 220 km, its two-stage--"bundled"--version can carry 500 kg paylaods up to altitudes of 800 km. The proposed OTRAG 10,000, which has been "put on ice" but by no means abandoned, is capable of transporting payloads of up to 2,000 kg, the usual satellite weight, into geostationary orbit for commercial intelligence and commercial satellites at an altitude of 36,000 km and is considered the equal of the Ariane 2.

Possible application of OTRAG research results and in-house know-how to the global space industry would be desirable, but is not feasible under present conditions. The subjects for a potential exchange of experience would be the following: the OTRAG-applied module principle for producing made-to-measure rockets; a safe, less expensive fuel (regular diesel fuel in combination with nitric acid as an oxidizer); "ablative" cooling, which acts upon the specific insulation layer of the combustion chambers; an advanced radial fuel injection; and finally, decentralized electronics in combination with a steering method based on concomitant propulsion throttling. OTRAG intends to use all of these to help moderate the expenses of space technology and they represent practical solutions to existing problems without trying to be spectacular.

The highly economical, but always safety-conscious OTRAG uses neither highly complicated valves nor supersensitive sensors, which have caused Ariane breakdowns or launch delays with grave consequences. It uses no hydraulic or pneumatic systems susceptible to malfunctioning, and no complex, swiveling power plants, paired with special insulation and turbo pumps as in the U.S. space shuttle disaster.

Simple and Efficient

The motto of the head office of the Garching plant is "combine simplicity with efficiency." That is why OTRAG management is convinced that its vehicles can improve on the malfunction quota of the Ariane, if the agreement could ever be implemented.

Almost 40 years have elapsed between Peenemuende and Kiruna. In 1944, during that disastrous summer of the penultimate year of World War II, German "winged bombs," known as V1 and later as V2, fell on England's cities

with devastating effect. The fate of the German researchers and scientists who worked in Peenemuende is well known.

Half of the Peenemuende team was captured by the Russians and was responsible for much of the beginnings of the Soviet space flight industry, however tinged with strategic considerations.

The rest of the group of experts was brought to the United States at the end of the war and thereafter played a significant part in the buildup of a high-performance space flight organization there. In that group was Dr Kurt Debus, who died 3 years ago in the United States, a former director of NASA's J.F. Kennedy Space Center.

Debus also served from 1975 to 1980 as the chairman of the board of directors of OTRAG, which was funded by tax-deductible contributions. In some respects, this enterprise followed in the footsteps of tradition-steeped German rocket research. For example, as early as 1929 German rocket pioneer J. Winkler described the "bundling" principle, now used by OTRAG, as the most economical and effective basis for future rocket development.

In the area of rocket thrust utilization, OTRAG developed a standardized propulsion unit with 3 metric tons of thrust, which is excellently suited for bundling and whose three-stage version is capable of developing 144 metric tons of thrust (including 48 bundled engines). Startup costs for the OTRAG rocket should be considerably below those for the Ariane.

Frank K. Wukasch, P.E., has been in charge of the Garching enterprise since 1980. While his predecessor, Lutz T. Kayser, a student of the famous space travel professor Eugen Saenger, originated the revolutionary module principle, in other respects he apparently fell short in the requisite foresight and therefore was frequently inclined to make politically unwise decisions.

Political Problems

He and OTRAG got into predictable difficulties as a result of its long-maintained testing areas, first under Mobutu in Zaire and later in Qadhdhafi's Libya. It conducted engine and launch tests there on a continuing basis, as well as holding actual launches in the Libyan desert. This was further aggravated by the fact that several Arab countries showed an interest in further development of an OTRAG rocket with a 300 km range which had already been successfully tested in Libya--the consequences of this are easy to surmise.

The change in OTRAG management indicates a basic change in this respect also, eliminating any fears of costly compromises as the price of a suitable launching site with adequate range.

Despite the current "radio silence"--large carrier vehicles are currently not the subject of ongoing discussions at OTRAG--OTRAG technology is to be further refined. Among other things, the present so-called inertial guidance system is expected to be replaced by a later development, most probably one recently developed in the United States. Thus cooperation with overseas sources is already tentatively recognizable. Primarily OTRAG will provide launches of guaranteed precision, which will make its rockets competitive for the long term.

In view of the stand down of the U.S. space shuttle for an indefinite period, carrier vehicles are once again in the foreground of consideration as transport vehicles. The latter are better suited for stationing geostationary satellites anyway and are also more economical than space shuttles, which were constructed primarily for the transport of heavier loads in lower orbits and which require several times the launch cost due to their correspondingly greater technological requirements.

On the other hand, the aging, large U.S. launch vehicles that have about the same payload capacity as the shuttle, which are under consideration for emergency use in the United States, have become technologically obsolescent and have been "mothballed" for some time.

Should the DFVLR and the Federal Research Ministry in Bonn fail to provide adequate support to the Bavarian space pioneer organization in the near future, OTRAG would unavoidably have to fold its tents in the FRG. In that case, the FRG would have to settle for playing a very minor role as a secondary source of supply.

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CSO: 3698/599

WEST EUROPE/AEROSPACE

FRG AEROSPACE INDUSTRY COMPETES FOR HERMES PROJECT

Stuttgart FLUG REVUE in German No 7, Jul 86 p 23

[Article by Goetz Wange: "Proposal for Participation in Hermes"; first paragraph is FLUG REVUE introduction]

[Text] There is contention within German industry about participation in the Hermes space shuttle. In the case of the Ariane 5 launcher, almost everything is well defined for the development stage.

There is no doubt in the German aerospace industry, despite the setbacks with the Space Shuttle and also recently with the unmanned launcher rockets, that the planned programs must be carried forward. Therefore, future programs were widely discussed in Hannover. Moreover, German industry--despite Chancellor Kohl's restrained declarations during his opening address--is proceeding on the assumption that late this fall the FRG will decide on participation in the Hermes space shuttle proposed by France. It is still hoped that the German share can be increased to 30 percent; only then would the French allow some influence on the overall system. "It is not merely a question of attractive components," Klaus D. Berge, managing director of MBB-ERNO, commented to FLUG REVUE; "It is almost more important for us to be involved in the operational aspects of Hermes." These range all the way from wind tunnel tests to the construction of a small Hermes model, named MAJA, which will make it possible to obtain realistic aerodynamic and thermodynamic measurements during the radio-controlled return flight through the Earth's atmosphere at speeds of Mach 25 down to Mach 10. In addition to the DFVLR (German Research and Experimental Institute for Aviation and Space) training facilities in Porz, Berge favors the use of German landing facilities.

Unlike the Ariane 5 launcher, for which German industry has already agreed to the distribution of the development and construction share it was awarded (approximately 22 percent), there is some dissatisfaction with the approach to Hermes. Dornier, which is to contribute to the entire crew system and which is already working on it at its own expense, is requesting the same share as its competitor, MBB.

MBB-ERNO continues to urge the BMFT (Federal Ministry for Research and Technology) not to abandon its request to the French for assembling the second Hermes prototype in Germany. "Otherwise, as with Ariane and the Airbus, only products bearing French labels will appear on the market," German industry warns. MBB managers do not intend to accept the economic argument, particularly since assembly is to take place with preassembled parts. Until now, the French have rejected a second location for integration and intend to have only the rear section with the engine module mounted in MBB-ERNO's Ottobrunn plant.

The discussion about Hermes and the British HOTOL counterproposal, together with the current sizable American efforts in connection with transatmospheric aircraft, have caught the GMFT's attention--and not just of its space officials. A hypersonic technology working group was recently established at MBB-ERNO. However, in order to make a reasonable contribution to Hermes, HOTOL, or other new vehicles, all German participants would have to put together a joint program worth at least DM100 million per year.

As for the engine section of a single-stage spacecraft which is to be able to reach any point on earth in 2 hours, the ESA [European Space Agency] has called for a 6-month study starting on 1 July. MBB, supported by MTU [Motor and Turbine Union], has joined with Rolls-Royce for this study. The competitors will be [the French] SEP [European Propulsion Company] along with SENCMA [National Company for Aircraft Engine Studies and Construction] and the Italian firm, SNIA-BPD.

For the Ariane 5 launcher, Dornier probably will design the cargo bays for multiple satellite launch and the liquid oxygen tanks, and MAN [Augsburg-Nuremburg Engineering Works] will develop the structure of the solid fuel booster.

There is some dissension about the second stage: While MBB will offer an H10 hydrogen version (8 metric ton payload in GTO) without competitors, despite objections the French aerospace authority CNES has licensed the Italian firm SNIA-BPD as a competitor for the L5 stage (5.5 metric tons), which operates with storable liquid fuel.

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CSO: 3698/M203

WEST EUROPE/AEROSPACE

FINLAND TRAINING ENGINEERS FOR ESA, USSR SPACE RESEARCH

Helsinki UUSI SUOMI in Finnish 26 Jun 86 p 9

[Article: "Training of Space Engineers to Begin in Finland This Fall"]

[Text] The training of engineers specializing in space-related subjects will begin at the Institute of Technology this fall. "The development of the training program is the direct result of Finland's more active role in cooperation on space technology projects and in organizations," notes professsor Seppo Urho, the chairman of the task force defining the training program in space technology.

For an example he points to the bilateral cooperative venture with the USSR in manufacturing satellites and instruments for TELE-X. Joining the European Space Agency ESA provided an especially significant impetus for Finland which becomes an incorporated member in 1987. The final decision about membership will be made tomorrow and the agreement will be signed in September.

ESA membership will open doors for Finland to participate, among others, in the new projects, the science program and the systems applications of the future, which are most closely associated with information processing, remote mapping and meteorology. Areas of specialization among the training alternatives include space technology plus its applications and remote mapping. Remote mapping is the least expensive way to survey natural resources, for example. Earlier the teaching of space technology was dependent on separate, and often overlapping, courses within the different training programs. Yesterday the task force defining the development of space technology training program gave its memorandum to Jussi Hyyppa, president of the Institute of Technology.

12989/12947
CSO: 3698/583

WEST EUROPE/AUTOMOBILE INDUSTRY

CONFERENCE ON HYDROGEN POWERED CAR

Frankfurt/Main FRANKFURTER ALLGEMEINE ZEITUNG in German 23 Jul 86 p 8

[Article by Anatol Johansen: "A Hydrogen-Powered Car in the Next Decade?: Technical Difficulties Must Still Be Overcome/Conference of Specialists in Vienna"]

[Text] Vienna, 22 Jul 86--The World Hydrogen Conference, which brings together the hydrogen experts every other year in a different city, could hardly have chosen a better time. Now, following the nuclear disaster at Chernobyl and just as after the oil-price shocks of 1973 and 1979, there is again interest in "alternative" energies, among which precisely hydrogen is playing a large role--after all, it can be obtained from water in practically unlimited quantities and burns to water vapor, at least under ideal conditions, almost without harmful gases.

Thus more than 400 specialists from 42 countries--including the Soviet Union, other Eastern Bloc countries and China--came to Vienna for the 6th World Hydrogen Conference to discuss how far along the possibilities of hydrogen are as an energy source. Even in the past, there was no shortage of good ideas. Thus as early as the end of the 1970's, for example, the American firm Lockheed proposed the establishment of a freight airline in which four hydrogen-powered jumbo aircraft of the type L-1011 were to operate between Pittsburg in the U.S. state of Pennsylvania, Frankfurt/Main and Riad in Saudi Arabia. But since just the conversion of the aircraft to hydrogen propulsion would have cost about $650 million, the project failed: there were no financial backers.

It has also not yet been possible to put into practice a Japanese proposal for a hydrogen-powered express train, as Prof Walter Peschka from the German Research and Development Institute for Air and Space Travel (DFVLR) in Vienna reports. In Canada, on the other hand, the research work for hydrogen locomotives is continuing successfully. For there it seems that with the help of electrolysis one can use cheap hydroelectric power to split water into hydrogen and oxygen and later utilize the so cheaply acquired hydrogen as a means of propulsion.

The automobile industry is achieving rather practical results with hydrogen propulsion, as can now be seen in Vienna. Thus several years ago, the DFVLR, which along with the Austrian Academy of Sciences and the International Agency

for Hydrogen Power has just organized the Vienna conference, equipped a 2-liter BMW 518 with a pressure tank for 120 liters of supercooled liquid hydrogen, which took up almost the entire trunk, however. With this tankful, the car with a carburetor engine covers distances of more than 500 kilometers. The series engine of the car, in turn, was not modified for hydrogen propulsion.

There was a problem, however, in that some of the hydrogen evaporated: after about 30 days, the tank was empty, even when the car had only been parked and not moved. In the meantime, however, there are hydrogen tanks that are considerably better insulated. Today, they said in Vienna, a hydrogen car can be parked for about 3 months before the fuel evaporates.

On the Danube, Daimler-Benz is demonstrating another method under which the hydrogen is bound to a metal (titanium-chrome-mangenese alloy). In this way, to be sure, one can dispense with the large insulated pressure tank in the trunk. But one is getting a weight disadvantage: the hydrogen reservoir is very heavy but can store only 5.4 kilograms of hydrogen. Fifteen so-equipped cars (5 Mercedes 280 TE and 10 Mercedes 230) are being tested in Berlin.

In recent years, they were not idle abroad either. In Switzerland, they experimented with chemically binding hydrogen to the liquid hydrocarbon toluol. The Japanese, in turn, worked with a three-cylinder, two-cycle hydrogen diesel engine and the Americans worked, among other things, with a hydrogen-powered, six-cylinder, 3.8-liter Buick.

All sought in their own way to get around the disadvantages of hydrogen. For one must either keep the hydrogen under pressure in special double-walled tanks at temperatures below minus 250 degress Celsius--at minus 253 degrees, the hydrogen already begins to vaporize, that is, turn into a gas whose energy density is too low--or one must bind hydrogen to other substances, which results in weight problems, among other things. In addition, hydrogen is very light--liquid hydrogen with the same energy content weighs only about one-third as much as conventional fuel. But in energy, it requires considerably more space; in operating with hydrogen over the same distance, one needs a tank about three or four times as large as in conventional operation with gasoline or diesel fuel.

Nevertheless, Hans Hagen from the BMW board of directors in Vienna is counting on a positive development for hydrogen propulsion technology. He presented the first European car propelled with liquid-hydrogen injection: a BMW 745i with a 3.5-liter engine that has just now been perfected. The car with a tank having a capacity of 45 liters and 200 horsepower (150 kilowatts) propulsive power achieves the same performance as a gasoline-powered vehicle of the same type. Hagen admitted, however, that the combustion chamber, the shape of the fuel tank, and other components of the vehicle still need to be optimized for operation with hydrogen. According to Hagen, another decade could pass before there is a hydrogen automobile that is ready for series production. As for the costs of a hydrogen vehicle, Hagen said in Vienna that they would--when the production level of today's cars is achieved--be 10 to 15 percent higher than those of gasoline-powered cars, the kind of difference, then, that is usual today between gasoline and diesel-powered passenger cars.

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CSO: 3698/596

WEST EUROPE/BIOTECHNOLOGY

DANES FIRST TO LEGISLATE GENE MANIPULATION

Stockholm NY TEKNIK in Swedish 19 Jun 86 p 7

[Article by Staffan Dahllof: "Unique Danish Law Governs Genetic Engineering"]

[Text] Copenhagen. The world's first law concerning genetic engineering was adopted by the Danish parliament, the Folketing.

The law prohibits the use of genetically manipulated organisms in nature.

Bacteria which resist frost, and plants with built-in insecticides are the current results of new findings in the field of biotechnology. This kind of use of genetic engineering is prohibited by the Danish law. The authorities can grant an exemption, but not until the principle has been approved by parliament.

The law looks more leniently at genetic manipulations with the aim of creating new biological tools in a closed environment.

All Applications Must be Approved

Bacteria, yeast, fungi, and other organisms which are coded for secreting desirable products such as medications, represent genetic engineering which is permitted in principle.

According to the new law, different applications must, however, be approved from a health and environmental point of view.

