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AEROSPACE, CIVIL AVIATION

Airbus Industrie Continues Talks with U.S. Firms

36980297b Stuttgart FLUG REVUE in German May 88 pp 10, 13

[Article by Helga L. Hillebrand: "Cooperative Talks at Airbus on A320 and A340: Trijet Model Under Discussion"; first paragraph is introduction]

[Text] Airbus is negotiating with U.S. firms about future cooperation. An A320 assembly line in the United States, investment in a lengthened A320 or an MD-11 with A320 wings are under discussion. An agreement is not in sight.

For several months now, there has been speculation about the substance of talks concerning cooperation between Airbus and a U.S. aircraft manufacturer. At present, detailed negotiations are under way with McDonnell Douglas and Lockheed. Earlier talks with Rockwell concerning a second production base for the horizontal tail unit broke down due to the high price asked by the Americans.

Contacts with Lockheed are also very vague. Participation in the development and production of a lengthened version of the A320, for which Airbus figures it has a market interest but scarcely the long-term capacity for realization, could constitute a second possibility here. A second assembly line in the United States would also be conceivable, should a major order from a U.S. (or perhaps Canadian?) airline beckon; for A320 customers who place their orders today, Airbus is able to promise delivery only by 1993—for most airlines much too long a wait. Airbus is aware that a decision must be made in the months ahead concerning whether there should be a second assembly line.

The most intensive negotiations are with McDonnell Douglas. To McDonnell Douglas, Airbus represents a dangerous adversary: The MD-80 is directly competitive with the A320, and the MD-11 is in the same class of long-range jumbo aircraft as the planned A340-200/-300. A cooperative arrangement could at least stop the competitive situation between the MD-11 and A340. And even now McDonnell must watch as Airbus outstrips it in preliminary contracts: When the MD-11 program was begun in December 1986, McDonnell had 92 preliminary contracts to show. At the startup of the A330/340 program in June 1987, Airbus had 130. Since then, there have been 145 Airbus contracts (including 80 firm orders), compared to exactly 76 MD contracts.

Thus, there is talk of an Airbus/McDonnell halfbreed, which could combine the fuselage of an MD-11 with the modern wing of an A340. The resulting trijet airplane would have a capacity somewhat lower than the Boeing 747—and Airbus and McDonnell Douglas would like to break into this monopoly market. For this reason, McDonnell is already talking about transporting passengers in the lower fuselage area, thus below the usual cabin. McDonnell also wants to stick with the old MD-11 cockpit without fly-by-wire controls and sidestick, while Airbus is demanding a modern cockpit.

In addition, there is another possibility for cooperation: Airbus would offer McDonnell Douglas a share in the lengthened A320 and in return collaborate on a smaller propfan model. Airbus itself sees no possibility of an Airbus airplane with a propfan engine in the foreseeable future.

However, one thing is clear to Airbus: There can be no cooperation in a program while the partners remain fierce competitors in another area. And since Airbus clearly emphasizes that the A330/240 program will continue, while McDonnell will not readily abandon its MD-11, an intense struggle can be expected.

In the opinion of Heribert Flosdorff, managing director of Airbus Industrie, the problems that Airbus has with the Americans would not be solved by a cooperative agreement. Heribert Flosdorff's basic comment on the negotiations leaves no doubt about Airbus' position: "We are willing to cooperate with U.S. firms or with others if that will make the product technically better and financially more advantageous. But Airbus can exist on its own as well."

12271

MTU's CRISP in Wind Tunnel Tests, Pratt & Whitney Interested

36980297a Stuttgart FLUG REVUE in German May 88 pp 26-27

[Article by Helga L. Hillebrand: "Shrouded Propfan in the Wind Tunnel: Chances for CRISP in America"; first paragraph is FLUG REVUE introduction]

[Text] A decision should be made as early as this year on which design of a shrouded propfan is to be further developed under the guidance of the U.S. company Pratt & Whitney. MTU's CRISP design is one of the leading candidates.

The propfan design of Motoren- und Turbinen-Union (MTU) in Munich has in the meantime made good progress. Since October, initial wind tunnel studies have been conducted in the high-speed wind tunnel of the German Aerospace Research and Testing Institute (DFVLR) in Cologne.

CRISP, which stands for Counter-Rotating Integrated Shrouded Propfan, is a shrouded propfan with two counter-rotating blade units. The German design clearly surpasses the American competition at General Electric and Pratt & Whitney in terms of its shroud. Through it, the range of application is more varied. Thus far, it has been possible to install open propfans only in the tail of

the aircraft, due to flow interference with the airfoil and cabin noise. With open propfans, there is the additional danger of damage to the airframe should parts of a fan blade come loose during operation.

The wind tunnel tests in Cologne, which are part of a study program supported by the Ministry for Research and Technology and conducted in conjunction with Pratt & Whitney and Fiat Aviazione, are not yet being run with a complete power unit. Only the main supercharger, with a rotor cycle of 10 fan blades, is being measured at a scale of 1 to 6. Before MTU goes over to the opposite-moving rotor, the aerodynamic characteristics of one rotor cycle are to be studied. The rotor blades being used are still made of titanium. However, only last summer new fan blades made of composite material were exhibited at the Aerosalon in Le Bourget.

A study begun only recently could be of particular interest to the competition, but also to aircraft manufacturers: The wind tunnel is to be used to demonstrate that CRISP can actually be mounted under the wing without any undesired interference with the airfoil. To this end, a wind tunnel model of the A320 wing was given a scale CRISP engine.

Other wind tunnel tests are planned for England and the United States. Pratt & Whitney is studying possibilities in the United States for combining the CRISP engine with its own ideas into a shrouded propfan, called the ADP [Advanced Ducted Propfan]. By the end of the year, the American decision should be made concerning which propfan design is to be developed further. MTU feels that it has a good chance here. Although it is anticipated that the project leader would be Pratt & Whitney, MTU hopes to become closely involved in the rest of the development program. Even if the MTU propfan is not chosen, MTU is nonetheless counting on being integrated into the team.

Not Operational Until Mid-1990s

MTU sees scarcely any limits on the application of its CRISP. Although the current design is primarily configured for the 100 to 150-seat class of aircraft, there is really no upper limit. Even the jumbo category is not being ruled out as a possibility. Particularly interesting is the possibility of installing the CRISP unit later. Thus, it is conceivable that an A320 could be later equipped with CRISP. The use of a V2500 or CFM56 nuclear engine with the added planetary gearing and the counter-rotating rotor with a shroud is conceivable. With the V2500 nuclear engine, a takeoff thrust of 133 kN could be generated in the CRISP model. And in this configuration, fuel savings would still come to 17 percent, at least according to MTU promises.

However, the CRISP engine is only optimal with a new nuclear engine, known as the supercore. Compared to the present-day turbofan engines, MTU expects a savings of 21 percent in specific consumption.

In the meantime, talks have also been under way with Pratt & Whitney and International Aero-Engines (IAE) on possibly realizing a CRISP demonstrator with the PW300 or the V2500 as the nuclear engine.

It is still a long way off before mass production will be possible. MTU believes that CRISP could be operational by the mid-1990s or later.

12271

Europeans Critical of Space Station Agreement

36980298a Stuttgart FLUG REVUE in German
May 88 pp 62, 68

[Article by Dr Wulf von Kries: "Space Station Agreement Questionable"; first paragraph is FLUG REVUE introduction]

[Text] Criticism is voiced against the agreement concerning Europe's participation in the Space Station; military use continues to be a topic.

At its March meeting, the council of the ESA (European Space Agency) approved the Space Station agreements that were negotiated with the United States: a governmental agreement between the European participant states of the Columbus program on the one side and the American federal government on the other side, and an implementation agreement between ESA and NASA. This concludes a two-year's tug of war concerning the shape of what is up to now the most demanding and expensive trans-Atlantic space cooperation. The subject of the negotiation was the manned Space Station which President Ronald Reagan in 1984 made the responsibility of NASA, and which, according to present planning, should start basic operation at the end of 1995. The Europeans will supplement this core station by a permanently connected, operationally ready laboratory module. Besides this main contribution, the Europeans will furnish a polar exploration platform and will construct a semi-automatic laboratory flight unit that will operate within the Space Station compound. Japan will likewise extend the American station by a permanently docked technology module, and Canada will participate with smaller contributions towards the Space Station infrastructure.

Real Partnership Not Achieved

The overall resulting complex, however, will not be an international Space Station in the real sense of the word. First of all, NASA is erecting "the space station of the United States" (NASA Chief Fletcher). Consisting of a basic structure, operating and supply systems, a residential and a laboratory unit, as well as fixed platform elements, this basic station will be "verified" for a year before the European addition is made. Thus, the Europeans could not achieve a negotiation objective that was postulated at the ESA Ministerial Council Meeting at the beginning of 1985 in Rome, namely "true partnership"

with the United States. Europe will indeed participate with an independent contribution; but this concerns exclusively the extension of the use potential of the American station. And just like the Spacelab already developed for the Space Shuttle, the "attached pressurized module (APM)" is particularly subject to the NASA directives regarding design, development, and operation.

As master of the overall Space Station enterprise, the American space agency has not only reserved to itself unrestricted responsibility as regards all safety matters. It also determines the station-supervening design and draft planning, according to whose standards the coordinated individual development of elements contributed by ESA must align itself. A committee composed from representatives of all participating countries will indeed consult concerning the use of the internationally extended Space Station; but the NASA chairman has the last word. Operational planning and operational guidance will be provided by a NASA operating organization and by the American Space Station Control Center.

Nevertheless, the Europeans could achieve a guarantee for their property, for legal sovereignty, and an unlimited usufructuary right to their Space Station components. This surely is an improvement compared to the Spacelab agreement of 1973. According to agreement, however, the free use opportunity at the ATM is limited to half of its use potential. And this use is further limited by the fact that ESA has available only one eighth of the resources delivered by the Space Station, such as current or technical and manual operating capacity. This is the price for Europe being allowed to participate at all. Only a very rough estimate of the costs of the European Space Station participation altogether can be given at this point. While the American core station is billed at $14.6 billion, the European Columbus development program should cost about $4.5 billion.

Furthermore, the following must be paid to NASA: —All shuttle transports of Columbus hardware to the Space Station and back,
—Ditto for experimental units and probes, and
—Finally a continuing share of 12.5 percent in the apportionable basic operating costs of the station, which NASA currently estimates at 400 million dollars.

And these expenditures are not all. In the final analysis, the Space Station with its Columbus components is not an end in itself. It is to be used for science, technology and industry. The equipment for this also must be financed. Besides the cost risk, which in the last analysis can scarcely be estimated, the trans-Atlantic Space Station enterprise still harbors a risk of a special type. This has to do with American ideas about "national security." No recourse is possible against the assertion of national security interests by the United States. If the American government wants to use its Space Station for military purposes, it will (and may) do so. If this inhibits its use by the "partners" or makes such use partly impossible, that just cannot be helped.

Columbus Viewed as Independent Manned Space Station Test Bed

36980298b Stuttgart FLUG REVUE in German
May 88 pp 118, 122, 123

[Article by Goetz Wange: "The Great Freedom—Space Technology: Columbus Man-Tended Free-Flyer (MTFF)]

[Text]The free-flying space laboratory (MTFF) brings you up one step further in the direction towards an autonomous place in the cosmos. But even if the supply with the space glider Hermes functions, dependency remains. For maintenance, one must look to the U.S. station.

Autonomy was the subject of many discussions, in the foreground of the Space Station agreement between the United States and the European ESA states. From the point of view of the Europeans, there remained an extremely thin compromise (see also page 62): When all is said and done, the Americans indeed also have the say as regards the docked Columbus module. For their apprentice years, the Europeans will just have to live with this. But beginning in 1998, the great freedom beckons: A free-flying space laboratory, called Columbus Man-Tended Free-Flyer, will for the first time grant them their own manned base in cosmic space flight. An opportunity with consequences.

Its very start is to demonstrate independence. Unlike the Columbus module, which docks at the international Space Station, and is transported up with the Space Shuttle, the MTFF is to be brought, by means of a European carrier, to a 450 km high orbit (28.5 degree inclination). The starting vehicle of the 18.5 ton giant, that is more than 11 meters long (diameter 4.1 meters) is the Ariane 5. During the ascent phase, the two solar generators, each 35 meters long, remain rolled up, and even the antennas find only folded-in space in the payload tip of the rocket. Only about 107 minutes after lift-off, Europe's free-flying space laboratory in the cosmos will present itself in its full size.

MBB-ERNO—as so-called system architect, responsible for all Columbus parts—is also system manager for the MTFF. The integration of the components is taken care of in Bremen, where Air Italia will deliver the segments of the pressurized module, and Dornier will deliver the resource module as main components. Provision has been made to avoid nasty surprises during assembly. At a cost of more than 50 million marks, a Columbus simulator is being installed at MBB-ERNO, a complex computer program, which can already test, before the beginning of construction, whether everything will fit together. It stores not only the data for all components from European production, but also those boundary conditions that are prescribed by the American Space Station.

Consider all the freedom that the operation of the MTFF will open up for the Europeans! Here, too, one cannot make do entirely without interfaces to the American partner, because at least every four years the free-flying European space laboratory should dock at the main station for general overhaul and for tanking up. The procedure for this has already been specified, and it takes a total of seven hours. At a suitable interval, the MTFF must pull in its solar generators and switch over its control nozzles to cold-gas operation. The MTFF then drifts slowly into a parked position at the Space Station, where it is seized by a manipulator arm and is placed at the docking junction.