All experiments, also in teaching laboratories, must be cuncurrently registered with the authorities. The Danish Food Administration will be the monitoring agency. Later this responsibility will be shifted to the individual county councils (counties).

Special Position Internationally

With the new law Denmark assumes a special international position. In many countries previous restrictions concerning genetic engineering are being abolished.

In Sweden, the hybrid-DNA-delegation only acts in an advisory capacity today. In Sweden, permission is granted according to environmental and work protection regulations which is the case with all other industrial and research activities.

In a pending guideline from OECD it is also maintained that there are no scientific reasons for special laws concerning genetic engineering (see Ny Teknik 1986:14).

It is not quite that easy to find the reasons for the Danish special position. But the public opinion work of the environmental group Noah against the pharmaceutical firms Novo and Nordisk Gentofte have played a major role. The two firms have appealed for permission to utilize genetic engineering for insulin and growth hormone respectively. The trial by the appeals court has not been completed yet.

Parliament Sceptical towards Technology

In general, the attitude of the Danish parliament towards technology is also more sceptical than, for instance, that of the Swedish parliament. The Danish politicians never lent nuclear energy a willing ear despite pioneering efforts with nuclear fission by the Danish physicist Niels Bohr.

The new law concerning genetic engineering is backed by a united parliament with the exception of Mogen Glistrup's Progress Party.

While in committee, the law was made more stringent compared to the government's first proposal. A definite intention to have the law promote advanced biotechnology was omitted. The prohibition of genetically manipulated organisms in nature was added.

To a certain extent the criticism by industry and researchers has also been heard. The final version of the law reduces part of the proposed supervisory bureaucracy. A special law concerning genetic engineering in agriculture was killed in the political committee discussions.

There is still criticism from biotechnology representatives who claim that the law will be an unnecessary obstacle to development.

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CSO: 3698/555

WEST EUROPE/BIOTECHNOLOGY

FIR TREES CLONED BY FINNISH RESEARCHERS

Helsinki HELSINGIN SANOMAT in Finnish 13 Jul 86 pp 3, 19

[Article by Sauli Korpimo: "Select Pines Grow in Test Tubes"]

[Text] Finland Experiments With Cloning Evergreens

Ways of cloning or replicating evergreens are being sought in Finland. The Forest Management Foundation has begun micro-cutting experiments through which an attempt will be made to find out whether it would be possible to quickly grow many identical shoots from artificially generated spruce and pine buds. If the experiment succeeds, increased production can be expected from previously improved trees and the best improvements can be put to use quicker than before.

Sitra has allocated 1.9 million markkas for a 3-year experimental study which is part of the Oulu University cell cultivation research. In cell cultivation a new plant is grown from a tiny cell, a plant part which has been fully developed in micro-cutting replication.

The best pine in Finland could be cloned into millions of identical select trees after a few years if the micro-cutting experiment of the Forest Management Foundation succeeds.

The Foundation began studies this year to determine whether evergreens could be reproduced from the so-called micro-cuttings. Similar experiments are conducted in only 4 countries: New Zealand, the United States, France and Sweden. If the experiment is successful, spruce and pine could quickly provide many identical shoots--although it is true that they would cost more than those grown from seeds.

Ornamental plants are already being cloned throughout the world by the hundreds of millions and the same technique also produces the parent plants required for the seed production of many garden and field plants.

But evergreens have not yet succumbed to the will of the biologist. They are difficult to replicate and many questions are still without firm answers. Nevertheless many dare believe that mass cloning of pines and spruces will soon take place in Finland.

The Forest Management Foundation experiment is part of the pine cell tissue cultivation research performed at Oulu University. The cell tissue cultivation of forest trees has already been known throughout the world for about 20 years. It has been applied primarily to tropical trees, but also birches can be generated with this method.

In cell tissue cultivation the new plant is grown from a bit of cell tissue from a cut in the old plant. At least in principle every cell could grow to become a new plant exactly like its parent.

Micro-cutting replication is a somewhat coarser affair. Instead of working with microscopically small cells, it utilizes already grown plant parts, buds. They can hardly be seen with a naked eye, either, at least not in the beginning.

Micro-cutting replication is related to the standard slip-cutting replication. Berry bushes, poplars, willows and even spruce trees can be grown easily from slips; a young branch is cut and inserted in soil. It takes root and grows into a new tree or a bush.

Slip cutting method, however, is a difficult and a slow way to produce tree shoots.

Not all the branches of trees are equally suitable for cuttings. The qualities of the cultivated trees also have to be first treated in experiments that may take several years. This is not good since only the branches of young trees will take root. It could happen that the tree has been judged suitable, reproduction is desired, but the branches will no longer take root.

In addition, the branches of a 10-year-old tree have already specialized into branches. Even when the branch is placed vertically into the ground it still thinks it is a branch and turns to grow horizontally. Only after years will the branch understand that it is a tree and turn its trunk upward.

Finland's most important tree, the pine, cannot even be grown from slip cuttings.

The Forest Management Foundation is now seeking ways to aid and promote cutting replication. Researchers are trying to artificially generate new buds on trees and to get the buds to grow into trees. It still remains to be seen whether nature can be manipulated to the extent that the tree will always think that it is young.

If the experiments succeed, the previously cultivated trees will produce a greater return and the best improvements will be available for use in large quantities more quickly.

Three Woman Task Force

Maija Salonen, a Licentiate of Philosophy; Natural Science Candidate Sinikka Salonen and laboratory aide Paivi Majasalmi experiment with micro-cuttings at the Haapastensyrja Forest Management Center at Loppi.

Salonen has already discovered that "Spruce buds will grow into shoots but pine buds will not."

The production of new trees begins with the selection of mother or parent trees. The greenhouse has a few hundred offspring of the improved trees. They are being sprayed with a cytokinin growth hormone. Cytokinin is a hormone of the plant's juvenile phase. It has been used to induce buds on a 100-year-old pine. "If the new bud is physiologically not as old as the parent plant we have achieved a lot," says Maija Salonen. All shoots have plenty of undeveloped buds that remain at a dormant stage. Salonen stimulates the resting buds to grow by changing the hormonal balance of the plant. The plant is given a hormone twice a week and after 2 weeks a small swelling becomes visible between the needles; the bud is growing. More hormones and soon the plant is full of little pimples; it has tens, perhaps over a hundred new buds.

Over 2 months the buds are separated and taken into a laboratory to grow into micro-cuttings.

But there are many dangers on the way to new life, for example disease-causing bacteria and spores of mold fungi. For this reason Sinikka Salonen and Paivi Majasalmi take each bud with tweezers, dip it into alcohol and hypochloride and then rinse it several times with distilled water. After handling each bud they sterilize the tweezers.

Difficult Spots Remain

The sterilized buds are placed in test tubes containing nutrient broth. It has everything needed: minerals, sugar, vitamins and growth hormones. Spruce buds can grow a half centimeter in a month.

But would it not be better if the bud could be grown into a shoot already on the tree? Then one would not have to transfer the buds into test tubes, but put tiny shoots in them instead. Pine buds do not grow appreciably in test tubes although 95 percent of them will begin growing on trees. "We have been transferrring them with and without needles and have removed the bud scales. There are sitll many other possibilities that have to be tested," Maija Salonen explains.

Americans have developed a method which can be used to reproduce their native pines. It can be of great benefit to the Finns, but an American patent will not work as such in Finland. Our pine is a different plant.

When the small shoots in the test tubes reach 2 centimeters they can be induced to grow new buds. This is where the efficiency of the new method lies; artificially generated buds are separated from the micro-cuttings, they are extended, allowed to grow new buds, detached, extended, and so on endlessly. One bud can produce a large number of shoots.

The shoots that have reached a length of a centimeter or two are transferred from one test tube to another containing auxin hormone. It is time to begin growing roots, to become a real tree.

No one knows yet under what conditions the roots would be best grown. In sterile laboratories or under ordinary conditions? That too has to be tested.

In the greenhouse the small shoots have ideal conditions, eternal summer. The temperature is 23 degrees and the light shines for 16 hours per day; moisture and nutrients are provided as appropriate.

But how does a pine intended for a northern evergreen zone at the edge of a tundra behave in eternal summer? Researchers assume it will not fare well with such treatment. The hardening of the shoots will begin. The temperature is lowered and the length of daylight is shortened. Finally the shoot gets the winter treatment. It is thought that perhaps the buds will not begin to grow unless the tree gets to rest in between. Only a few hardening techniques have been tested at Loppi.

A difficult situation still remains to be confronted; what happens to the laboratory shoots when they are transferred into an ordinary greenhouse? The intention is to plant them in turf and grow them just as ordinary cultivated seedlings.

A Special Product for Those Who Pay More

And what if all goes well and we have learned to replicate the pines? Will the Finnish pines be replicated until all the heaths are full? "No," says Martti Lepisto, the director of the forest management program of the Foundation. "It would provide too great a danger of disease and pests. They spread easily in genetically homogeneous growth. The same heath will get shoots cloned from different trees."

Nor do all the clones from the same tree grow exactly the same in the forest. They will have differences according to their place of growth.

Selected strains of replicated trees will not, however, be planted in every farmer's woodlot in the near future; they are clearly more expensive than ordinary shoots grown from seed. For example, the price of shoots grown from cuttings in New Zealand rose tenfold.

"This will be a better and a more expensive special product," says Martti Lepisto. The Foundation studies micro-cutting replication with a 1.9-million-markka grant until 1988. Lepisto, however, will not promise a finished product by that time, since even the growth of a spruce shoot takes 3 years. Cloned shoots thus should have been ready this year already.

12989/12947
CSO: 3698/583

WEST EUROPE/BIOTECHNOLOGY

BONN ANNOUNCES MEASURES TO PROMOTE BIOTECHNOLOGY

Duesseldorf HANDELSBLATT in German 17 Jul 86 p 3

[Article by H.J.S. under the "Biotechnology" rubric: "Better Climate for Peak Performance: The Federal Government Wants to Accelerate the Pace of Innovation"]

[Text] Bonn, 16 Jul 86--The Federal Government attaches growing importance and a high innovation potential to biotechnology. This was pointed out by Heinz Riesenhuber, federal minister for research and technology in Bonn. At the same time, he drew attention to the fact that biotechnology, as a key technology with a "broad effect," influences many technical areas. In the future, according to Riesenhuber, the Federal Government's promotion measures for biotechnology and gene technology will be concentrated on four objectives:

--Peak scientific and technical performance is to be encouraged and demanded. It is desired to establish a friendly climate for research through appropriate general conditions. The general conditions include the preferential support of persons and installations capable of outstanding performance, the securing of the necessary latitude for the competition of ideas and discoveries, and the distinction and recognition of such performance by the state. Riesenhuber named the gene centers in Cologne, Heidelberg and Munich as examples for the measures that have since been introduced in biotechnology.

--The pace of innovation in the German economy is to be accelerated. The most important promotion instruments are central key projects and projects of integrated research. These direct supporting measures are supplemented through indirect measures with rather broad objectives that are intended to promote mainly middle-class industry and the rising generation of scientists. Supporting resources are made available for middle-class industry through a measure that is very much simplified administratively.

--Research and development projects in special areas of state provision for the present and future: in Riesenhuber's opinion, biotechnological research makes a substantial contribution to the resolution of public tasks--in the areas of health, nutrition and environment, for example. It is important to

make use of the chances that are being opened up by the new methods in gene technology and cell biology, especially for the development of drugs or plant breeding.

--The future chances of the rising scientific-technical generation are to be improved through qualified training. In the medium term, it is to be expected that the expansion of the research capacities in economic enterprises and public institutions will lead to a greater number of jobs for appropriately trained young people, thinks Riesenhuber.

9746
CSO: 3698/598

WEST EUROPE/BIOTECHNOLOGY

DETAILS ON FRG BIOTECH RESEARCH AT BRAUNSCHWEIG, BAYER, HOECHST

Rijswijk PT/PROCESTECHNIEK in Dutch Oct 85 pp 65-69

[Article by P. Verlaan, R.S. Hamstra, A.C. Hulst, L.E.S. Brink, M. Fontyn, J. Tramper and K. van 't Riet: "Biotechnology in the Federal Republic--Far-reaching Cooperation between Businesses, Institutes and Universities"; first paragraph is PT/PROCESTECHNIEK introduction]

[Excerpts] In May of this year, a group of nine co-workers from the production technology section of the LHW [Wageningen Agriculture Institute] paid a working visit to five German businesses and institutions where biotechnology plays an important role. The purpose of this visit was to get mutually acquainted and exchange information and ideas. That is to say that along with lectures and tours organized by the organizations involved, there was also time reserved in the program for the presentation of a part of the production technology section's biotechnological research. This article provides a summary of their experiences and impressions.

Hannover Technical Institute

The "Institute For Technical Chemistry of the University of Hannover" is a division of that university with an average staff of 65 to 70. The division's field of research encompasses many topics and projects which are divided into seven sections: biotechnology, measurement technology, noncatalytic gas/solid and solid/solid reactions, separation processes and enzyme technology, homogeneous gas reactions and molecular spectography techniques, process dynamics and, finally, catalysis. The focal point of the activities (50 percent) is in the biotechnology section and in the separation processes and enzyme technology section.

An example of the last-named field of research is the application of liquid membrane systems in a bioreactor, in which both reaction and extraction take place via just one such membrane.

The influences of acidity level and temperature on the activity of the immobilized enzyme are also being investigated, primarily because these factors can differ from those for pure enzyme systems.

Other interesting research projects which were explained at the Institute for Technical Chemistry and which will be more closely examined in the 'GBF [Institute for Biotechnological Research] Braunschweig section are the development of a "low-shear" reactor on which the gas intake (ventilation) occurs by means of a moving membrane system that at the same time provides a complete mixing of the reactor, and measurements of the speed of bubbles in a bubble column with ultra-sound-doppler anemometry so that the speeds can be measured even in fermenting liquids with a high degree of opacity.

The institute's laboratories are equipped with a computer infrastructure that permits an efficient use of the apparatus for diverse applications. To this end, a computer system has been set up with a pyramid-shaped hierarchy: VAX/11 and PDP/11 machines that are linked by various microprocessors. These facilities are used, among other things, in an enzymatic catalysis in an airlift-loop reactor. The process in the reactor is described by a distributed parameter model in which a single parameter can be experimentally varied at any time, while the remaining parameters stay constant. In this way, the specific influences of the separate parameters can be carefully investigated.

Table 1: The Institutions Visited

Institution	Host
TU, Hannover	Prof K. Schluegerl
GBF, Hannover	Dr M.R. Kula/Prof J. Klein
Bayer, Wuppertal	Prof G. Schmidt-Kastner
Hoechst, Frankfurt	Dr U. Faust
KFA, Juelich	Prof C. Wandrey

GBF Braunschweig

The "Institute For Biotechnological Research, MbH." (GBF) was formed in 1976 from the "Institute For Molecular Biological Research", originally founded by the Volkswagen foundation. Since that time, GBF has received 90 percent of its financing from the federal government and 10 percent from the state of Lower Saxony. Personnel currently stands at 370, of which 120 are academics. The budget for 1984 came to DM 30 million.

An important research goal within GBF is the potential for employing the biochemical capacity of microorganisms, cells and enzyme systems for application in processes for chemical products. The facilities and the infrastructure of GBF are such that even complicated biotechnological projects, beginning with studies in microbiology or cellular biology and going on to the study of a process in a pilot plant, can take place under one roof. Research into potential applications on an industrial scale is set up so that the results of the research can be used by industry for the further development of a process. Intensive cooperation is taking place between working groups from industry, the universities (chiefly the Braunschweig TU [Technical University] and the Hannover TU) and other institutions(KFA [Nuclear Research Lab] Juelich).

The field of scientific endeavor can be roughly divided into four parts: microbiology, cellular biology and genetics, enzyme technology and the

chemistry of natural products, and bioprocess technology. We were introduced to the different divisions during the tour of GBF. A few projects were explained by the people involved. In the microbiology division, for example, research is being conducted on the synthesis of antibiotics from slime bacteria (myxobacteria), the formation of pigments with nannocystis, and the formation of steroids. In cooperation with the enzyme technology division, work is also being done on cofactor regeneration in L-amino acid production. This process is described in the "KFA Juelich" section of this article. A few striking projects which clearly bear the mark of GBF will now be explained in more detail.

Beta-interferon production from the L-cells of mice is the sort of project where the research takes place in the divisions for cellular biology, genetics and bioprocess technology. DNA-transformed L-929 cells from mice are used to investigate how human beta-interferon can be produced in bioreactors (up to 70 liters).

Another project is the production and refinement of intracellular enzymes. This research takes place in the enzyme-technology division.

Table 2: Overview of the Focal Points of Biotechnical Research at the Institutions Named in Table 1

Institution	TU Hannover	LHW	GBF	Bayer	Hoechst	KFA
Subject						
membrane reactors	X	x	x	X		X
airlift reactors	x	x		x	x	
ultrafiltration		x		x	x	
aeration [dmv] membranes	x		X	x		
cofactor regeneration	x	x	x			X
single cell protein					X	
automation of fermentations	x		x	x	x	x
downstream processing	x	x	X	x	x	x

Bayer Wuppertal

Part of the health care sector of Bayer (a component of the pharmaceutical division) is located in Wuppertal. The health care sector is subdivided into six business units, three of which are in West Germany and another three are located in the United States. In the FRG: pharma ethical products, self-medication, consumer products. In the United States: hospital products, biochemistry products, diagnostics.

We visited the pharma ethical product business unit, which is subdivided into basic research, production and development (P&D), clinical research, and marketing and sales. The tour took place chiefly in a subdivision of P&D, biochemical process development. Areas of interest here are:

--The development of new processes for new products;

--the development of new processes for existing products;

--biotechnology;

--the production of bioproducts for small-scale clinical evaluation;

--providing service to and trouble-shooting for the other business units of the Bayer concern.

Without directly referring to the abovementioned division of labor within the biochemical process development, some of this subdivision's noteworthy fields of research will be touched on below. In cooperation with Alfa-Laval, Bayer has developed a continuous sterilization process. This system reduces the costs associated with unit operation because the fermentor only needs to be sterilized once during the continual operation. At the same time, it is possible to reclaim energy from this system, which is scarcely possible in the batch process when several batches are in operation alongside one another. Several examples of the application of membrane reactors at Bayer were explained, such as the application of native penicillin acylase in a reaction process. The half-life of this enzyme is approximately 12 hours. The enzyme activity can be improved, however, by a factor of 25 by immobilizing the enzyme and letting the process take place in a watery solution in the abovementioned reactor (ultra-filtration reactor).

Another application is the splitting of a racemic mixture of DL-amino acid esters in a membrane reactor. Here, subtilisine is immobilized in the porous structure of the membrane. Autocatalysis is a problem with this process (1 percent per hour at 37 degrees centigrade and pH = 7). Time at the reaction front can be minimized with proper use of the membrane reactor, while that of the reaction front so that autocatalysis can be limited to a minimum.

Research into bioreactors is done with simultaneous operation on the same scale of a second-generation bioreactor, such as the airlift-loop reactor, and a conventional production process consisting of a battery of completely controlled and guided fermentors.

Furthermore, things at Bayer are so organized that the process apparatus has been developed so that several unit operations take place in the same formations. An example of this is bioconversion in a membrane reactor and the production separation of methyl-N-acetykl-DL-methionine into N-acetyl-L-methionine by electrodialysis.

Hoechst Frankfurt

Biotechnological research at Hoechst is an integrated unit within the plant and is concentrated on the pharmaceutical, agricultural an environmental fields. The Central Research Division, of which Biotechnology is a subdivision, is working on the development of new products, methods and techniques which can lead to new possibilities for the business. The four major lines in biotechnological research are the development of new enzymes for the food industry and new chemicals (basic research); process development of continuous fermentation of a flocculating yeast for the production of ethanol; waste-

water treatment and single-cell protein production. This last subject forms the most important block of research at Hoechst.

Juelich Nuclear Research Plant

The Institute For Biotechnology (IBT), established in 1977, is one of the fourteen institutes that together form the Juelich Nuclear Research Plant. The roughly 400 employees are divided among three research groups: microbial degradation of biopolymers, biotransformations, and biological waste water treatment.

The enzymatic hydrolysis of the polysacrides cellulose and hemicellulose is economically attractive route to such things as glucose, xylose, amino acids, ethanol and methane. With the aid of gel-chromatography and gel-electrophoresis, IBT is isolating cellulose and hemicelluloses from aspergillus niger microorganisms. They are trying to increase the productivity of these enzymes through mutant selection and genetic manipulation. The kinetic characteristics and stability of the biocatalyser are being investigated in the enzyme-membrane reactors with the aid of HPLC [high pressure liquid chromatography] analysis.

The second research group (biotransformations) is occupied with the economy of biocatalysers (like enzymes, enzyme complexes and cells). Much research is directed towards the enzyme-membrane reactor which makes it possible to keep enzymes, enzyme systems and even cofactor regeneration systems in a homogeneous state in the reaction medium, while the reaction products can be continuously carried off by an ultra- or micro-filtration membrane.

The breakdown of organic materials in waste water (for example, acetic acid and butyric acid) into biogas with the aid of anaerobic bacteria is another important field of research at IBT. The biogas activity of a few suitable classes of bacteria has been significantly optimalized.

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CSO: 3698/549

WEST EUROPE/BIOTECHNOLOGY

FRG SETS UP NEW INFRASTRUCTURE FOR GENETIC RESEARCH

Frankfurt/Main FRANKFURTER ALLGEMEINE ZEITUNG in German 19 Jul 86 p 4

[Article: "New 'Infrastructure' for Gene Technology"]

[Text] Bonn, 18 Jul 86--A new infrastructure has been set up for research and development in the area of biological and gene technology. One year after the corresponding program of the Federal Government was presented, three gene centers in which universities, research installations outside of the universities, and industry are cooperating are operative in Heidelberg, Cologne and Munich. They will be supported by the Federal Ministry for Research and Technology for 12 years. The fourth gene center will be set up in Berlin as a permanent facility. The senate and Schering AG are participating in it.

In an interim analysis of the program, the Federal Ministry for Research and Technology pointed out the high innovation potential of biotechnology. Biological process engineering has turned out to be a weak point. Two focal points are to be established in this research discipline. This subject is to be developed at the University of Hanover in close cooperation with the microbiological institute of the University of Goettingen. Researchers in Stuttgart are to deal with biological decomposition under the exclusion of air (anaerobic). They are also joined by the Fraunhofer Institute for Interface and Biological Process Engineering.

As Binder, the responsible official in the Research Ministry, said in Bonn, there are some difficulties in the changeover from the direct project promotion previously practiced to special promotion of biotechnology, in which the scientists have relative freedom in disposing of state grants. The close association between university and industrial research is considered a way out. In addition, small and medium-size enterprises can develop their research capacities in especially promising areas of gene cell culture and enzyme engineering within the scope of a special concept . For this purpose, about DM100 million are available through 1989.

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CSO: 3698/598

WEST EUROPE/BIOTECHNOLOGY

FRG: BACTERIA PRODUCE AMINO ACIDS BY MUTANT GENE MANIPULATION

Solothurn CHEMISCHE RUNDSCHAU in German 30 May 86 p 5

[Article by A.N.: "Bacteria Produce Amino Acids: Using Mutations To Deal With the Control Loops"]

[Text] To meet the need for amino acids, around 500,000 tons are roduced per year, circa 300,000 tons of monosodium glutamate along, which is used for spicing foods. For feeding animals, synthetically produced methionine (100,000 tons) and lysine extracted in fermentation (40,000 tons) are currently used to enrich fodder. Pharmacology, on the other hand, needs relatively small amounts of amino acids.

A growing need for amino acids, above all natural ones, requires economical processes. In the future, biotechnology can make an increased contribution to this, as investigations at the biology department of the University of Bielefeld have shown.

Most bacteria are capable of synthesizing amino acids themselves. Starting with genes for synthesizing amino acids, the enzymes that catalyze the biosynthesis of amino acids in the cell are built via transcription and translation. If, moreover, the amino acid is sluiced out of the cell, then it can accumulate in the surrounding medium. This occurs chiefly with corynebacteria and brevibacteria, which explains why they are used intensively in the production of amino acids by fermentation.

Bacteria normally produce just the amount of amino acids needed for heir metabolism. To this purpose, they have developed different control loops, for example at the transcription level. A repressor protein, activated by binding with an amino acid, can be taken up by an operator site on the bacteria's chromosome and so break off the transcription.

When there is a lack of amino acids, the bonding to the operator site is released and the gene can be transcribed. Another control loop exists on the enzymatic level: The amino acid that is formed can inhibit one of the enzymes of the metabolic path and so reduce the enzyme's activity.

All these control loops are detrimental to the extraction of amino acids by fermentation. A possible remedy is to produce suitable mutants through

selection. The disadvantage of this method is that the mutations have to be unspecific, and hence there results the laborious task of mutant selection. Genetic technology, however, makes a specific intervention into the bacterial genome possible. After one of the genes for synthesizing amino acids has been suitably cloned, an increased number of copies of this gene will be present in the cell.

If one starts with the assumption that the enzyme determines the effectiveness of the path of biosynthesis, then an increase in the amount of enzymes should also mean a greater amount of the end product. But this does not exhaust the possibilities. It is possible not only to deliberately break off the abovementioned control loop, but also to further optimize the transcription and translation of the gene for synthesizing amino acids. Recently, one has hoped for new potential applications through modifying proteins (protein design). The optimization of a strain through gene technology will thus represent an essential factor in the future of biotechnology.

Most processes are currently carried out in fermentors, in sterilizable vessels with tubes for supplying air and media as well as instruments for controlling the process. The size of the reactor depends on the procedure; the size of the vessel for fermenting amino acids can reach 450 m_3.

Production is started by inoculating the strain to be produced in a medium that has been autoclaved in the fermentor. The cells grow to a density of up to 10_9 to 10_{10} cells per milliliter. This sort of batch fermentation, which has to be started over after each harvest, takes between 24 and 72 hours. The medium contains either simple carbon and nitrogen sources, from which the cells build the desired amino acids, or additional, chemically synthesized preliminary stages that can be biologically transformed in a few steps. Molasses, a by-produce of the sugar industry, often serves as an inexpensive raw material. The concentrations of the product that can be obtained depend on the amino acid desired.

12507/12379
CSO: 3698/584

WEST EUROPE/CIVIL AVIATION

EUROPEAN FIRMS PRESENT AIRLINER, PROPFAN PROPOSAL AT HANNOVER

A330/A340, MPC-75 Projects

Stuttgart FLUG REVUE in German No. 7, Jul 86 pp 22-23

[Article by Klaus Mueller: "German Propfan Aircraft;" first paragraph is FLUG REVUE introduction]

[Text] With the Airbus family increased by the A330 and A340, and with the MPC-75 project, the Europeans are looking for a market. Success brings self-confidence.

European industry, and the Germans, in particular, seized the opportunity: Boeing was absent from the International Air Show [at Hannover] and, therefore, European airliner manufacturers had the stage all to themselves. Airbus Industrie took advantage of the situation to show its production capacity; the A310-300 was there as the only "genuine" commercial airliner on the exhibition grounds and drew attention to the development capacity of the Airbus family. The distinctive external feature of winglets made the 200 version stand out from the others and introduced the technical innovation of this alternative to the high capacity aircraft commonly used in European air traffic.

However, the future of the "twins" is still uncertain, that is, that of the four-engine, long distance Airbus A340, and of the planned A330, the largest, although two engine, European model which will have the same wings as the A340. Nevertheless, Jean Pierson, president of Airbus Industrie, seemed to be confident that the five launching customers--considered necessary to start the program--for both versions will be found by the end of the year. There is still some concern about the design of the engine for the long distance A340--preferred by Lufthansa and Swissair, among others--since the range promised by Airbus Industries has not yet been reached and there are differing opinions on whether it can be achieved. The international consortium, IAE, which is developing the V2500, has too much to do to manufacture an engine for the "small" Airbus 320 in series and in due time. The CFM-56-5 model, which is under discussion as an alternative for the A340, "is a good engine," as Lufthansa experts admit, "but is based on the technology of the 1970's." Anyway, Lufthansa does not make any secret of the fact that it would prefer a V2500, if it ensured the required performances. IAE is confident that by the end of the year it will be able to overcome its initial difficulties with

Rolls-Royce compressors. Lufthansa also takes into account the smaller expenditures for maintenance and spare parts if the same motor, even in different versions, can be used for two models in their fleet.

In the meantime, the Europeans also seem to be leaning toward a decision to equip their airliners with the profan, the power plant which is supposed to combine the advantages of propeller and jet. However, European aircraft and engine manufacturers do not believe that the first propfan-equipped aircraft will be able to enter service as early as 1992, as Boeing is assuring its customers. According to many Europeans, the discussed project still contains too many uncertainties to maintain the scheduled timetable. Nevertheless, the German Motoren und Turbinen Union (MTU), which has acquired a good reputation in international partnerships, indicates that it does not want to bypass the new technology. MTU definitely intends to apply its CRISP [Counter Rotating Integrated Shrouded Propfan] concept to the A320. Even the board of the Airbus Industrie no longer rejects out of hand the unshrouded propfan as a power plant, although its development is not scheduled until the second half of the 1990's.

MBB is relying entirely on the new power plant for its MPC-75 model, which has been protected for a long time as a state secret. The contract for a joint development plan with the Chinese company CATIC had jsut been signed with the German technological company when an explanation of the intentions concerning the power plant was given: General Electric hopes that it will be able to cooperate in the planned project with its unducted fan design.

However, the model, based on which the Germans and the Chinese agreed on the first developmental stage, shows two unshrouded turbines on the tail equipped with two counter-rotating propellers. Designed for 75 to 85 passengers, the MPC-75 should operate for short distances of up to 1,800 km; thus, it is somewhat in competition with the Dutch Fokker F100. MBB engineers are obviously confident of being able to meet competition in this field through the higher performance expected from the propfan.

In any event, the company has already secured a large market through the cooperation with the Chinese agreed to in Hannover if the project leads to mass production. The PRC has a great backlog of demand for aircraft and must build infrastructures for the country's development, which is only possible through air connections because of the extensive size of its territory. Fears that Beijing may be having a customized aircraft developed at German expense are countered by the example of previous agreements in other fields.

There is however no doubt about the fact that the Chinese want to take advantage of Western technology. It appears from the few Western airliners ordered to date that the PRC can afford only limited imports of the expensive leading products of Western technology, and must make part of these expenses inside the country. At the same time, and this applies to other fields as well, the PRC is trying to find a connection with modern technology to promote its own industry. The assistance made available to the Chinese is welcome and greatly appreciated, as several examples prove. Moreover, those who do not refuse

assistance during this difficult period of Chinese development policy will be welcome in China in the future as well, and it is no secret that the Far East--and not merely the PRC--will offer the greatest developmental potential, and possibly the only one, in the air transportation field.

MTU 'CRISP' Propfan

Stuttgart FLUG REVUE in German No. 7, Jul 86 p 26

[Article by Goetz Wange: "MTU Presents the New Power Plant System, CRISP: Propfan for Airbus"; first paragraph is FLUG REVUE introduction]

[Text] During the International Air Show [at Hannover], MTU [Motoren und Turbinen Union] presented a propfan engine that is suitable not only for the small Airbus 320 but also for large long distance jumbos. The project will be developed with financial support from Bonn.

Airbus has overcome its initial dislike for propfan power plants. This does not mean that the managers in Toulouse have suddenly changed their opinion of the risks of developing this mixture of propeller and jet technology, which promises about 25 percent savings in fuel. Instead, MTU has provided an idea which better suits the range of Airbus models equipped with supercritical wings; namely, CRISP (Counter Rotating Integrated Shrouded Propfan), a shrouded propfan version which can also be installed under the wing.

Thus, the German propfan alternative contrasts with General Electric's Unducted Fan [UDF], which should undergo its first flight test this summer on a Boeing 727. The UDF can only be installed as a pusher propeller on the tail of a commercial aircraft.