In detail, there still exists a series of unclarified aspects of the MTFF and the other Columbus modules. Thus, Sami Gazey, Columbus Program Director at MBB-ERNO, explains: "We are already asking questions that in part are not yet being answered by our partners in the United States." On the one hand, this is a very good sign for progress on the European side, but on the other hand it is a clear index of problems at NASA. Memories of the Spacelab program are coming back, where about one quarter of the program costs arose from the circumstance that NASA, during the development phase, continuously changed previously fixed interfaces. MBB Manager Gazey expects a similar situation with the Columbus program: "According to my estimate, the docked laboratory module and the MTFF could be subject to cost increases up to 20 percent for the same reasons."

At this time, ESA has taken precautions by appropriate budgetary items. And likewise the industrial firms participating in Columbus. To avoid public clamor as with the Spacelab program, they likewise built in appropriate safeties in a first tender offer. "But in the meantime, the steam has gone out of this issue," assuages the Program Manager Gazey. By mid-December, he has to tender a binding offer to ESA.

Much more important for MTFF than its interfaces to the U.S. Space Station are those boundary conditions which result from its supply by Hermes. Every 180 days, the space glider, beginning at the end of 1999, is supposed to dock at the rearwardly-affixed coupling stud at the MTFF, where the counterpiece is integrated into the end cone of the pressurized module. Once the doors have been opened on both sides, the MTFF and the Hermes form a solidly joined unit. Through the sluice-gate, the astronauts can change on the space base, and also supply goods, new experiments, as well as replaceable subsystems, can be brought on board. Those specimens that are to be brought back to earth, leave the free-flying space laboratory along the same path.

The MTFF astronauts will work only during the approximately once-weekly visit of Hermes. Otherwise, the experiments run fully automatically. The ground station can intervene to a limited extent by reprogramming. At the moment, there is discussion of increasing efficiency in the space laboratory by using robots to exchange the specimens. An example of the various concepts: Manipulators which are run along the floor of the laboratory from one experimental device to another. By contrast, robots whose action radius is limited to certain sections or even only to one standard cabinet would have the advantage that no precautionary measures would have to be taken in the case of manned operation.

The main utilization areas for the autonomous Columbus station are basic research and preliminary programs for production in space, especially in the area of crystal growth, metallurgy, liquids, and biosciences.

Two tons of payload can be stored in the laboratory area. In the standard cabinets, there is an abundance of experimental equipment, as well as melting furnaces, automatic laboratories, or cultivation chambers for biological projects.

Out of the total 10 kW delivered by the solar generators, about 5 kW are available for the experiments.

However, experience gained from operating the free-flying laboratory will almost be more important for European space travel than the research results from the large number of experiments. It will appear whether the foundation stone has been laid for a continuously manned space station.

Columbus Man-Tended Free-Flyer

Main Parts	Pressurized module (two segments) plus Resource Module
Size in Orbit	11.6 m x 69.5 m x 21.8 m
Starting Weight	18.5 t
Payload	2 tons at the beginning, later expandable up to 5 t
Payload Volume	10.5 cubic meters
Power	10 kW total, of which 5 kW for payload operations (120 V DC)
Communications	100 Mbps downlink, 25 Mbps uplink
Operating Orbit	Boomerang orbit referred to the orbit of the international Space Station (450 km, 28.5 degrees inclination)
Life Span	30 years (maintenance every four years at the Space Station; service every 180 days by Hermes)
Basis Vehicle	Ariane 5

Long-Term Planning for Advanced European Space Transportation Systems

3698M400 Munich DORNIER POST in English No 1, 1988 pp 4-7

[Article by Rudi G. Reichert: "Long-Range Planning for Advanced European Spacetransportation Systems"]

[Text]

Mission-Scenario/Advanced Technology-Development

The decision for the national Hypersonic Technology Programme has also been triggered by the B'Ae-proposal (UK) for a single-stager, horizontally launched space vehicle, called HOTOL—as well as by the decision in the U.S. for the development of NASP, the National Aerospace Plane, a 3.3 billion dollar programme, based on the original idea for development of an "Orient Express" passenger aircraft. In the present phase 2 of the US Companies Rockwell International, General Dynamics and McDonnel Douglas are involved in the definition of an experimental vehicle, called the X-30, using supersonic combustion ramjet engines (Scramjets), which is scheduled for flight-testing by 1993.

In Germany several national studies on the subject of future space-launchers as well as on possible developments in the aircraft field have been made in 1986/87, where—due to the extreme technologies (time and cost), required—a single-stage spacetransporter could not be recommended for Europe. This led to the two-stager concept, using air-breathing engines, called Saenger to be used as a long-term goal for a national technology-programme.

The expected European spacetransportation-scenario for the relevant period of time will be:

- up to 15t unmanned payloads into LEO (28.5°) or corresponding equivalent payloads for other missions, e.g. heliosynchroneous or geostationary orbits, etc.
- approximately 5t manned payloads into LEO (28.5°) and back (four days autonomous orbital phase)
- Estimate of flight-frequencies:

—manned: 5 to 20 per year
—unmanned: 7 to 14 per year

As a comparison and in accordance with a recent report by Arianespace the total mass of commercial spacecraft will increase from 1985 until 2000 from 25t to 57t, corresponding to 15 and 24 satellites per year, respectively.

With the idea of having an independent European Space-Station, based on MTFF-modules (Columbus programme) by the time around 2015/20, a considerable increase in the yearly masses to be transported into space can be expected—in order to manage the logistics—-supplies as well as the exchange of the crew in a safe and cost-effective manner. The question still remains to be solved, if—for the larger cargo-missions—a more conventional launchers shall still be used in parallel.

Another feature of the space-transportation systems, discussed here will be the capability for take-off and landing in Europe,—i.e. from 38 to 40 degrees of northerly latitudes.

This included the requirement of a side-range-capability in the order of 2500 km.

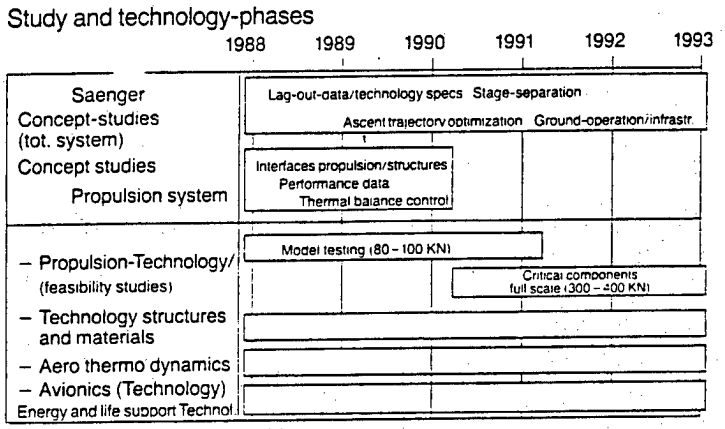
The Saenger Concept-Options

The concepts consist of an air-breathing first stage with a total, net mass of approximately 265t, the second stage, in the order of 90t (return PL payload 5t). A unmanned cargo-module, called "Cargus" for 15t of payload into LEO (28.5°) with a total mass in the order of 60t can also be applied alteratively instead of the 2nd stage (HORUS). It is to remark that in addition to the national engine studies by MTU and MBB there are also relevant engine-technology-studies, presently going-on at ESA, where the ideas of Rolls Royce, SNECMA-SEP and of Fiat Aviazione will be documented. In the field of air-breathing combination—engines for space-applications presently still various ideas exist and only more detailed investigations in conjunction with the respective vehicle lay-outs, trading advantages and disadvantages, followed by model engine-testing under simulated altitude-conditions will give final answers for the specifications of such future engine-developments.

The Saenger D vehicle-Option, proposed by Dornier was presented at the BMFT on December 1, 1987. The major difference of the Dornier Lay-out versus the MBB proposal lies in the operational usage (and/or the requirements) of the air-breather-engines as well as in the mach-number and design concept of staging. Here the air-breather-engines can be used up to a mach-number (5 or 6), depending on the actual technology-limits, also considering the thrust-decay at higher mach-number, reliability and cost. The rocket engines of the second stage will be ignited in due time in order to continue ascent flight until the optimal staging velocity and altitude is reached. (Also a parallel operation of the air-breather engines with the initial operation of the more powerful rocket engines can be envisioned).

The propellant for the initial operation of the rocket engines is contained in tanks of the first stage. Separation occurs by means of mechanical linkage-devices—as well as by separation—valves, which have been successfully applied in the Atlas-vehicle and on the US Space Shuttle (separation of the external tank).

By this method of de-coupling the cut-off of the air-breathing engines from the point of staging the following advantages are reached:



National hypersonic technology preparations

- The technology of the Air-breathers (reliability and cost) must not be stretched beyond reason. Also the diffusor inlet-area can be kept smaller (structural weight).
- A safe and optimal staging can be reached in accordance with the desired ascent profile, using the more powerful rocket-engines for the final ascent of the first stage.
- In case of starting difficulties of the rocket-engines the upper stage would be flow by the 1st stage.

The BMFT decided, to further study the Saenger-concept commonly between MBB and Dornier with respect to the various options and technologies which still exist in order to prepare for the decisions concerning preliminary specifications and/or priorities for the national Hypersonic Technology Programme.

Of course, at a later time such vehicle studies will have to be taken-up and/or continued in international cooperation, which is also true for the full-scale technology-developments, including the fight-demonstrators and larger test-facilities, due to the relatively high cost, involved for such a programme.

TOTAL SYSTEM DATA	Launch mass	(Mg)	360
	Take-off thrust	(KN)	2400
	V* ascent into LEO	(m/sec)	14.400
	Ruckkehrnutzlast, bemannt	(Mg)	~ 5
	One-way payload, LEO	(Mg)	~ 15
	Stage separation M = /h	(–) / (km)	7 – 8 / 35 – 40
	Cross range	(km)	2 x 2.500
1st STAGE	Propellant mass H_2/O_2	(Mg)	~ 110
	LOX portion	(Mg)	~ 10
	Net mass	(Mg)	~ 155
	Mean spec. impulse	(sec)	3.050
	Burning-time	(sec)	1.850
	V* (including cruising range)	(m/sec)	8.830
2nd STAGE	Initial mass	(Mg)	~ 95
	Propellant mass	(Mg)	~ 65
	LOX portion	(Mg)	56
	Net mass	(Mg)	~ 22
	Spec. impulse	(sec)	472
	Burning-time	(sec)	210
	V*	(m/sec)	5.550
	Landing mass	(Mg)	~ 27

Main technical data (Saenger) – European launch

National Hypersonic Technology Programme-Planning

The national HST-programme of the BMFT is planned to run over a time period of five years. It consists of conceptual studies for the total system as well as for the propulsion-system and the actual technology work in the individual disciplines:

- Air-breathing propulsion, (60 percent)
- Aerothermodynamics, (15 to 20 percent)
- Structures and Materials, (15 to 20 percent)
- Avionics and Equipment, (5 percent)

Furthermore, the test requirements out of the various disciplines shall be compiled, leading to a planning with respect to modifications of existing relevant facilities and the demand for new ones, required (IABG/DFVLR). In this connection also model- and/or simulation-testing will be taken into consideration. (Also such facility plannings will have to be internationally coordinated eventually, in order to avoid duplications and/or to guarantee proper usage.)

In any case, it is positive that initiatives were taken by the BMFT for the early preparation of new technologies, required for advanced European transportation-systems in order to influence the strategy in this field and to allow for an adequate involvement of the German industry and institutions in such future programmes.

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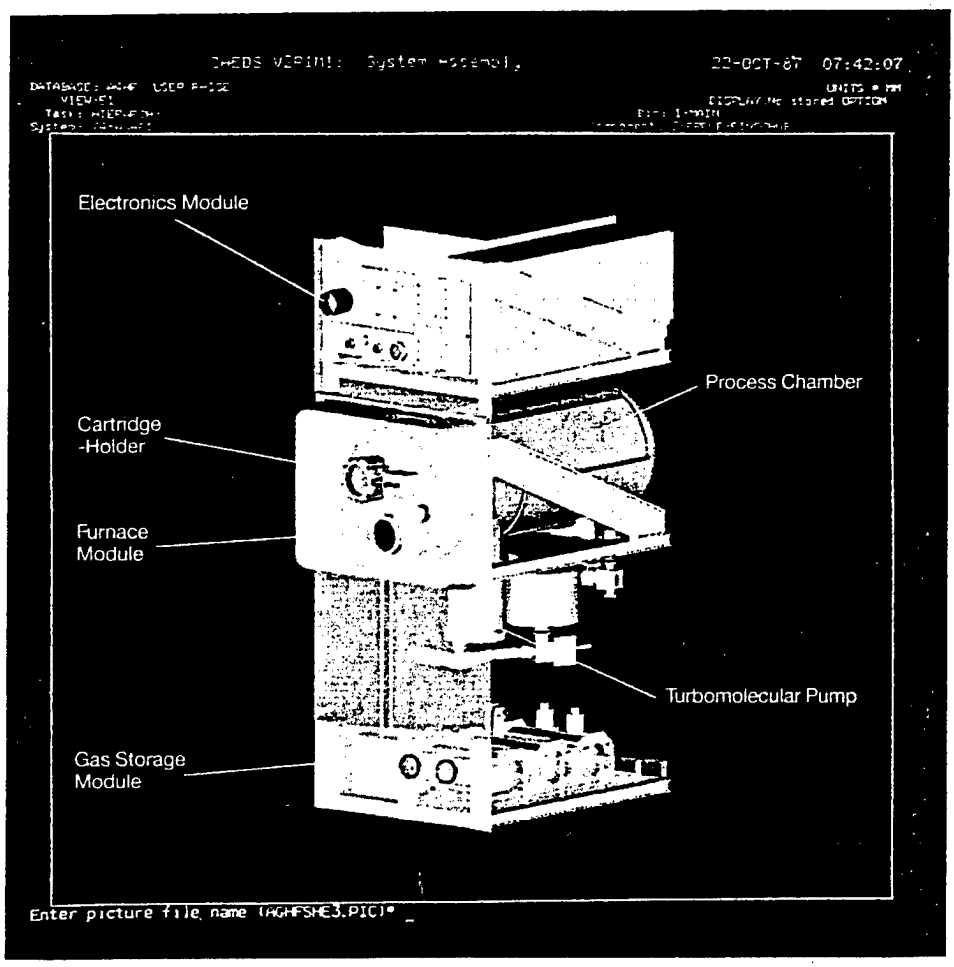
Dornier of FRG Designs Equipment for Crystal Growth Experiments