MTU's CRISP offers the following advantages: Noise propagation is reduced considerably by shrouding the propfan, and also the danger resulting from defective blades is lower. Structural and weight advantages can be obtained through installation on the wing, similar to the turbofan engines currently manufactured. Moreover, this makes it possible to retrofit existing aircraft with the new power plant without major modifications.

The development of this project would have a significant market impact for Airbus. It would be possible to attract customers who have so far been reluctant to order the 150-seat Airbus A320 because they have been waiting for the competition, the Boeing propfan named 7J7.

With regard to propfan development costs, the engine industry is trying, first, to introduce as many existing technologies as possible. If CRISP is developed, the engine would then be established in the framework of the international consortium, IAE, which also designed the V2500 engine for the A320 model and whose hot section could be ideal for the CRISP.

The airlines may also prefer the CRISP propfan to General Electric's UDF because, according to preliminary calculations, the CRISP can reach speeds of

Mach 0.8 compared to the Mach 0.7-0.76 of the competition's unducted engine. This speed differential is particularly significant during long distance flights. Therefore, CRISP seems to be suitable, in a larger version, for jumbos as well as A340's.

During the ILA, MTU provided the following technical details for CRISP:

-two-stage, counter-rotating, controllable pitch propellers (12 blades each);

-short, low resistance propeller shroud of light-weight construction with noise reduction;

-counter-rotating "in-line" planetary gears.

Industrially speaking, MTU depends on Pratt & Whitney. In order to obtain good results during production, the Germans are carrying out an extended technological program with the support of the BMFT [Federal Ministry for Research and Technology]. Early in 1987, the first wind tunnel evaluation of the CRISP concept should start in the German-Dutch wind tunnel and in other DFVLR [German Research and Experimental Institute for Aviation and Space] experimental facilities.

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CSO: 3698/M201

WEST EUROPE/CIVIL AVIATION

SAAB-MCDONNELL DEAL MAY FALL THROUGH, SF340 TOO COSTLY

Stockholm DAGENS NYHETER in Swedish 27 Jun 86 p 8

[Article by Goran Jonsson]

[Text] Linkoping--Saab-Scania may be forced to drop production of tail units for the MD-11 for the American aircraft manufacturer McDonnell Douglas. This project was to have been a short-term solution to the problem of maintaining jobs at Saab's Aircraft Division.

The reason is that Saab's own civil aircraft project, the SF 340, has required so much investment money. For this reason, Saab went to the government and asked for a low-interest loan, but the government refused. The industrial policy that says industrial projects must be self-supporting remains intact.

Saab had previously borrowed 350 million kronor from the government for its SF 340 project.

Problems maintaining employment will come now that military orders are declining. In addition, there will be a gap of several years between the Viggen and the JAS. Saab must compensate for this decline by increasing civil production. Just several years ago 90 percent of all production was military. This year civil production is expected to exceed 50 percent.

The already difficult conditions of the SF 340 project became even worse last November when Saab's American partner Fairchild Industries withdrew from the project because of economic problems. At that time, Saab was forced to make even greater investments. Fairchild paid Saab $32 million (about 230 million kronor), but transferring half the aircraft production has been a heavy burden, nevertheless. Among other things, a new wing factory had to be built.

Aircraft Division chief Harald Schroder called this a time of investment and admitted that the SF 340 project was not proceeding particularly well at present.

"We have already invested so much long-term capital that we will be unable to produce the MD-11 without government loans at favorable rates," Harald Schroder said.

He stressed, however, that this was not a question of subsidies.

"This is a profitable project in which the government will benefit, as well. But it will take time before the money is recovered," Harald Schroder said.

Profits In Nineties

Saab will not recover its investments in the SF 340 before the 1990's. The original break-even level, after which the project would begin to yield profits, has been adjusted upward time after time from the original figure of 200 planes sold. The most common figure used today is just over 300 planes, but figures of 350 and even 400 planes have been mentioned.

Saab has not released any information to clear up all the speculation.

"The question of a 'break-even' level is meaningless. I do not know how many planes comprise this level. There is no one sitting around calculating this level day after day," said Harald Schroder, who added that no one was asking how many Saab 9000's had to be produced to break even.

Saab now has 90 SF 340's on firm order, 54 of which have already been delivered, and options for about 10 more (Saab must begin repaying the government loan after 100 planes have been sold). In conjunction with the transfer of production to Sweden, there will be a slowdown in production, with six planes produced in 1987. When production is in full swing, 50 planes will be produced each year.

The original plan was for the SF 340 project to pay for itself in 1986.

Harald Schroder does not want to "publish any account" of how much it cost Saab to take over the entire project. Saab has invested a total of about 2 billion Swedish kronor in the SF 340.

Best Seller

At present, 7 years after it began, the SF 340 project is going worse than expected. But this airplane is of a size (30 passengers) that is the best seller in the world--sales are almost twice as high as that of its competitors. According to Saab, the Canadian firm DeHavilland has sold 32 of its Dash-8 planes, while Brasilia has delivered only about 15 planes. Saab does not consider the Italian-French ATR-42 to be a competitor. This plane is a size larger.

When Saab began its first civil aircraft project in modern times in 1979, the total world market was estimated at 2,000 airplanes. But these predictions, which were based on rapid growth over a few years, have now been discredited. Today the market is believed to be between 1,000 and 1,500 planes over a period of 10 to 15 years.

Half of the market is in the United States, as a result of the upswing in regional airlines and the deregulation of aviation in 1978. The desire to

sell the plane on this important United States market was one reason why Saab sought an American partner. A sales organization had already been developed when Fairchild withdrew from the project, so that Saab is now active on the American market.

Both Saab and outsiders believe that the long-term consequences of the Fairchild withdrawal are positive. Many production problems resulted from late deliveries from Fairchild. In addition, Fairchild does not have a good reputation.

All the problems surrounding the SF 340, with its engine problems, groundings, and other difficulties, have not damaged Saab's reputation internationally. Much good will has been lost in Sweden, however.

The largest Swedish customer, Swedair which purchased 10 planes, has praised Saab, however, for tackling all these problems and considering them to be extremely serious. In brief, Saab has taken full responsibility for the product.

"Next winter there will be no problems," Saab's Aircraft Division chief Harald Schroder said.

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CSO: 3698/614

WEST EUROPE/CIVIL AVIATION

MBB'S ACTIVITIES, PLANNED STRATEGIES

Frankfurt/Main FRANKFURTER ALLGEMEINE ZEITUNG in German 23 Jul 86 p 13

[Article by G.M.: "The Airbus Has Again Brought Substantial Losses: MBB Between Visions of the Future and the Everyday Routine/Flirting With China and Indonesia"; boxed material is included as the last paragraph]

[Text] Messerschmitt-Boelkow-Blohm GmbH (MBB), Ottobrunn--A company like the air and space concern MBB must look far into the future to be able to recognize its enterprise goals and set the proper priorities. MBB chief Hanns Arnt Vogels sees above all three important future themes: Europe's civilian and military utilization of space, the European air defense in the year 2000, and the policy in the area of civilian aircraft. If possible, MBB wants to function as the German system leader in the large international programs that are up for debate here.

In its efforts to establish the necessary resource latitude for the important tasks, MBB has intensified the "free," that is, self-financed research and development. Meanwhile, these expenditures add up to about 8 percent of the enterprise net performance. For Vogels, of course, this is the upper limit of what the enterprise should take on in the long term. The current investment projects (the total accruals of tangible assets of DM320 million most recently may well be increased by another DM50 to 60 million in 1986) include a laboratory building for a newly established central field whose main task is microsystem technology, that is, the combining of microelectronics, optronics and micromechanics. In addition, a "Service Center Electronic" is being established in cooperation with American firms that is to cover a large number of interconnected development jobs.

The path into the future, which in part shows the vague outlines of science-fiction visions, is doubtless paved with difficulties; Vogels speaks of "discontinuities." The best example for this is currently being provided by space operations. Here the visions extend from the project of the European space shuttle Hermes, which Vogels cannot imagine without a German participation of at least 30 percent, to the development of "hypersonic programs," which in the next century are to make possible the transport of things and people at a speed of 10 to 20 mach. To be sure, the ordinary daily routine is being influenced by the results of the "Challenger" disaster and of

the unsuccessful launch of an Ariane rocket. Although delays are expected, MBB hopes to manage without a drop in employment.

In the area of military aircraft, the uncertainty about the PAH-2 antitank helicopter conceived as a joint German-French project is currently the worry of the day. In the unwelcome event of a failure, Vogels would see a national German development as the only feasible alternative.

Meanwhile, to reduce its dependence upon the large Airbus airliners in civilian aircraft construction, MBB is now thinking about building smaller airliners with 75 to 100 seats. For them, it has an eye on China and Indonesia as future markets and partners--in the case of Indonesia, jointly with Boeing and possibly with Fokker as well. The current Airbus production (A 300 and A 310) had to be further reduced to 2.7 units monthly.

In the matter of profit, that threw cold water on some wonderful dreams and caused the Airbus to book a loss of DM130 million in 1985 (DM110 million the previous year); there are hopes for a reduction to DM60 million in 1986. The situation is unsatisfactory in several other areas as well. DM90 million from changes in foreign-exchange parities were mainly covered through reserves that became available.

Excluding certain export receipts, the operating result is characterized as balanced (DM90 million the previous year). The export receipts have determined the addition to reserves (approximately DM73 million). An unchanged balance-sheet profit of DM 36 million is reserved for the partners.

In the coming year, MBB hopes to be able to begin another sales boom. Under old plans, according to the manaagement with some reservations, it is to be DM7.4 billion instead of the DM6 billion achieved in 1985 (plus 5 percent). The new plans are now yet ready, however.

[Boxed item: MBB has entered into a cooperative contract for industrial robots with the Japanese Toshiba concern. The know-how of MBB in system engineering and the planning of automated factories is thereby to be combined with the experience of the Japanese robot manufacturer. Toshiba delivers robots that are geared by MBB to the respective applications and incorporated into automation systems. In this way, the product area automation engineering of MBB, along with a self-developed driverless transport system, can offer a complete family of robots and thus an additional key component for system solutions in the area of factory automation. In addition, MBB can the exclusive seller of the Toshiba robots in the FRG, Switzerland and Austria.]

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CSO: 3698/596

WEST EUROPE/CIVIL AVIATION

MBB QUESTIONS FORWARD CONTROL SURFACES FOR A310

Stuttgart FLUG REVUE in German No. 7, Jul 86 pp 78-79

[Article by Helga L. Hillebrand: "No Canard for the Airbus"; first paragraph is FLUG REVUE introduction]

[Text] Because the Americans have submitted studies for passenger aircraft with canards, MBB has also conducted research on this new concept using the A310 as a model. Results show that a few advantages and numerous structural problems can be expected.

The canard configuration is used increasingly in new designs for business and commuter aircraft. Therefore, it was not surprising that canards are also proposed in design studies for new Boeing passenger aircraft. However, the design of the Airbus aircraft seems to be rather conventional--with good reason.

Physical Principles Versus Structural Problems

With a grant from the Federal Ministry for Research and Technology (BMFT), MBB developed a study in Hamburg to determine the advantages and disadvantages to be expected with the use of canards in passenger aircraft. .ft.

For a direct comparison with an existing aircraft of conventional design, the A310 Airbus was selected as the basic aircraft. From this starting point, scientists moved the stabilizers from the tail section to a position in front of the wings.

In principle, a fundamental advantage can be expected from the configuration found in canard type aircraft such as the Speed Canard or the Starship: The conventional elevator configuration in the tail section produces a negative lift which must be compensated for by a corresponding increased lift of the wing. In other words, the wing must produce more lift than would be necessary on the basis of aircraft weight alone and, therefore, the wing surface must be correspondingly larger. With the control surfaces positioned in front of the wing, the canard produces positive rather than negative lift, which adds to the lift of the wing. Therefore, it should be possible to greatly reduce the wing surface which, in turn, leads to a major weight reduction. So much for the physical principle, which makes the choice of the canard passenger aircraft seem reasonable.

Under closer scrutiny, however, the canard configuration loses much of its appeal. Stability considerations, in particular, but also structural analysis provide evidence of the enormous problems of the canard design for passenger aircraft. In order to maintain aircraft stability and maneuverability, the center of gravity must be located in front of the wing/fuselage neutral point, and this must be the case under any load condition. At the same time, it is known that surfaces in front of the center of gravity destabilize while surfaces behind the center of gravity stabilize. Therefore, to obtain a stable position of the center of gravity, canards must produce a considerable portion of the total lift.

A further parameter is longitudinal maneuverability. This is especially critical in a high lift configuration with maximum flap position and low speed. Additionally, in this case the lift of the canard must be at least comparable to that of the wing. This can only be achieved when the canard, as well as the wing, is provided with a high lift system, that is, with extendable flaps. The result is a highly complex stabilizer design.

Where To Put the Main Landing Gear

Initially, starting with the A310, only the control surfaces were brought from the tail to the front, maintaining the distance from the wing and the wing's position. However, in order to provide full loading capability, a specific center of gravity range is required. This concept resulted in two canard configurations. The optimum stabilizer and wing surface was calculated with a computer, and the wing was pushed farther back.

One of the possible canard configurations provides for mounting the engines under the wings, as in the A310: the second moves both engines to the tail. However, this latter configuration has a drastic effect on the overall design because the tail cargo bay would no longer be available.

In addition, MBB engineers wanted to check the effects of the sweepback and aspect ratio of canard surfaces. For each of the basic configurations, they provided a version with a canard aspect ratio of three rather than eight and a sweepback of 25 instead of 45 degrees. The result was, for configuration No. 1 with the engines under the wings, a canard surface of 50 square meters and a wing surface of 710 square meters. Configuration No. 2 with tail engines had a canard surface of 62 square meters and a wing surface of 163 square meters. The wing surface of the A310 is 219 square meters. Maintaining this wing surface would require a canard surface of 65 square meters for No. 1 and 83 square meters for No. 2. The wings are pushed back by 5.45 meters in configuration No. 1 and 12 meters in No. 2.

Although these two configurations have not been completely built, several difficult structural problems have already been identified. For example, in order to fasten the stabilizers in the nose section, the pressure hull must be perforated, the load [krafteinleitung] must be applied at this point, and a complicated pressure seal is necessary. The high lift system of the stabilizer leads to greater expense and adds considerable weight. An additional problem crops up with regard to aerodynamics. The airflow around the canard affects the aerodynamics of the wing and adds to total air

resistance, which requires a modified wing profile. Also, the main landing gear must be placed in a different position; the farther the wing is pushed back, the farther the undercarriage must be moved forward. For configuration No. 2 with tail engines, the undercarriage would be placed in the area of the leading edge of the wing. In this case, the landing gear assembly would be placed in a module in front of the forward spar, thus adding to the weight. These are only some of the potential problems; to this must be added restrictions in the cabin design and many others.

However, the starting point for all these considerations was the economics of the passenger aircraft. Consequently, the next question is whether savings in operating costs may be expected.

One factor in this is the empty operational weight. If the original size of the wing is maintained at 219 square meters (A310), then the empty weight rises by .8 percent to 3.6 percent (depending on the configuration) because of the larger canard. Canard configurations with performance-adjusted wings may result in empty weight savings of between 3 and 5 percent. In this case, however, the added weight for the necessary design modifications cannot yet be estimated. Also, the total air resistance rises by 4.3 percent to 17.3 percent because of the aerodynamic disturbances caused by the canard. Configuration No. 2 in particular has disadvantages in this respect. Total fuel consumption, calculated by an Airbus method, is 5 to 30 percent higher in comparison with the A310.

Overall, a reduction of total operating costs can only be anticipated when sufficient structural measures solve the problem of interaction between canard and wing air flows. The only effective advantage of the canard configuration for passenger aircraft is in the reduction of wing and canard surfaces, which appears to be approximately 25 percent. However, this advantage cannot obscure the considerable disadvantages.