3698M402 Munich DORNIER POST in English No 1, 1988 pp 33-35

[Article by Wilfried Biemann: "Advanced Gradient Heating Facility for Crystal Growth Experiments in Spacelab"]

[Text] Dornier is developing the Advanced Gradient Heating Facility (AGHF) under contract to ESA. This



System design

advanced experiment setup will provide excellent conditions for crystal growing and other material experiments in Spacelab. The first application is planned for the IML-2 mission of NASA. From its predecessors, the AGHF differs from its modular design, comprehensive experiment instrumentation, and the extreme temperature stability of the gradient heating system.

Modular Design

The AGHF is based on three 19-inch modules which will be integrated one below the other in a Spacelab rack. AGHF contains from top to bottom:

- Electronic module—with data and power electronics and operator front panel
- Heating module—with vacuum process chamber comprising two heating blocks, one cooling zone, one feeder system, and a vacuum system to generate pressures below 10^{-5} mbar.
- Gas supply module—with one to three glass bottles for a maximum of two inert gases like argon and helium, pressure control and pressure relief valves as well as the filler necks which are covered at the operators' side.

In spite of the compact arrangement, the different function groups thus can be developed and tested separately by Dornier and the subcontractors (SEP in France; CMI in Norway; BTM in Belgium).

The modules are designed for exchangeability of important subassemblies. By using appropriate heaters and cooling subassemblies or even a different module, restructuring for different experiment types is easy. Although the first version of AGHF was designed for semiconductor crystal growth, the interface structure allows an easy adaptation for metallurgical tests including quenching of the samples.

The modules are fixed in the rack on three essentially identical rails so that the total load of 140 kg is favourably distributed.

Data Electronics

The data electronics control and monitor scientific and safety-relevant functions independent of the data processing equipment of Spacelab (Spacelab CDMS) by means of an experiment processor. This module also contains the analog and digital circuits to supply the sensors and actuators in the AGHF and to acquire their data; 30 measuring channels for the samples plus more than 50 other sensors, more than 20 control and switching functions, and 16 individual LED displays are connected. In addition, the data electronics receive and transmit data via an interface with the Spacelab's data processing system. The bit rate is approximately 3 kbit per second.

The measuring channels for the water thermocouples are especially important and of very high quality as their signals are used for heater temperature control. Each of the four thermocouples has its own channel with automatically temperature-compensating amplifier and integrating analog-to-digital converted with 16-bit resolution.

The software for the system operation is programmed in C and installed in ROMs in the data electronics. It allows to process samples with a maximum of 50 independent sectors. For each section, feeding velocity and temperature of the heaters can be selected in an experimental data memory which is introduced at the front panel. Sample coding ensures the correct association process parameters, data and samples.

Power Electronics

The power electronics transform the uncontrolled voltage available in Spacelab of 28 more or less 4 V into the required regulated and stable voltages and currents. With a maximum input current of nearly 60 A, the AGHF fully uses the power available at one input.

For heater supply, regulated high-power sources with more than 80 per cent efficiency are used, which supply 16A and 22A. The same power supplies can be switched for 50 to 900 milliseconds to supply currents of up to 30A to the samples for Peltier pulse marking of semiconductors.

Operator Front Panel

The operator front panel at the electronics module indicates the system and experiment status with 16 LEDs. In addition, switches to start and stop as well as abort an experiment are provided. Here, the astronaut confirms that he has carried out the few operations required for sample changing which cannot be monitored by the data electronics.

A specialty worth mentioning is a connector which is connected to the same serial interface of the data electronics as the Spacelab data processing system.

In a special "reprogramming phase" at the beginning of each process, the pre-programmed parameter set can be reprogrammed. This is done via the serial data interface of the data processing system of Spacelab, or via the above-mentioned connector at the front panel. This connector can be linked during the mission to a small additional external computer. On the ground it is used to transfer data and instructions between a command and test computer and the system is test operations or for comparative experiments.

Heater Module

The heater module, of course, forms the centre of the crystal-growing setup. In the AGHF, it fulfills to a very high extent the requirement that as little disturbing accelerations as possible should be transferred to the samples, and that stable high gradients should be reached in the samples. The components of the heater-/cooler arrangement and the feeder mechanism have been designed accordingly. By the interaction of the property dimensioned heating blocks, the above-mentioned high-quality measuring channels, and a very sophisticated control algorithm, the heater/cooler arrangement reaches the required heater temperature stability of plus or minus 0.2 K even at 1400°C.

For feed by a 50-pole stepping motor is used which is operated in sine-cosine mode under control of the data electronics. Every cycle is resolved in time and amplitude with 12 bits. Together with a satellite roller spindle and a high-precision worm gear, a very smooth feed is obtained even for the slow speed of 0.01 mm/min, while a maximum speed of 20 mm/min can also be reached.

The heating facility requires a vacuum of better than 10^{-4} mbar. Therefore, a turbomolecular pump is installed between the AGHF and a Spacelab ventline. This vacuum pump is equipped with active magnetic bearings in order to avoid disturbing accelerations.

Crystal growing sometimes requires several days duration under constant conditions. Therefore, the vacuum quality in the AGHF had to be independent of the pre-vacuum, which can fluctuate by several orders of magnitude under the influence of all systems simultaneously connected to one line. A vacuum lock with two vacuum shut-off valves of which only one is open at any one time is used, and the line vacuum is measured and monitored by the AGHF.

Gas Supply

The AGHF needs inert gas as a protective measure in the process chamber between experiment runs and during sample changes. For the first time, a separate module which can easily be disconnected from the system is used for this purpose. This avoids in particular the problematic and time-consuming filling of gas bottles in the integrated Spacelab immediately before launch, a critical work as the system is filled with a pressure of 170 bar.

Samples

The sample material must be enclosed in a crucible and installed in a metal cartridge. The outer diameter of the cartridge is specified to be 20 mm when it is cooled with a liquid metal ring; otherwise, it may be up to 21 mm. the maximum crystal growth length is 80 mm. The cartridge can house up to 28 thermocouple, lines for Peltier pulse marking current, and a crucible failure detector.

Future Development Potential

After the first implementation, the AGHF offers optimum conditions for further development. Different heater/cooler arrangements for isothermal, gradient, or zone heating experiments, quenching installations, gas and vacuum atmosphere can certainly be introduced. The adaptation to the Columbus space station or full automation also should be relatively simple. So it is hoped that the concept and components of this system will lead the way for many future experiment systems for material science in space laboratories.

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ESTEC Develops SAR Swath-Widening Techniques

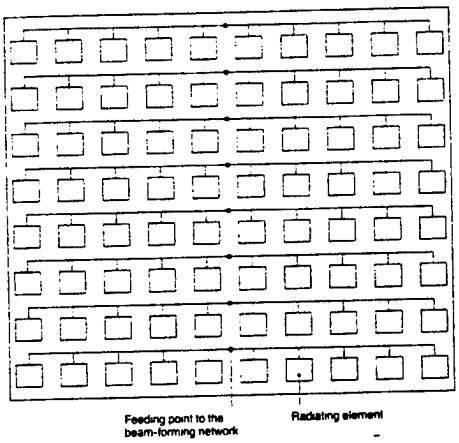
3698M401 Munich DORNIER POST in English No 2, 1988 pp 24-27

[Article by Winfried Walter and Dr Hans Martin Braun: "SAR Swath-Widening Techniques"]

[Text] The European Space Agency had awarded this study two years ago because users wished to view very large areas of Earth simultaneously in future SAR (Synthetic Aperture Radar) missions. Basic possibilities to expand the swath illuminated by SAR are, among others, a lengthening of the antenna, positioning of two parallel beams, or using electronic beam steering.

These possibilities were investigated with the goal of widening the swath of 80 km available with the ERS-1 SAR to 200 km. Taking into account all essential electrical and mechanical aspects, the feasibility of the following antenna designs was analysed:

- a 20 m long antenna (this corresponds to twice the length of the ERS-1 SAR antenna)



Front view of a microstrip antenna panel

- a 10 m long antenna with one large transmit beam and two small receive beams
- a phase-controlled 20 m long antenna (active array).

In addition, the suitability of three possible technologies was investigated with regard to their electrical performance, mechanical and thermal stability, weight and integration feasibility into the Ariane IV launcher: aluminium waveguide, CFRP waveguide, and microstrip arrays. In principle, all three technologies are suitable from the electrical and mechanical point of view.

In the study, the microstrip array was favoured, as this technology is considered to have the greatest growth capabilities for SAR applications in future. Electrical analyses were made for the three proposed antenna types, design studies were conducted, as well as thermal and structural analyses. Finally a general comparison of the passive and active antenna principles was made.

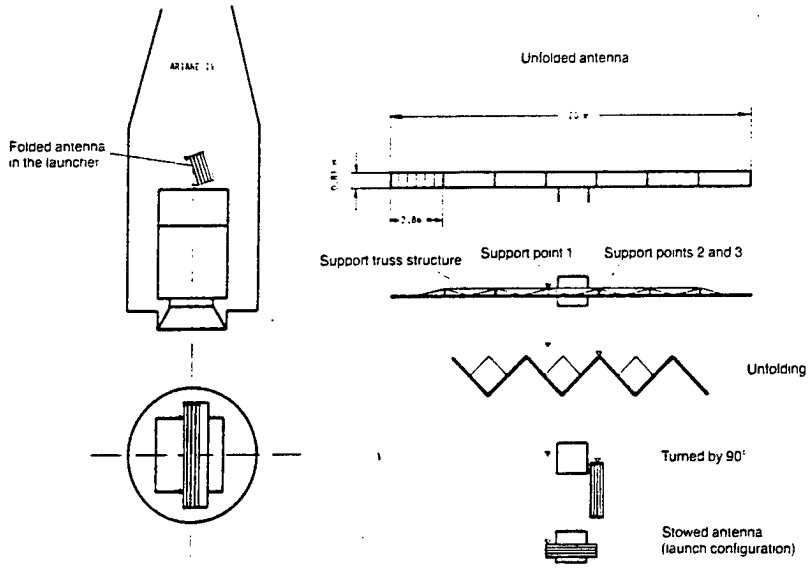
Passive Long Antenna

Electrical design

Based on the requirements for the radar system, the following electrical parameters were set up for the study of the long passive antenna:

Antenna length	20m
Centre frequency	5.3 GHz
Bandwidth	50 MHz
Polarization	vertical
Peak Power	17.5 kW
Lobe width, azimuth	0.15°
Lobe width, elevation	16.3°
Antenna gain (within swath)	39.9 dB to 37.1 dB

In addition, the maximum antenna sidelobe levels were defined by masks. The elevation mask required that the form of the lobe should be controlled by a special phase excitation of the individual radiating elements on the



Configuration and unfolding process of the passive long antenna

antenna surface whereas in azimuth a constant uniform illumination was selected to obtain a maximum gain. This electrical antenna design was made independent of the technological design. The control network for the long passive antenna, which defines the illumination function, has been designed in the form of a "Blass matrix".

This antenna can be implemented either as a slotted waveguide array or as a microstrip array. The latter consists of metal structures of a dielectric plate. For waveguide antennas, the control network is mounted on the rear. For microstrip antennas, it can be mounted at the rear or implemented onto the metallized structure at the front. The control network can be realized in waveguide or microstrip technology. The latter technology has been preferred as lower radio-frequency losses and smaller manufacturing problems are expected.

Mechanical Design

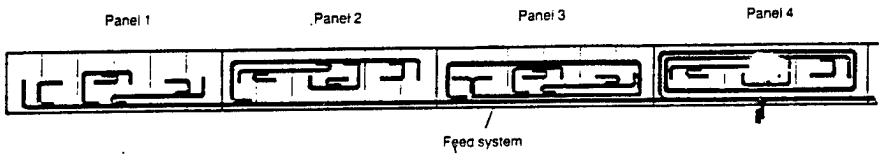
The passive long antenna is a planar structure 20 m long and 0.81 m wide when unfolded; the dimensions of the folded panel package in the launch configuration are: 2.9 m (long) x 0.81 m (wide) x 0.5 m (high).