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CSO: 3698/M205

WEST EUROPE/CIVIL AVIATION

BRIEFS

LONG DISTANCE AIRBUS PLANNED--Hamburg--This year the [MBB] manufacturing group for cargo and passenger aircraft will manufacture seven fuselage sections, including sections for static and dynamic certification tests for the A320 (first flight: 1987). MBB continues to work on the new long-distance Airbus in the pre-development phase. The green light was given by the board of directors of Airbus Industries at the beginning of 1986. Starting at the end of 1991, the four-engine, long distance A340 aircraft (previous project name: TA11) should be available, while the A330 (a high capacity medium distance aircraft) will be available in 1992. With this the Airbus Industrie could offer a range of products which cover capacities of 160 to 350 seats and an operational range which allows comfortable and economical flights from 4,500 to 12,000 kilometers. Through Deutsche Airbus GmbH, MBB owns a 37.9 percent share of Airbus Industrie, MBB's scope of business in the north ranges all the way from planning through development, parts manufacture, large component production, wing integration, and Airbus interior outfitting to maintenance, conversion, and worldwide spare parts supply. [Excerpt] [Munich-Ottobrunn MBB INTERNATIONAL in German Jun 86 p 1] 8617/6662

CSO: 3698/M199

WEST EUROPE/LASERS, SENSORS, OPTICS

SWEDISH METHOD LASER-WELDS CRACKED CHIPS IN 10 MILLISECONDS

Stockholm NY TEKNIK in Swedish 19 Jun 86 p 24

[Article by Calle Froste: "His Laser Beam Heals Injured Chips"]

[Text] A laser beam can do in a millisecond what otherwise takes 30 minutes in a 1000°C oven. The laser beam is only a few hundredth of a millimeter in diameter, and the method can be used in the final process of integrated circuit manufacturing for repairing damage which occurred earlier in production.

After six years of basic research, Goran Alestig at the Chalmer's Institute of Technology presents this new way of heat-treating semiconductors in his doctoral dissertation.

So far no industries have started to use the new technique, and Goran Alestig does not know any electronic components which necessarily need the new laser.

"We have not looked at the commercial possibilities at all," says Goran Alestig who thinks that his method will never become a standard solution. It may become a method in certain special areas.

Perhaps the laser method can find a niche among the integrated circuits which are shrinking more and more and require high precision.

Integrated Circuits

To explain how the new method can be used, it is almost necessary to first explain how an integrated circuit is constructed and how it works.

A semiconductor is a material which conducts electricity neither well nor poorly.

An integrated circuit, a chip, is a semiconductor plate, most frequently made of silicon, the size of a pen tip.

The semiconductor plate is completely filled with transistors, diodes, resistors, and other electronic components. The components are not set there, instead they consist of small lines or channels which are chiseled out of the small silicon wafer. The chiseling is done with acids. Different types of masks protect those areas that are not supposed to be etched off.

Arsenic

For the channels to be able to transport information they must be electrically conducting. This is done by introducing foreign material into the silicon; the material is almost exclusively boron, arsenic or phosphorus. The mixture causes a change in the ability to conduct electricity as free electrons are introduced.

The introduction of the foreign materials into the channels of the silicon wafer is called "doping".

Most integrated circuit manufacturers inject doping materials with an ion accelerator, a machine which with a first electrical discharge produces ions, i.e. charged elementary particles.

Another stronger discharge then accelerates the ions which hit the small channels on the silicon wafer with enormous precision. The process takes place in a vacuum.

Cracking

A disadvantage is that the silicon crystals are completely cracked when the ions penetrate the silicon. The crystals are broken up, become porous, and must be repaired before the integrated circuit can be used.

The most common repair method is to place the integrated circuit in a 1000°C oven for about 30 minutes. There, the damage repairs itself, the atoms line up again and form crystals.

It is here where Goran Alestig's new method can be used. Instead of the oven he uses a laser for repairing the crystals.

The laser which is used is a 10 watt argon laser. Despite the low output the intensity is very strong since the lights passes through a system of lenses. In the lenses the light is focused and concentrated into a beam with a diameter of only .05 mm.

Three Advantages

The laser has primarily three advantages:

--The method is fast; heating up and repair take only one to 10 milliseconds/ versus the previous 30 minutes in the oven.

--The laser is precise and can be used locally on small surfaces since the beam is so small.

--The doping atoms do not have time to move in the silicon, which is a problem with long heating times.

The laser beam can also be directed and swept over the entire integrated circuit surface. But this is not the purpose it is built for. With large surfaces it takes a long time to scan across the complete integrated circuit.

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CSO: 3698/555

WEST EUROPE/MICROELECTRONICS

ITALIAN SGS PRESIDENT: SURVIVAL STRATEGIES FOR SMALL FIRMS

Duesseldorf VDI NACHRICHTEN in German 11 Jul 86 p 2

[Article by Rudolf Schulze: "The Chance Is Cooperation With the Large Firms: Semiconductor Industry Is of Strategic Importance for Europe," first paragraph is VDI NACHRICHTEN introduction]

[Text] Duesseldorf, 11 Jul 86--Japanese producers are in the process of taking over the semiconductor market piece by piece. But when the previous competitors continuously give up ground, producers and users become dependent upon suppliers of base technology and are degraded to dealers in electronic systems. This is the view of Pasquale Pistorio, president of the Italian semiconductor company SGS. Pistorio is calling for a strong domestic semiconductor industry.

Anyone who, as Pasquale Pistorio, assumes that semiconductor components in the form of electronic systems influence the progress and the quality of an industrial society must draw two conclusions:

--as soon as the leading role of an enterprise in the development of semiconductors is lost, it becomes dependent upon the supplier of base technology and is degraded to being a dealer in electronic systems produced by others and

--when it no longer has command over semiconductor technology, it loses control over its own industrial fate.

The president of the Italian SGS draws the conclusion: "Industrialized countries or advanced economic macrosystems such as Europe must maintain a strong domestic semiconductor industry."

Pistorio considers false the position of the people who think that the only hope for a survival of the European semiconductor industry is in its withdrawing from the broad business with standard products and in concentrating its resources in product niches where the competition from Japanese and American companies is not so tough.

It has been proven that a company can serve a market niche for a certain amount of time but only when

--the company's technology is at the latest level and

--the niche is large enough to offer growth without large investments in market expansion.

But survival in market niches is possible only until large-scale enterprises themselves begin to fill these gaps.

According to Pasquale, large-scale enterprises have two advantages. In the first place, they are strong in the production of standard products at low costs and, secondly, these companies have greater resources and could therefore invest more to remain up-to-date technologically.

In the opinion of the SGS president, however, there is a way for a niche company in the semiconductor branch to maintain its leadership, namely, when the firm

--has access to a permanent "abundant source" for the most up-to-date technology and

--the availability of a semiconductor production is guaranteed.

Pasquale Pistorio: "This obviously can be guaranteed only through an association with a lage manufacturer." His conclusion: a niche firm that specializes in semiconductors can survive and be profitable as long as the market niche is relatively small and is immediately abandoned as soon as it becomes attractive for a large-scale enterprise.

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CSO: 3698/591

AERITALIA: CORPORATE STRATEGIES AND ACHIEVEMENTS

Rome AVIAZIONE in Italian Apr 86 p 203

[Article by Alberto Mondini: "Aeritalia--Strategies and Achievements"]

[Text] A look at the Aeritalia facilities in Turin and Naples is always informative; by periodically talking to the managers, designers and engineers, and technicians, one can not only bring oneself up-to-date on the continual changes that are taking place here but one can also find out which way things are going. And, with the enthusiasm of the engineer, it is a pleasure to watch this unique technological progress which is the result of patience and long research and which, with the broadest possible perspective of history, grasps the significance of this progress over the years and in the European and worldwide context.

As we know, Aeritalia is not yet 30 years old; it was born on 12 November 1969 as the result of the merger of Fiat Aviazion and Aerfer and Salmoiraghi, which was later joined by Partenavia. Production of the following aircraft continued at Turin (at Corso Marche and at Caselle): F 104S, G-91 Y, G-91-I, and Mercure, along with electronic research; at Naples, they were working on DC-9, DC-10, Atlantic, and AM-3C. But the high-sounding names of the latest years in aviation must not deceive us; when it came to the American airplanes, this involved rather humble work and the AM-3C was a small aircraft for the Army which was not selected for series production. There were two major programs: The G-222, entirely Italian-designed, and the MRCA Tornado, which is still in the blueprint stage.

We Built Buses

There was a considerable gap between what was done at Turin and what was done at Naples; at Naples, they were essentially doing sheet-metal work and they built "also buses," says engineer Amedeo Caporaletti, manager of the transport aircraft group and deputy general manager of Aeritalia.

Aerfer had glorious traditions which we need not review here except to say that traditions strengthen those who continue working but which are only an occasion for a sad comparison for those who do not know how to or simply cannot adjust. But when an enterprise still retains vital energies, albeit rather becalmed at that, it suffices to assign it a tough task to wake it up again.

This happened to ex-Aerfer which had become Aeritalia when its managers were successful in getting the G-222 program transferred from Turin to Naples; this was indeed a tough task: produce a complete airplane, ready for flight, test it, and perfect it. "The G-222 was the test bench of this Group," says engineer Caporaletti, "and we solved the problems we had run into." He paused and then he added with a slight smile: "Perhaps in a not exactly painless way." And then he concludes with satisfaction "The G-222, which is being exported in considerable numbers, is in production and at this time we have 106 orders, of which only 4 were sold in Italy to the Italian Air Force." And so the G-22 was a "test bench"; it was a test that was passed with flying colors. The world of aviation as a matter of fact is made up of communicating vessels; everybody knows, if not everything, then much of everything, in positive and negative terms. Boeing knew right away that Aeritalia was working well at Naples; and it was thinking of associating with it for the purpose of collaborating in the design and production of the Boeing 767; it sent about 50 high-level employees to Naples who specialized in the various sectors and who evaluated Italian industry with the keen eye of specialists, all of whom were American. The exam was passed and a large group of engineers immediately left from Pomigliano d'Arco; they spent long periods of time in Seattle (some of them are still there) and they learned much from what undoubtedly is the world's biggest airliner production company. The formal agreement between Aeritalia and Boeing was signed in 1978 but the understanding began before. The most important part which Aeritalia produces for the B767 is the rudder which consists of composite material of carbon fibers; this is the biggest part of the aircraft made of carbon fiber produced anywhere in the world and Aeritalia also designed and built a machine to inspect the products made of this material; the name of that machine is Etis which aroused the interest of the American industrial enterprises.

While Italian industry's participation in the B767 is necessarily on a minority basis, participation in the ATR 42 is 50 percent with Aerospatiale.

Prodution was divided between Casoria, where the sheet metal parts are made, Foggia, where the composite material parts are made, and Pomigliano d'Arco, where all the parts are assembled up to the completion of the fuselage; they also do research there. Final assembly (putting the wings on the fuselage and installing the engines) is done at Capodichino where the flight tests are also being conducted.

Testing and Research

The computer reported 45,044 simulated flights when we came to inspect the ATR 42 at Pomigliano as it was being subjected to fatigue tests; 39 hydraulic trip hammers, servo-controlled by a very carefully programmed computer, simulate the mass forces, the aerodynamic forces, and the forces caused by the engines upon this airplane, which comes off the production line and which in every way is similar to the other airplanes that will fly in real life, while it is being consumed through simulation and will never fly really. Every simulated flight includes the following: takeoff, climbing, pressurization, turbulence (vertical and horizontal gusts), descent depressurization, some approach maneuvers, and landing; this flight, which

lasts 3.5 minutes simulates a flight of 45 minutes which is typical of the employment of this airplane that was designed for short runs. They also make some "flights" which simulate pilot training, with many landings and takeoffs. All in all, 140,000 flights will be simulated while the aircraft is guaranteed for only 70,000 flights, in other words, half that number, for the customers. Furthermore, 800 strain gauges record all of the deformations, even the slightest, so that, in the end, the computer gives us a complete picture of the stresses, the internal tensions and deformations; in figures, it tells us about the torment of the materials in the most varied operational conditions and above all it tells us everything about the fatigue performance. But the strain gauges for fatigue studies do not tell us everything; this is why the entire structure is being inspected with nondestructive techniques that tell us more about the situation inside the metal. If fatigue has an effect on any part in a dangerous way, the part itself is redimensioned or the structure is so modified that the stresses will be distributed in a different way. We asked how the new composite materials behaved under fatigue and it seems they do very well; while all of the metal structures develop cracks sooner or later, this does not seem to be the case with composite products. If a crack is found after an impact, it does not spread as it does in the metal. Composite materials however are subject to damage due to hail and are therefore checked frequently. Research involves several sectors; one of them concerns the sound-proofing of the airplane, something which is particularly difficult in turboprop models. The results with the ATR-42 are good; it is hoped that optimum results will be achieved with the propfan demonstrator. But the part produced by Aeritalia is noteworthy because of the propfan. The McDonnell Douglas-Aeritalia project employs multiple-blade, counterrotating coaxial propellers. An experimental MD-80, with a propfan engine and a conventional one with a turbofan should fly in April 1987; a non-experimental line aircraft should be built immediately after the tests, if they turn out positive, with two propfans, aiming at certification in 1992. For the propfan program, Aeritalia has invited 30 high-grade engineers from McDonnell Douglas who will collaborate in designing the structure of the fuselage and the engine support pylons.

Collaboration (by Aerfer) with McDonnell Douglas goes back to 1966; since then, more than 8,000 complete series of structural panels have been built for the fuselage. But, from 1983 on, collaboration changed in terms of its nature and now includes the design, development, and construction of the vertical empennage, the rudders, and the ailerons (made of composite materials) of the MD-80. Interesting cooperative efforts were begin with Boeing even prior to the 767 program, such as the program involving the spoilers for the 727 and the support elements for the engines and the wing-fuselage turtleback of the B747. Another research effort involves the Coanda effect; the fact that the United States Air Force launched a competition for a STOL substitute for the C-130 and that Boeing participated in that competition with the twin-engine YC-14 (1976), while McDonnell Douglas came in with a four-engine model with similar characteristics, did not end the argument. The research effort is based on an effect which is named after its discoverer, the Romanian engineer Enrico Coanda; it says in substance that a flow, which runs along a surface, tends to follow its

profile; here the air flow blown by the engine upon the upper camber of the wing tends to deviate down, following the curvature created by the external-airfoil flaps and, by way of reaction, supplying a push upward, which shortens the takeoff run. Aeritalia engineers are thinking of new projects which would make use of this fact in aerodynamics but they are not telling us how their solutions will differ from the already known solutions. As we can see, this is a vast range of tests, research, and initiatives. But what is the strategy? Engineer Caporaletti has boiled it down to just this: "Marrying programs and not companies," something which in itself is quite clear. If we want to make it even more plain, we might say that Aeritalia is teaming up with one or the other industrial outfit only in the context of a well-defined program but retains full freedom to engage in research and to orient its own production as it considers advisable.

Among the acquisitions of the Transport Aircraft Group we must emphasize at least FAG; this was an establishment which produced cushions, an aeronautical plant with 300 workers which however has a tremendous expansion capacity. The Foggia establishment as a matter of fact covers an area of at least 400,000 square meters, of which only 30,000 are covered (1,000 square meters per person--not bad at all!). At Foggia, they are working on carbon fibers and advanced metal alloys.

Avionicsat Caselle

At Turin Caselle, we have GEQ, in other words, the avionics and equipment systems group; at this facility and at the Neviano plant we can see what Aeritalia inherited from Fiat and from Salmoiraghi. Inheriting is a rather strange word here for the aviation industry which every few years or so changes its skin and it is completely absurd for aviation electronics, which we call avionics, and which is renewed almost every season. But the term heridity refers above all to the highly-skilled men who are capable of moving with the times and even moving ahead of the times, something which indeed is necessary. This is all the more meritorious since all of Italy's activities in this field during the years after the war consisted in mounting the equipment on aircraft that came from across the ocean.

Skipping the chapters inbetween--which are probably known to anybody who can read--we might say that the radio measurement equipment mounted on the Cessna Citation II and currently used by the autonomous flight assistance outfit are something absolutely new in the world; this equipment will in all probability be exported or will be sold on a license basis, even in the United States. We are trying to summarize here what is being done at Caselle (confining ourselves to "unclassified" subjects). Let us begin with the investigations on the "radar signature"; in scientific terms, this is called radar cross section and it is the measurement of the radar echo of each airplane. It varies according to the bearing which the aircraft has with respect to the radar; everybody knows that the echo for an aircraft which approaches head-on is less visible than that of an aircraft that is viewed from the side; but, bearings being equal, the shape of the aircraft exerts great influence and so do the objects (landing gear, antennas, pylons, etc.). By correcting and smoothing the angles we can minimize the radar

signature, getting close to the ideal represented by the stealth aircraft, in other words, the "furtive airplane," from the root of the verb "to steal," which has been much talked about for some time now. The radar signature is measured accurately on models, also in an anechoic chamber. Another "signature" which we must watch out for is the signature of the IR rays. One may well say that this is even more important than the radar signature today, for two reasons: First of all, the IR homing warheads are more common on missiles than those with active radar (those with semi-active radar are on the northern [over-the-horizon] path); second, because the optical-electronics equipment exploring the enemy's IR emissions are used more readily than those of the radars. The latter, as a matter of fact, betray their presence and are suitable for deception and for the offensive actions of the enemy at the very moment when they begin to transmit, while the passive IR unit can see but does not disclose its position.

Electromagnetic compatibility is another study subject at Caselle; bundles of wires run through the airplanes and each wire, as the current passes through, creates a magnetic field which disturbs all of the other conductors. This interference must be reduced to a minimum, in other words, one must guarantee the electromagnetic compatibility of the various circuits and electrical equipment units which coexist in the airplane. But engineers are also thinking of the future, when information will travel from one point to another along optical fibers, in the form of light pulses, without creating any magnetic field. The first optical fiber system in the European area will be airborne on board a G-222 of the Italian Air Force; this will an experimental Aeritalia system but that is only the beginning, the first step in a new phase of research and experiment for the installation of a complete optical fiber system in an advanced aircraft.

This so-called fly-by-light, as a matter of fact, will take the place of fly-by-wire even though the latter is only beginning. The fly-by-wire (electronic flight controls) system is being installed in the AMX and the electronic part of that system is made at Caselle. The data-bus is also being adopted for this aircraft; this is a common conductor that moves such data from one point to another point in the aircraft; for example, this includes data furnished by the accelerometer, the Pitot, the thermometer that measures the temperature of the gases at the turbine outlet, etc. These data, which come from different points, travel on the data-bus and each "gets off it" according to its display and the apparatus in which the data are inserted. Electronic systems pertaining to the data-bus and the main computer of the AMX are being built at Caselle; this computer performs all of the calculations needed for aiming the weapons, navigation, and the control of all avionics. This equipment makes vast use of microprocessors and are the subject of research and experiments by the avionics and equipment systems groups.

The self-diagnosis instruments (ATE, from Automatic Test Equipment) used for the Tornado in Italy were designed and built at Caselle. The results are so satisfactory that they aroused the interest of the Royal Air Force. The importance of these instruments need not be specially emphasized; in a modern airplane, especially a combat aircraft, we have a quantity of avionics that makes up a good percentage in terms of the weight and cost of the complete aircraft; without avionics, the aircraft could not carry out a single

one of its missions; it could perhaps take off and fly around the field in good weather. Avionics--whose progress is faster than that of the aircraft frames and engines--can also be changed totally during the active lifetime of an airplane. It is so complicated that old-type controls--such as the method of probing here and there with the voltmeter to see whether the prescribed voltages are present--would be by far too long-drawn-out and insufficient.

So here we have the automatic test equipment which knows how to perform all of the checks to be made on the instruments to make sure that everything is in order, etc.; it comes up with a response that can be read even by the layman. The famous "go-no-go" of aviation history, in other words, whether everything is "go" and whether perhaps something is "no-go"--that is now being replaced and the aircraft is ready to take off.

GEQ also produces sights with laser telemeter for armored vehicles and displays with cathode-ray tubes. This research has resulted in a computerized automatic system for super-heating which has been applied in treating tumors with excellent results.

5058
CSO: 3698/632

WEST EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

INTEGRATION KEY TO SWEDISH R&D COMPOSITE SOLIDITY

Solothurn CHEMISCHE RUNDSCHAU in German 30 May 86 p 32

[Article by L.Z.: "Promotion of Research and Development in Sweden: Stability Comes From the Composite"]

[Text] Swedish concerns have clearly increased their investments in technology and know-how in recent years. Via the Council for Technical Development (STU), the Swedish government contributes to initiating and promoting research and development that aids technical, scientific and industrial innovation in Sweden.

From the energy crisis emerged the necessity to develop materials that could be produced and used with lower energy costs than before. Moreover, the materials of the future must not have any harmful effects on the environment during their production and use. The products also have to last longer and, since global resources are limited, the reuse of materials is becoming more and more important.

In Sweden, there is also great interest in the development of processes combining different materials, like plastic with metal, ceramics with metal, etc. This process requires non-destructive testing and laser and electron beams to weld and harden the surfaces.

STU's support is organized into three main fields: Metallic materials, polymeric materials and inorganic materials/high-performance ceramics.

Powder Metallurgy and Fast-Hardening Alloys

Research into new metallic materials is primarily oriented towards metals produced by powder metallurgy and metals from fast-hardening alloys (microcrystalline and amorphous metals). Viewed internationally, the Swedish steel and metal industry has an important position both in the development of processes and in the development of materials. Powder metallurgy offers advantages in production because it is less complicated, reduces use of energy and raw materials, and increases productivity. Fast-hardening alloys open the door to development of materials with unique magnetic, mechanical and electrical characteristics.

Polymeric materials have varied characteristics and areas of application. For example, ethylene, propylene and isoprene can be polymerized. In terms of volume, there are currently as many polymeric materials produced as iron and steel. In addition, the possibilities for developing new and interesting materials are still far from exhausted. STU is promoting a five-year program in Sweden for composite fiber materials based on polymers and will shortly be starting a further program for electrically conductive polymers. Composite fiber materials have a high degree of solidity and rigidity and they are very resistant to chemicals and the effects of climate. Because of their high solidity in relation to low weight, aramid and glass fiber-reinforced epoxide materials were used in several components of the new Swedish Saab-Fairchild SF 340 airplane, e.g., in the rudder, propeller, fuselage seat, carrying surfaces and the cabin floor.

Glued Constructions

Research into adhesive techniques is also a subject of great interest. Constructions with glued compounds are simpler and the materials are more resistant to fatigue and corrosion. Adhesive techniques have been applied in building Swedish military planes for two decades, today Saab is also using adhesive techniques in the construction of civilian aircraft. In addition, the Swedish motor industry is also looking into adhesive techniques.

Conductive Polymers

Electrically conductive polymers differ from conventional materials in their low weight, porous structure and sharply varying conductivity. Such materials thus allow completely new solutions to technical problems, smoothing the way for new technologies.

High-Performance Ceramics for Gas Turbines and Diesel Motors

High-performance ceramics are a focal point of interest throughout the world. A few of their special characteristics are low thermal expansion, high resistance to oxidation and corrosion, and a halving of the weight of certain products that formerly were made of metal. Ceramics research is performed, among other places, at the Swedish Silicate Research Institute in Goteborg. The STU is also supporting work in product development at Asea Cerama in Robertfors, where they are working with silicon carbide and zirconium dioxide.

12507/12379
CSO: 3698/586

WEST EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

BRIEFS

WESTLAND/AGUSTA HELICOPTER PROGRESS--Everything is ready in London for the presentation of the new Eb Ici helicopter. This craft is the result of collaboration between the Italian Agusta Company and the British Westland Company. The old programs were retained in spite of the fact that, in March 1986, 30 percent of Westland wound up in the hands of Fiat and the American giant United Technologies which beat Agusta and other Europeans. Thus the three board members who represent the interests of Fiat and United Technologies in Westland had to stay on the job to look after things. [Text] [Rome L'ESPRESSO in Italian 18 May 86 p 221] 5058

CSO: 3698/632

WEST EUROPE/TECHNOLOGY TRANSFER

BRIEFS

SWEDISH, DUTCH FIRMS IN EUREKA--The image processing company Context Vision of Linkoping will receive support from Eureka. Together with the Philips company TRT, Context Vision has received a subsidy of 60 million kronor for technological development work. The purpose of the Eureka-supported joint agreement between TRT and Context Vision is to develop an image-analysis system based on very large-scale integrated circuits (VLSI). According to executive vice president Tore Mattsson, this will result, first of all, in lower prices on image-processing computers and, in certain cases, in improved performance. At present, Context Vision's GOP 300 computers cost 1 to 1.5 million kronor. According to the 50-50 agreement that has been reached, Context Vision will supply two computer systems, a number of licenses, and "a lot of man hours," acccording to Tore Mattsson. TRT will do the computer-assisted design work for the new VLSI circuits, which will be manufactured by a third party. "Unfortunately, I cannot say exactly what the project involves," Tore Mattsson said. That is secret, in accordance with the agreement. He pointed to a number of areas in which his company is active, however. The joint project will involve several of these areas: remote analysis of pictures from airplanes and satellites; medical applications (such as analysis of microscopic pictures of cell samples); testing of materials; prospecting (for example, analysis of drilling samples, seismic data); applications in graphics (image enhancement, retouching, etc.); quality control in industrial automation. The conditions for participation in Eureka, which is a joint project involving 18 countries, are that the project must be civilian in nature and involve some element of high technology. [Text] [By Fredrik Lundberg] [Stockholm NY TEKNIK in Swedish 3 Jul 86 p 2] 9336

CSO: 3698/614

EAST EUROPE/CHEMICAL RESEARCH

PROTECTIVE EFFECT ON ULTRASTRUCTURE OF PANCREAS OF ENDOTOXIN DETOXIFIED BY RADIATION IN EXPERIMENTAL ENDOTOXIN SHOCK

Budapest KISERLETES ORVOSTUDOMANY in Hungarian No 2, Apr 86 pp 151-156

[Abstract]The ultrastructural changes of the pancreas were studied following the intravenous administration of 1 mg/rat of endotoxin (E. coli 098) and 1 mg/rat of endotoxin detoxified with 150 kGy of 60Co-gamma irradiation (TOLERIN). It was found that an autolytic destruction in the inner membrane system of the pancreatic mitochondria is produced by the endotoxin introduced into the systemic circulation. Administration of similar doses of TOLERIN does not produce a similar effect; moreover, when given in small doses (100 microgram) as pretreatment, it wards off the above effect of endotoxin on the pancreatic mitochondria. This is attributed to the membrane-stabilizing effect of TOLERIN. The findings suggest a direct membrane-destructive effect of the endotoxins and a role played by the dysfunction arising from the degradation of pancreatic mitochondria in the pathogenesis of irreversible shock.

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CSO: 2502/71

LAW GOVERNING NUCLEAR ENERGY, POWER PLANTS, MATERIALS

Warsaw DZIENNIK USTAW in Polish No 12, 22 Apr 86 pp 137 - 144

["Law on Nuclear Energy" adopted on 10 April 1986]

[Text] Acknowledging the need for a peaceful use of nuclear energy in various fields in the process of economic development of the country and with a view to ensuring protection of life, health and property of citizens, as well as protection of the natural environment against contamination which the use of nuclear energy may cause, the following is resolved:

Chapter 1

General Regulations

Article 1.1. The present law regulates activities associated with the use of nuclear energy for the socio-economic needs of the country, outlines the responsibilities of organizational units carrying out such activities, specifies the organs with pertinent jurisdiction and their tasks and sets guidelines for civil liability for nuclear-related damage and responsibility for violations of nuclear safety and radioactive protection.

2. Specifically, activities associated with the use of nuclear energy for the socio-economic needs of the country include:

1) production, processing, use, storage and transportation of nuclear material and sources of radiation and distribution of these materials and sources,

2) siting, designing, contructing, starting up, operating and decommissioning nuclear installations, securing and storing radioactive wastes,

3) health protection of the workers employed in nuclear units, handling nuclear materials, sources of radiation and radioactive waste, as well as the training of these persons.

Article 2. The use of nuclear energy for the socio-economic needs of the country is permissible after the necessary steps have been taken to ensure the

safety and protect the life and health of people and property, as well as the environment.

Article 3. Terms used in the present law mean:

1) nuclear material - material containing fissionable nuclides or those which can become fissionable as a result of nuclear reactions, specifically, the isotopes of uranium, plutonium and thorium,

2) nuclear installation - an installation or equipment in which nuclear materials are produced, used, processed, stored or transported in an amount capable of generating a chain fission reaction,

3) ionizing radiation - rays consisting of particles causing direct or indirect ionization or of both kinds of particles, excluding the photons of ultraviolet rays,

4) source of radiation - radioactive substance adequately prepared for the use of radiation it emits,

5) source of ionizing radiation - a source of rays or an installation generating radiation,

6) radioactive wastes - objects or solid, liquid or gaseous materials containing radioactive substances or contaminated by these substances above the established level and further use of which is infeasible or impossible,

7) nuclear safety - a condition in which the legally established norms of exposure to radiation for persons working in nuclear installations and other persons will not be exceeded during normal operation of the installation and in the event of any disruptions,

8) radiation protection - prevention of exposure to radiation for people and the natural environment, and in the event preventing it is impossible, containing its consequences as much as possible,

9) nuclear-related damage - damage caused to a person, property or environment by radioactive, toxic, explosive or other action of nuclear material and products of its fission,

10) the operator - in terms of civil liability, one of the organizational units carrying out actions referred to in article 4,

11) tolerance dose (tolerance dose equivalent) - maximum dose of ionizing radiation set for individual groups of people which cannot be exceeded except in cases specified in the law,

12) physical protection - the entirety of organizational and technical measures aimed at efficiently protecting nuclear materials from acts of subversion, subotage, theft or other harm.

Article 4.1. Operations related to the use of nuclear energy and consisting of

1) production, processing, distribution, storage, transportation or use of nuclear materials and radioactive sources and wastes,

2) construction, start-up, operation and decommissioning of nuclear installations,

3) construction and operation of storage for radioactive wastes,

4) production and use of equipment incorporating sources of radiation,

5) production and use of equipment generating ionizing radiation,

6) production of dosimetric equipment as well as equipment and installations protecting against radiation,

7) starting up laboratories and stations where sources of ionizing radiation are to be used,

8) production of commonly used products which emit ionizing radiation,

9) servicing of equipment, installations and processes crucial from the standpoint of nuclear safety and radiation protection.

- require a permit by the organ having jurisdiction over nuclear safety and radiation protection.

2. The organ which has granted permission can at any moment suspend it or modify it as needed if the requirements or conditions of nuclear safety and radiation protection have not been met.

3. The Council of Ministers may outline by an order:

1) conditions for granting the permits referred to in paragraph 1,
2) cases other than those referred to in paragraph 1 in which operations related to the use of nuclear energy also require permits.

4. Director of the PAA [State Nuclear Energy Agency], henceforth "director of the agency", sets forth specific requirements and conditions for nuclear safety and radiation protection.

Article 5. Nuclear materials and sources of radiations are subject to registration and control; nuclear materials also require physical protection.

Article 6.1. Import, export and transit through the territory of the People's Republic of Poland of nuclear materials, sources of radiation and equipment incorporating such sources take place under the conditions specified by the director of the energy in consultation with the ministers of transporation and foreign trade.

2. Import and export of nuclear materials, sources of radiation and equipment incorporating such sources and import of commonly used products which emit ionizing radiation require a permit referred to in article 4.

Article 7.1. Any activity in the environment exposed to ionizing radiation must be carried out in such a way that the number of persons exposed is kept to a minimum and the doses of ionizing radiation received by these person be the lowest possible and not exceed tolerance doses.