The main components of the antenna structure are:

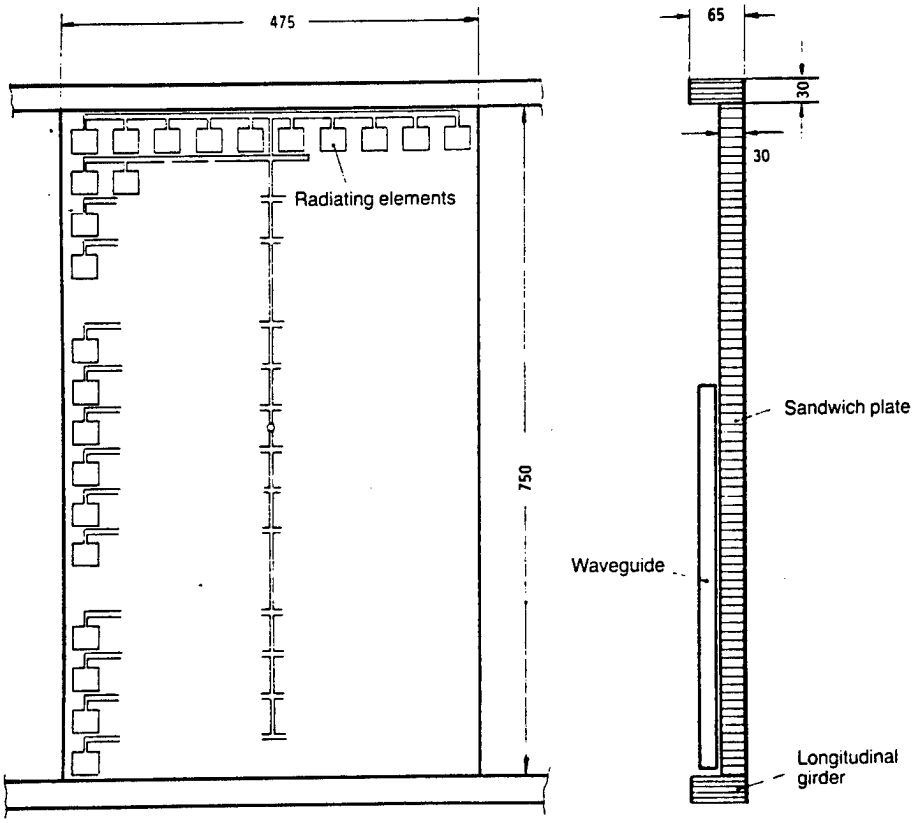
- seven mechanical panels of identical size (2.9 m x 0.81 M)
- a foldable truss structure
- a hold and release mechanism
- an unfolding mechanism
- six panel pairs connected by hinges
- a locking mechanism

In the launch phase, the panel package is held by four clamps pertaining to the hold down and release mechanism in order to take up the high take-off loads without damaging the antenna in the launcher payload bay.

When the climb phase is over, three clamps are released and the whole panel package is swiveled by an electric motor through 90° while it is still held together by an additional clamp. When this clamp is released, the unfolding process starts which is also motor-driven. A roller and pull rope system at the hinges between the panels ensures the simultaneous and controlled unfolding of the individual panels in the form of a leporello. The truss structure at the rear of the panels is unfolded at the same time to provide the panel row with the necessary stiffness when fully unfolded. When the unfolding process is finished, the antenna is automatically locked.



Feed system of the passive long antenna



Electric panel of the passive long antenna

ach mechanical panel essentially consists of six electric panels, a sandwich support plate, two sandwich bars at the long edges of the sandwich plate, and the feeding waveguide system at the panel rear.

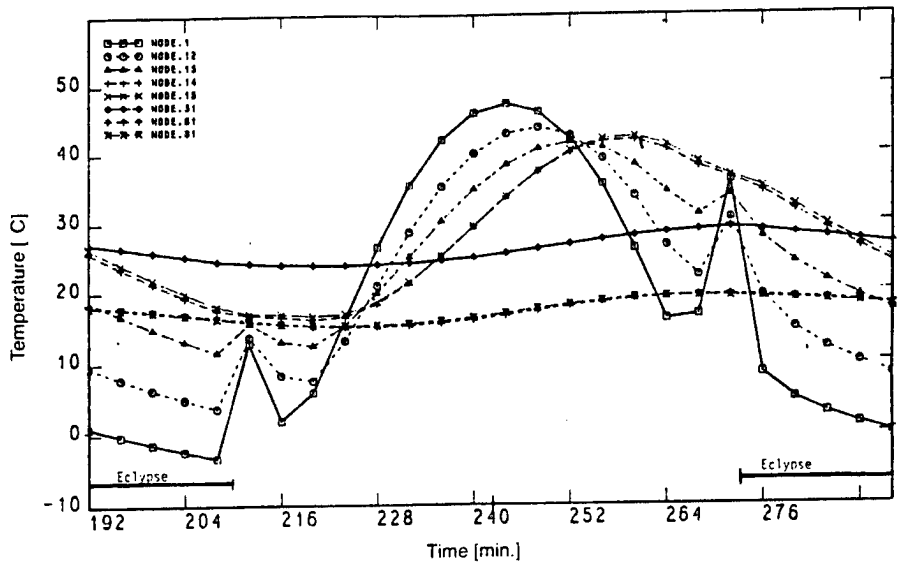
The electric panels are in principle designed as multi-layer compound structures of Kapton foil with a big number of rectangular radiators (copper coating), a Nomex dielectric below (honeycomb structure made of aramide paper), metallized CFRP layers, and electric conductor networks. The antenna feeder system consists of metallized, straight and bended CFRP waveguides with couplings and conical connections to link waveguides with different cross-sections.

Thermal Analysis

The thermal design was selected in accordance with the thermal requirements. The radiating front of the antenna remains uncovered, while the rear is protected by a blackened foil. The calculations showed different temperatures at the individual structural parts over the panel cross-section during one orbit. The biggest temperature difference is approximately 50°C.

Structural Analysis

The dynamic analysis carried out with the passive long antenna led to a minimum natural frequency of 2.67 Hz for a mode which is characterized by a bending around the antenna cross-axis. Antenna deformation due to temperature gradients is expressed by a deflection of the outer ends by less than one millimeter.