2. Tolerance doses are set for:

1) persons employed in an environment exposed to ionizing radiation,
2) persons residing or staying in the vicinity of sources of radiation as well as for persons exposed to radiation due to the radioactive contamination of the natural environment,
3) persons exposed to ionizing radiation due to the use of commonly used products emitting such radiation.

3. Setting tolerance levels does not remove the obligation to minimize actual exposure to radiation as much as possible.

Article 8.1. Tolerance doses include the sum of exposure to the sources of ionizing radiation situated inside and outside an organism.

2. Tolerance doses do not include radiation originating in outer space and emitted by natural radioactive elements contained in the environment in its natural condition or present in the organism under physiological conditions.

Article 9.1. While preventing an accident or containing and eliminating its consequences, in the event of obvious need, the manager of an enterprise or a person authorized by him can order a male employee to carry out a function which can cause exposure by the employee to a dose of radiation exceeding the annual tolerance dose but not more than by a factor of 5; the employee cannot refuse to carry out such an order.

2. However, exposure of the employee referred to in paragraph 1, as well as in other cases, should be limited in such a way that the entire dose in any period of 6 consecutive years including the year of increased exposure does not exceed 6 times the annual tolerance dose.

3. Exposure of an employee over 1 year to a dose greater than twice the annual tolerance dose is permitted only if he has never before been exposed over 1 year to a dose exceeding twice the annual tolerance dose.

Article 10.1. In case of a need to save human life, an individual taking part in a rescue mission can be allowed by the person in charge of the mission to expose himself to ionizing radiation for the dose of which no upper limit is set, if this individual volunteers and is informed ahead of time of the danger of exposure to radiation and its consequences for his health or life.

2. Provisions of article 127, paragraph 2 of the Civil Code apply respectively to the liability for damages suffered by the person referred to in paragraph

1.

Article 11. Tolerance doses are not applicable to persons exposed to ionizing radiation for medical purposes.

Article 12.1. Decisions of the organs of state administration will not violate the requirement of nuclear safety and radiation protection.

2. A decision is contravention of provisions of paragraph 1 is not valid.
Article 13.1. The minister of health and social welfare will determine by decree conditions for safe use of ionizing radiation for medical purposes.

2. The director of the agency, upon consulting the minister of health and social welfare, sets tolerance doses of radiation and derived indicators denoting danger, including permissible emission of radiation by commonly used proudcts.

Chapter 2

Nuclear Installations

Article 144.1. Specifically, the following are nuclear installations:

1) power stations, cogeneration stations and pure nuclear heating plants,

2) enterprises using nuclear reactors as a source of heat or of radiation for technological purposes,

3) units producing, processing or storing nuclear materials,

4) research and experimental nuclear reactors.

2. An installation or unit of equipment is classified as a nuclear installation by the decision of the director of the agency.

Article 15.1. The funding agency is responsible for meeting the requirements of nuclear safety and radiation protection of the nuclear installation at the drafting, construction, start-up and trial run stages, whereas the operating unit is responsible at the stages of regular operation and decommissioning.

2. Meeting the requirements of nuclear safety and radiation protection is the responsibility of other participants in the investment project in line with their tasks, regardless of the responsibilities of the funding agency.

3. In selecting a site, designing, constructing, starting up and operating a nuclear installation, technical and organizational arrangements should be used which are necessary in light of the achievements of science and technology in order to prevent hazard to persons servicing the installation or other persons and the environment.

Article 16. In accordance with regulations on territorial planning, the organ with responsibilities for selecting a location for a nuclear installation coordinates the location recommendation and the decision to select a location, prior to it being made, with the the director of the agency as to the requirements of nuclear safety and radiation protection.

Article 17.1. The director of the agency issues a license to construct, start up, operate and decommission a nuclear installation with regard to matters of nuclear safety and radiation protection at the request of the funding agency. This license is a prerequisite for obtaining the permit to build, use and dismantle a structure pursuant to the building code.

2. The license referred to in paragraph 1 can be issued upon finding that the requirements and prerequisites for nuclear safety and radiation protection have been met.

Article 18.1. A restricted zone is set up around a nuclear installation; the use of this zone is limited in order to reduce the danger of radiation.

2. The director of the agency will, in cooperation with the ministers of construction, space management and communal economy, and environmental protection and natural resources, set forth specific guidelines for placing a restricted zone around a nuclear installation.

Article 19. The director of the agency orders a reduction in capacity or shutdown of a nuclear installation if its operation violates nuclear safety; a new increase in capacity or startup of the installation require the permission of the director of the agency.

Chapter 3

Nuclear Materials

Article 20.1. The director of the agency grants licenses to produce, process, handle, store and use nuclear materials at the request of the manager of the proper organizational unit.

2. The manager of an organizational unit to which the license referred to in paragraph 1 has been granted is responsible for handling nuclear material in accordance with the requirements of nuclear safety and radiation protection.

Article 21. The organizational unit in possession of the license referred to in article 20, paragraph 1 is obligated to keep records and maintain control of nuclear materials and ensure their physical protection.

2. The director of the agency, in cooperation with the ministers of materials and fuel economy, interior, foreign affairs and transportation, sets forth the guidelines for registration, control and physical protection of nuclear materials.

Chapter 4

Sources of Radiation

Article 22.1. The director of the agency or a person authorized by him grants licenses for the operations associated with sources of radiation referrred to in article 4, paragraph 1, points 1 and 4 through 9, at the request of the manager of the proper organizational unit, provided paragraph 2 is adhered to.

2. Licenses to produce, pruchase, start up and operate X-ray equipment with energy under 300 keV are issued by the state medical inspector of the province.

3. The minister of health and social welfare outlines the conditions which radiologicl departments should meet as well as guidelines for work involving the operation of X-ray equipment.

Article 23. Manager of an organizational unit which has been granted the license for the activities referred to in article 22 is responsible for ensuring radiologicl protection in operations involving a source of radiation.

Article 24.1. An organizational unit carrying out operations with sources of radiation is under obligation to keep records and control these sources.

2. Equipment incorporating sources of radiation and generating radiation, both produced domestically and acquired abroad, is subject to inspection prior to commissioning for purposes of radiation protection.

Article 25. The director of the agency will set forth guidelines for registering and inspecting sources of radiation and controlling equipment which incorporates sources of radiation and generates radiation, as well as specify the organizational unit with pertinent responsibilities.

Chapter 5

Radioactive Wastes

Article 26.1. Radioactive wastes generated during production, processing, conservation, storage and use of nuclear materials and sources of radiation as well as during the operation and decommissioning of nuclear installations should be rendered harmless in a way preventing hazard to the people and environment, except as provided by paragraph 2.

2. Wastes which nuclear inspection service determines not to be a radiation hazard are not classified as radioactive wastes.

3. Records of radioactive wastes should be kept in places of their generation, maintenance and storage.

4. The director of the agency sets guidelines for determining the wastes to be radioactive and classifying and registering them, as well as conditions for their disposal, maintenance and storage.

Article 27.1. The director of the agency issues licenses to build and operate radioactive waste storage facilities as far as nuclear safety and radiation protection are involved. This license is a prerequisite for obtaining a permit to build and operate a structure pursuant to the provisions of the building code.

2. The manager of the organizational unit which has been issued a license to operate a radioactive waste storage facility is responsible for the storage in compliance with the requirements of nuclear safety and radiation protection.

Article 28. The manager of the organizational unit is responsible for the handling of radioactive wastes on the premises of the unit and for preparing them for transportation and storage off the premises of the unit in compliance with the requirements of nuclear safety and radiation protection.

Chapter 6

Transportation of Nuclear Materials, Sources of Radiation and Radioactive Wastes

Article 29.1. Nuclear materials should be prepared for transportation and transported in a manner rendering a chain fission reaction impossible.

2. The director of the agency or a person authorized by him grants permission to transport nuclear materials, sources of radiation and radioactive wastes.

Article 30.1. To the extent not covered by other regulations, ministers with responsibilities for the particular mode of transportation, in cooperation with the minister of the interior and the director of the agency, outline the requirements for safe transportation of nuclear materials, sources of radiation and radioactive wastes.

2. During the preparation for shipping and during transportation of nuclear materials, sources of radiation and radioactive wastes, hazards created by their physical and chemical properties should be taken into account, and requirements and conditions applicable to the transportation of hazardous materials should be met.

3. Exposure to radiation of the persons servicing transportation, including those performing loading and unloading of transported nuclear materials, sources of radiation and radioactive wastes, should be controlled and cannot exceed tolerance doses for the persons referred to in article 7, paragraph 2, point 2. This requirement does not apply to persons employed in the environment of exposure to ionizing radiation.

Article 31.1. Provisions of articles 29 and 30 do not apply to in-plant transportation on the premises of organizational units which produce, store or use nuclear materials, sources of radiation and radioactive wastes.

2. Requirements and conditions for transportation referred to in paragraph 1 are set by the director of the agency in a license issued pursuant to article 17, paragraph 1, article 20, paragraph 1 and article 22, paragraph 1.

Chapter 7

Training and Occupational Safety of Employees

Article 32.1. An employee can be allowed to work with nuclear materials, sources of radiation and radioactive wastes if he is familiar with the regulations on nuclear safety and radiation protection applicable to his position and possesses requisite skills.

2. The employee referred to in paragraph 1 can be hired upon the finding by the pertinent health care facility that there are no counterindications for his employment in an environment of exposure to ionizing radiation.

3. Counterindications for employment in an environment of exposure to ionizing radiation as well as the kind and frequency of medical checkups for persons employed in this environment are specified in other regulations.

4. An organizational unit where nuclear materials or sources of radiation are used or radioactive wastes are generated or processed, must develop a training program, train the employee before putting him on the job in the field of nuclear safety and radiation protection and carry out periodic [refresher] training of this nature.

5. The program of training developed by the organizational unit referred to in paragraph 4 should be certified by the director of the agency.

Article 33.1. Only an employee with requisite qualifications who has been given requisite licenses on the basis of an examination can be employed in an organizational unit which uses nuclear materials or sources of radiation, processes or stores radioactive wastes as well as at a nuclear installation at a station essential to nuclear safety and radiation protection.

2. The director of the agency determines whether:

1) to suspend a person who does not have the licenses required for a given position,

2) to refer for a repeat exam an employee whose knowledge, skills or behavior at a position requiring licenses do not guarantee that he meets the requirements of nuclear safety and radiation protection.

3. The director of the agency:

1) determines the kind of positions referred to in paragraph 1, prerequisites and manner of issuing licenses to work with nuclear material, sources of radiation or radioactive wastes, excluding X-ray equipment with energy under 300keV and the manner of verifying the knowledge and skills of employees performing such operations,

2) nominates the persons of his choosing to the examination board.

4. The minister of health and social welfare determines the extent and sets guidelines for the training of persons responsible for the status of radiation protection in departments of radiology.

Article 34. Organizational units hiring employees for work in an environment of exposure to radiation must:

1) provide continuous medical supervision, required means of personal protection and dosimetric equipment for such employees,

2) keep records of individual radiation doses received by such employees and carry out systematic dosimetric observations at the work stations.

Article 35. Director of the agency outlines the requirements which dosimetric equipment used in radiation protection must meet as well as requirements for keeping the records of results of dosimetric control.

Chapter 8

Civil Liability for Nuclear Damages

Article 36.1. The person operating a nuclear installation is the only one liable for nuclear damages.

2. If more than one person operates a nuclear installation, they are jointly and severally liable.

3. The person operating the nuclear installation is entitled to indemnification by the person causing nuclear damages if they resulted from a willful act.

Article 37.1. Up to the moment a nuclear shipment is received by the addressee, the operator who sent the shipment is exclusively liable for damages caused to the third persons during the transportation of the nuclear shipment.

2. Should nuclear damages occur in international transportation, the operator sending a nuclear shipment or an operator receiving such shipment is exclusively liable for third persons. The moment of transfer of responsibility is outlined in the contract between the sender and the addressee of nuclear shipment. In case explicit provisions are lacking from the contract, the sender is responsible up to the moment of handing the nuclear shipment over to an authorized person at the border station of the state in which the shipment is to be received.

3. The person responsible for nuclear damages is entitled to indemnity from the persons providing transporation services if the damages resulted from their willful act.

Article 38. The person operating a nuclear installation is not liable for nuclear damages if they result from an act of war or a willful act for which the injured party is solely responsible.

Article 39.1. The party liable for indemnity is responsible for all consequences of the event causing nuclear damages.

2. Indemnity for nuclear damages covers:

1) losses which the injured party has suffered due to the bodily harm or injury to health as well as destruction of or damage to property, and other persons have suffered due to the death of the injured party,

2) benefits which the injured party could have obtained had the damage not occurred,

3) necessary expenses which have or will be made after the event causing damages in order to prevent the exposure of people and the natural environment to radiation.

3. Indemnity for nuclear damages also includes compensation for depleting public property due to the exposure of the natural environment. Should such damages occur, the state treasury is entitled to seek redress. The indemnity obtained becomes income of the fund for environmental protection.

Article 40.1. The operator of a nuclear installation must obtain civil liability insurance for nuclear damages.

2. The minister of finance will specify the unit providing civil liability insurance for the operators of nuclear installations.

3. If nuclear damages to a person exceed those specified in the insurance contract, the injured party may seek indemnification by the state treasury for the amount of extra damages.

4. The Council of Ministers determines the way of indemnifying for nuclear damages to property and environment exceeding those specified in the insurance agreement.

Article 41.1. No statute of limitations applies to claims for nuclear damages to a person; a ten-year statute, counting from the day the event that caused the damages occurred, applies to claims for damages to property and natural environment.

2. A two-year statute of limitations, counting from the day the indemnity is paid, applies to the claim for indemnification referred to in article 36, paragraph 3 and article 37, paragraph 3.

3. A ten-year statute of limitations, counting from the day when the event causing the damages occured, applies to claims for nuclear damages to property and the national environment made by one socialized economy unit against another.

Article 42. Provisions of the civil code apply to the liability for nuclear damages inasmuch as the provisions of articles 36 through 41 do not apply.

Article 43. The provisions of articles 36 through 42 do not violate regulations on compensation for job-related accidents and occupational diseases.

Chapter 9

National Atomic Energy Agency

Article 44.1. National Atomic Energy Agency, henceforth referred to as "the agency," is a state agency with responsibilities for the use of nuclear energy.

2. The agency reports to the prime minister.

3. The prime minister may set up and close down regional offices and determine their location and jurisdiction.

Article 45.1. The agency is headed by a chairman with the responsiblitiies of the central organ of state administration in charge of the use of nuclear energy.

2. The prime minister nominates and recalls the chairman of the agency.

3. At the request of the chairman of the agency, the prime minister nominates and recalls deputy chairmen.

Article 46. The following matters are the responsibility of the agency:

1) coordination and supervision of activities aimed at a safe use of nuclear energy,

2) research and use of nuclear energy in the national economy,

3) production of nuclear equipment and machinery as well as of sources of radiation and their distribution,

4) rendering radioactive wastes harmless and storing them,

5) registration, control and physical protection of nuclear materials,

6) informing the populace about the actions of the state in the sphere of using nuclear energy,

7) cooperation with other countries in the peaceful use of nuclear energy.

Article 47. The following matters are the responsibility of the chairman of the agency:

1) representing the agency and managing its operation,

2) setting the guidelines for the activities referred to in article 46 in accordance with the social and economic needs of the state,

3) managing the state inspectorate for nuclear safety and radiation protection,

4) issuing licenses for activities falling within the jurisdiction of the state inspectorate for nuclear safety and radiation protection,

5) issuing licenses and making decisions as provided by the present law,

6) certifying the persons employed in the operation of nuclear installations, sources of radiation and in processing and storing radioactive wastes,

7) supervising and controlling every activity which results or may result in the exposure of people and the natural environment to radiation,

8) initiating, projecting and planning comprehensive actions aimed at the development and peaceful use of nuclear energy,
9) analyzing and evaluating the activity of subordinate organizational units and coordinating this activity,

10) personnel policy and assistance in training cadres in the field of nuclear energy,

11) joint actions with the appropriate main and central organs of state administration in matters related to the use of nuclear energy,

12) supervising the operation of state enterprises and other organizational units to the extent set forth in other regulations,

13) issuing orders in matters falling within the jurisdiction of the agency and the chairman of the agency, pursuant to the law and with a view to abiding by it, the orders being subject to publication in the official gazette of the PRP MONITOR POLSKI.

Article 48.1. Within the agency, the board of the agency, henceforth "the board," operates, which consists of the deputy chairmen of the agency, the main inspector of the nuclear inspectorate, representatives of the ministers of mining and energy, science and higher education, national defense, interior, foreign affairs, health and social welfare, environmental protection and natural resources and materials and fuel management as well as a representative of the Polish Academy of Sciences.

2. The chairman of the agency manages the operation of the board.

3. The board passes resolutions in matters for which the agency is responsible, in particular:

1) sets the guidelines for the policy of using nuclear energy for the socio-economic needs of the country and its implementation,

2) adopts programs and plans of operations and reviews annual progress reports of operations,

3) sets the guidelines for cooperation with other countries.

4) considers other matters referred by the chairman of the agency or the Council for Nuclear Energy.

Article 49.1. The Council for Nuclear Energy, henceforth "the council," operates at the agency as a consultative and advisory body in the matters falling within the jurisdiction of the agency as referred to in article 46.

2. At the request of the chairman of the agency, the prime minister nominates and recalls the head of the council.

3. The chairman of the agency nominates and recalls members of the council.

Article 50.1. The Council of Ministers outlines by decree specific responsibilities of the agency and its chairman.
2. The statute of the agency granted by the Council of Ministers determines the organization of the agency, specific responsiblities of the board and jurisdiction of branch offices.

3. The statute granted by the prime minister determines the composition, responsibilities and mode of operation of the council.

Chapter 10

State Inspectorate for Nuclear Safety and Radiation Protection

Article 51.1. The state inspectorate for nuclear safety and radiation protection, henceforth "the nuclear inspectorate," supervises and controls every operation in the use of nuclear energy for the socio-economic needs of the country which results or may result in the exposure of persons and the natural environment to ionizing radiation.

2. In particular, it is the responsibility of the nuclear inspectorate to:

1) analyze and evaluate the use of nuclear energy to meet the socio-economic needs of the country as it relates to nuclear safety and radiation protection,

2) inspect nuclear installations and organizational units in possession of nuclear materials, sources of radiation and radioactive wastes,

3) make decisions on matters of nuclear safety and radiation protection,

4) issue extemporary orders along the guidelines and in the fashion set forth in the present law,

5) set the necessary requirements to ensure nuclear safety and radiation protection.

Article 52.1. The chairman of the agency, chief inspector and inspectors of the nuclear inspection discharge the responsibilities of the nuclear inspection.

2. The chief inspector and inspectors of the nuclear inspectorate are nominated and recalled by the chairman of the agency.

3. The chief inspector reporting to the chairman of the agency manages the work of inspectors of the nuclear inspectorate.

Article 53.1. The chairman of the agency can entrust employees of subordinate organizational units with the tasks referred to in article 51, paragraph 2, item 2.

2. The employees referred to in paragraph 1 have the authority of the inspector of nuclear inspectorate as provided by the present law and the regulations issued on the basis of it.

Article 54.1. In the line of duty, nuclear inspectors are entitled to:
1) enter at any time of day or night nuclear installations, transportation vehicles and organizational units where nuclear materials, sources of radiation and radioactive wastes are used, produced stored or shipped,

2) inspect documents pertaining to nuclear safety and radiation protection in the inspected nuclear installation or organizational unit,

3) review the compliance of activities referred to article 4, paragraph 1 with the regulations on nuclear safety and radiation protection as well as the conditions set forth in licenses,

4) take independent technical and dosimetric measurements should such a need arise.

2. Nuclear inspectors carry out review of nuclear safety and radiation protection on the basis of the service indentity card, and persons referrred to in article 53, paragraph 1 - on the basis of a certificate issued in their name by the chairman of the agency or the chief inspector of nuclear inspection.

3. The manager of an inspected nuclear installation or organizational unit must provide resources and conditions necessary for review and grant access to all documentation.

4. Employees of an inspected nuclear installation or organizational unit must give oral and written explanations to nuclear inspectors regarding the subject of the inspection.

Article 55. In case a direct violation of nuclear safety and radiation protection is determined to have taken place during the inspection, the

chairman of the agency, chief inspector of the nuclear inspectorate and nuclear inspectors issue extemporary orders in order to eliminate this violation.

2. If the extemporary order is issued by a nuclear inspector, the manager of the inspected unit may appeal to the chief inspector of the nuclear inspectorate for retracting or modifying this order, or he may appeal to the chairman of the agency if the extemporary order is issued by the chief inspector of nuclear inspection.

3. Making the appeal referred to in paragraph 2 does not suspend the execution of the extemporary order.

Article 56. In the case referred to in article 12, paragraph 2:

1) proceedings for invalidation can also be initiated at the request of the chairman of the agency,
2) at the request of the chairman of the agency, the organ authorized to invalidate the decision must suspend the execution of that decision.

Article 57.1. The chairman of the agency can order the elimination within a given period of time of violations of nuclear safety and radiation protection regulations and deviations from the requirements and conditions set forth in permits granted on the basis of provisions of the present law.

2. If irregularities other than those referred to in paragraph 1 are found, the chairman of the agency may approach the manager of the inspected unit or of the parent organization in the matter of correcting such irregularities.

3. If the need arises, the chairman of the agency can appeal for holding accountable the persons responsible for the irregularities found.

4. The manager of the unit approached by the chairman of the agency must inform him within 30 days on when and how corrective action is taken.

Article 58. The code of administrative proceedings applies to the proceedings of nuclear inspectorate.

Article 59. A decision on nuclear safety and radiation protection may be appealed to the Supreme Adminstrative Court.

Article 60. Persons carrying out nuclear inspection are entitled in the line of duty to protection provided for public servants.

Article 61. The Council of Ministers will outline by decree the organization, specific tasks and manner of carrying out nuclear inspection.

Chapter 11

Civil Liability for Violations of Nuclear Safety and Radiation Protection

Article 62.1. The person who:

1) undertakes the activities referred to in article 4 or import or export referred to in article 6, paragraph 2 without the requisite permit or in contravention of its conditions, hires employees without the licenses or qualifications and skills outlined in the regulations on nuclear safety and radiation protection,

2) being responsible for nuclear safety and radiation protection allows an employee or another person to be exposed to radiation in violation of articles 7 or 9,

3) does not abide by the obligation to carry out dosimetric control or keep records of nuclear materials, sources of radiation and radioactive wastes,

4) renders impossible or impedes control activities in the sphere of nuclear safety and radiation protection or despite his duty does not provide, or provides incorrect, information or conceals the truth about nuclear safety and radiation protection,

5) fails to comply with the decision of a nuclear inspector despite the measures of administrative execution applied to him,

6) loses or leaves without proper security nuclear material, sources of radiation or radioactive wastes entrusted to him,

7) does not fulfill his duties in the sphere of nuclear safety and radiation protection while transporting nuclear materials, sources of radiation and radioactive wastes and while preparing them for transportation and storage

- is subject to the penalty of arrest, imprisonment or fine.

2. The person who:

1) being an employee of a nuclear installation, does not inform his superior or the nuclear inspectorate about an event or condition which can threaten nuclear safety and radiation protection,

2) despite his duty does not inform the nuclear inspectorate of the scheduled time of an activity requiring its participation

- is subject to the penalty of a fine.

Chapter 12

Special and Final Regulations

Article 63. Ministers of the national defense and interior, in cooperation with the chairman of the State Atomic Energy Agency, will set the guidelines and manner for the application of the provisions of the present law in the organizational units reporting to them.

Article 64. Until new regulations provided for by the present law are published, but no longer than 6 months from the day it takes effect, old

regulations adopted pursuant to the law referred to in article 65 apply insofar as they do not contradict provisions of the present law.

Article 65. The law of 27 February 1982 on the creation of the State Atomic Energy Agency (DZIENNIK USTAW, No 7, item 64) is hereby repealed.

Article 66. The law takes effect on 1 July 1986.

For the chairman of the Council of State: K. Barcikowski
Secretary of the Council of State: Z. Surowiec

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CSO: 2602/48

NEW DEVELOPMENTS IN POLISH AUTOMOTIVE INDUSTRY

Comments of Factory Director

Warsaw AUTO-TECHNIKA MOTORYZACYJNA in Polish No 6, Jun 86 pp 3, 4

[Interview with Ryszard Welter, managing director of the Compact Car Factory in Bielsko-Biala, by the editor-in-chief of AUTO-TECHNIKA MOTORYZACYJNA]

[Text] [Question] The automotive industry in Poland is going through a very difficult stage. How do you see the present and future of the Compact Car Factory?

[Answer] At this time the PF 126p automobile in the standard version and in the face-lifting standard version is being produced for the domestic market. The factory is primarily exporting the face-lifting version, i.e., the model equipped with both internal and external options. The PF 126 will remain in production until all of the prepaid orders are filled.

Beginning with the second quarter of 1987, production of a greatly modernized version of the Fiat 126p will be started up. This will be the "Restyling" model, intended mainly for export to the capitalist countries. The car has to be modernized to adapt it to growing market requirements and changing European regulations, and also to improve its operating characteristics.

[Question] What will be the changes in the new version of the car?

[Answer] The changes consist principally of a new-design engine, 703 cu m capacity, 20 kW power, liquid-cooled, which will be located under the floor of the rear luggage compartment. Fuel consumption at 90 km/h will be approximately 4.5 cu dm/100 km, and at 70 km/h--which is a better average speed for a small car--it will be only 3.6 cu dm/100 km.

It should be mentioned that fuel consumption figures given for the restyling version are approximately 1.5 cu dm/100 km lower than those presently obtained with the PF 126 face-lifting standard. This is possible due to the larger engine capacity and the change in its cooling system.

In the PF 126 restyling version a third door will be added, making it easier to reach into the larger luggage compartment, which measures 134 cu dm, and

with the rear seat folded back, this increases to 480 cu dm. In addition, the carburetor and exhaust system will be different and a new ignition system will be installed.

Those are the models which the factory will produce until 1991, which will be the kick-off point for further production during the 1990-2000 decade.

[Question] Thus we can expect the Fiat Restyling very soon. But what about a completely new automobile?

[Answer] In the 1980's work was begun in the Compact Car Research and Development Center on the design of a new compact car which in the future could replace model 126p. It has been designed and prototypes of a new car with a front-wheel drive have been built.

It will be larger than the 126p, making riding for the driver and the passengers easier. Also, the luggage compartment is larger because the engine is now located in the front of the vehicle.

The newest trends in development and government-testing requirements for this group of vehicles in the 1990's have been taken into consideration. The fruit of this labor is a car called the "Beskid." This compact car was conceived as a popular car in Poland, i.e., low cost of manufacture and operation, very functional, and reasonably priced. The first prototype was already finished in 1983. The shape of the car is very original: it is of unibody construction and the hood tilts forward at the same angle as the windshield (30 degrees in relation to horizontal). The bumper and front lights are formed right into body, which makes for good aerodynamic properties. But it is still too early to talk in detail about the Beskid. Right now we are thinking primarily about Restyling. This version will be produced until 1990-1991 as a result of an agreement entered into with Fiat. Its production will serve us until a new automobile comes out.

[Question] Will you tell us what the mysterious X1 is?

[Answer] For some time Fiat has been working on a new automobile which would replace the present Fiat 126. This project was christened Topolino (Mouse). The new model will be a modern vehicle of the 1990's. It is to be a very comfortable small-size car. Several new designs have been made and a number of prototypes have been built. Research on various versions of this car is now underway. Eventually a variant will be selected which we can produce with better engineering in the following years and which will ensure total profitability of production. Discussions are now underway on whether there will be enough demand on the market for automobiles of this size. Predictions are that there definitely will.

The design of a small car for the 1990's is not yet final, but it is ready to go into production during the 1989-1990 year. This may seem strange, but it is more difficult today to design an economical and inexpensive compact car than a large luxury car, or even a racing car, because costs no longer play such a large part. The individual parts and assemblies of a car must be light, durable and simple, but at the same time they must be inexpensive and

take into account the technological limitations of mass production. The prime weight of such a compact, interesting car will not exceed 600 kg.

The results of road tests on the Mouse prototypes are interesting. These automobiles reach a maximum speed of 120 km/h with very little noise and vibration. Fuel consumption is approximately 4.0 cu dm/100 km at a steady speed of 90 km/h.

[Question] That is the future. What can customers expect in the next months and years?

[Answer] That we will produce more and more cars in the "face-lifting" version. That standard 126p will continue to be available because there are still customers who made prepayments on just this type and do not want to, or cannot, for financial reasons, pay for the face-lifting or restyling versions. Furthermore, we are constantly modernizing our automobiles from the standpoint of fuel consumption. They can also expect that problems of technical progress are not foreign to the factory. We are improving our current production and preparing ourselves for the manufacture of the successor to Fiat 126. Our special concern is the application of a modern method of quality control. Quality, very simply, has to be produced. A different approach to this problem in the factory has resulted in changes for the better in organization and in the technology of production. A mass-produced, inexpensive automobile cannot be identified with an automobile which is not durable or reliable.

More Economical Cars

Warsaw AUTO-TECHNIKA MOTORYZACYJNA in Polish No 6, Jun 86 p 25

[Article by Antoni Swiatek, engineer at the Compact Car Factory]

[Text] In the Compact Car Factory, work, aimed at a reduction in the consumption of fuel by the automobiles produced in it, goes on continuously. Everything done is linked to world trends and the extremely unfavorable conditions which exist in Poland.

In 1983 the first changes reducing fuel consumption were made. The exhaust muffler was changed, reducing flow resistance, as was the suction muffler. As a result--and stationary and road tests confirmed this--a reduction of 7 percent in fuel consumption was obtained.

In 1984 further changes were made. These included a change in the shape of the combustion chamber to an oval, an increase in the degree of compression to 8, an improvement in the characteristics of the centrifugal regulator, an adjustment upwards in the ignition, and a change in the camshaft travel. A further reduction of 5 percent was thus obtained. Road tests showed that as a result of work done during 1983-1984, the average fuel consumption of the Fiat 126p fell from 6.5 to 5.5 cu dm/100km.

At present research is being done on the recently designed prototypes of air-cooled engines. The results obtained will allow us to start production in 1987 of the 650 engine with a single-choke carburetor equipped with a new part, an economizer, and a electromagnetic valve which partially cuts off the

inflow of fuel when the engine is idling. The ignition apparatus will be equipped with an underp essure regulator. A new exhaust muffler will be installed. Studies have shown that fuel consumption will be reduced another 0.4 cu dm/100 km.

In addition, work has been underway for several years on a new feed system, called PPM, or pneumatic production of mixture. In using the PPM system, fuel consumption can be reduced 0.7 cu dm/100/km in comparison with the best performance of an engine with the traditional carburetor. But the system still has some technical defects which, if not corrected, could cause a lot of problems in large-scale operation.

Important research work is one done at the Compact Car Factory on liquid-cooled engines. Prototypes of engines have been built which have a capacity of 600, 650 and 740 cu m when placed lengthwise in relation to the axis of the vehicle, and one with 700 cu m capacity when placed crosswise.

The experience gathered is being applied in the 703 cu m engine, now being prepared for production. It is liquid-cooled and is located lengthwise of the axis of the vehicle for the Restyling version.

The feasibility of using small high-compression engines is being investigated. They are one of the smallest automobile engines in the world. The factory's research and development center is working on this with Japanese firms. Traction studies are now being conducted on these engines.

Design changes are being made to adapt the engines now being produced to gasolines with a lower octane rating.

The most important goal of the work is to reach an engineering compromise on the lowest possible fuel consumption and the longest engine life. Positive results from prototype studies enable the preparation of these results for application.

The achievements of the Compact Car Factory cited above will certainly provide the reply to the question as to whether we will be able to drive farther on our rationed gasoline.

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CSO: 2602/49

END