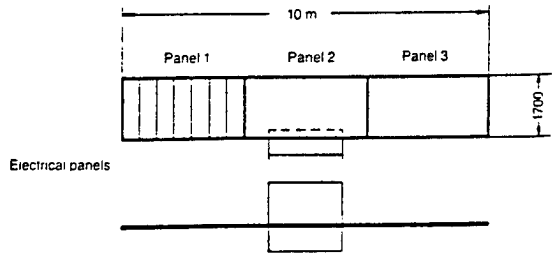
Transient temperatures over one orbit

Passive Dual-Beam Antenna

Electrical Design

The dual-beam receive antenna is an antenna which radiates the radar signal over a large beam in elevation and receives the radar echoes over two which are only about half as wide and positioned side by side. The following specifications differ from those for the long antenna:

Antenna length	10m
Beamwidth, azimuth	0.3°
Beamwidth, elevation	
Receive beam 1	8.3°
Antenna length	10m
Beamwidth, azimuth	0.3°
Beamwidth, elevation	
Receive beam 2	7.7°



Dual-beam antenna, unfolded

Mechanical Design

When unfolded, the passive dual-beam antenna is 10 m long and 1.7 m wide. The most important components are:

- Three mechanical panels of identical size (3.33 m x 1.7 m)

A hold down and release mechanism (similar to that of the long antenna)

Two panel pairs with hinge connection

Deployment and locking mechanisms

The unfolding process for the dual-beam antenna differs from that of the long antenna due to the smaller panel number. The central panel is fixed at three points to an intermediate structure on the satellite. When folded, the right panel rests on the central panel and the left panel on the right one. When the release mechanism is operated, the uppermost (left) panel, driven by a motor, moves to the side until it reaches its final position. The next (right) panel swings to the other side until it is full extended. A support truss structure is not necessary as the dual-beam antenna is only half as long as the "long antenna".

The structural design of the mechanical panels is practically the same as for the long antenna, apart from an increased number of electric panels per mechanical panel (seven instead of six). In addition, the antenna feeder system is significantly larger, due to the special electrical principle of the dual-beam antenna which unites two identical complete waveguides systems at the rear of the antenna.

Structural Analysis

The minimum natural frequency of the unfolded dual-beam antenna is 3.8 Hz. A dynamic analysis additionally carried out with the folded antenna yielded a minimum natural frequency of 54 Hz, which compares well with an earlier result obtained with the ERS-1 SAR antenna. Thermal deformation has approximately the same order of magnitude as on the long antenna.

Active Phased Array Antenna

Electrical Design

The active phased array antenna consists of radiating elements or element groups with directly dedicated amplifier modules which are distributed over the rear of the antenna. Being fed by means of a signal distribution network, these modules serve as signal amplifiers and control the illumination function in phase and amplitude allowing to steer and to form the radiation pattern.

In azimuth, the antenna is subdivided into 49 subarrays (electric panels) being equally designed and fed by low level signals. The small beams needed for the receive mode determine the maximum antenna width and the central part of it is used for the broad beam in transmission mode. This means that receive/transmit modules are used in the central part and receive only modules in the side parts. These modules are connected to a central computer where the respective lobe shapes and directions of radiation are controlled.

Mechanical Design

The unfolded active phased array antenna has a length of 19.6 m and a width of 1.08 m. The main components of the construction and the unfolding process are similar to those of the passive long antenna. The structural design of the electric panels, however, is totally different. They have a box form and consist of:

- the electric layers at the front
- U-shaped CFRP stiffening profiles in fixed intervals over the whole panel width
- a CFRP laminate which partly covers the U-profile row
- a rear CFRP cover

The RX/TX modules are arranged in zig-zag between the U-profiles. The connecting elements and cables of the feeder system are arranged in the second mounting layer, the current distributors and the distribution network are placed on the rear cover. Seven electric panels each are connected by two outer longitudinal girders to form a mechanical panel.

Thermal Analysis

The objectives of an efficient thermal control for the active antenna are, firstly, to limit the temperatures of the electronic components in the modules to a tolerable value and, secondly, to ensure the optimum transfer into outer space of the heat generated in the modules. The second objective comprises the heat transfer from the modules to the structure and heat distribution over the available surface.

These tasks are fulfilled by a purely passive temperature control: arrangement of large aluminium plates, application of a heat-conducting paste, thermal foils for the panel rear faces and the longitudinal girders, and coating of the reflecting antenna face with white thermal paint.

Structural Analysis

The dynamic behaviour of the unfolded active antenna is characterized by a minimum natural frequency of about 2.0 Hz; thus it does not differ significantly from the passive long antenna. The same holds true for thermal deformations. The maximum distortion of the antenna ends is less than one millimeter.

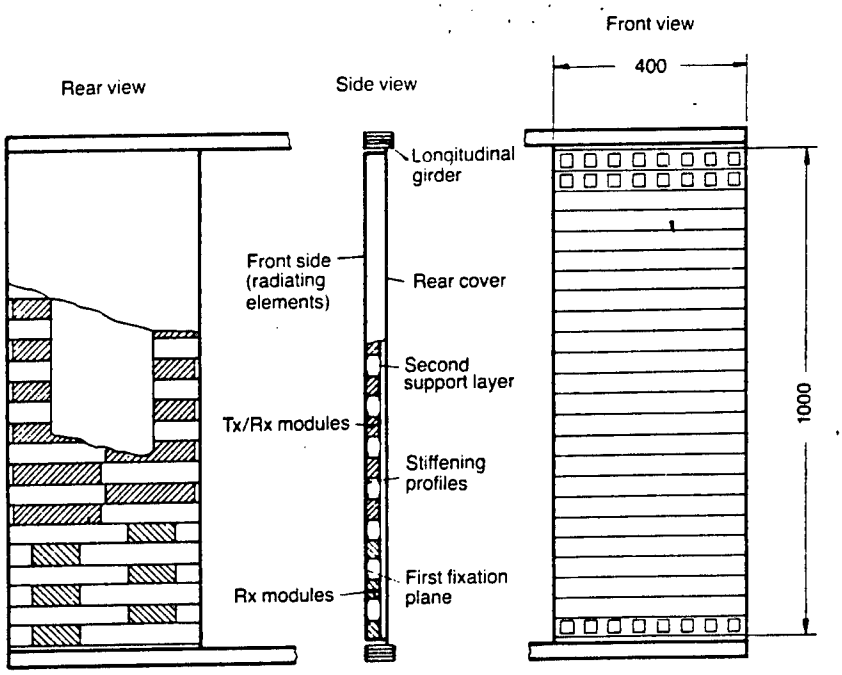
Comparison of Passive and Active Antenna

Electrical Aspects

A comparison shows that the active array is superior to the passive antennas in nearly all electrical aspects, as soon as several beams or beam steering and two polarizations are required. This comparison has not covered all aspects because of the fact that the amplifier stages of the passive antennas were not investigated within this study. Nevertheless, if the results of former studies and developments of radar systems with passive antennas are seriously considered the following trends conclusions could be drawn:

- The active antenna can radiate more radio-frequency power in total.
- It avoids very high power in the transmission channels and hence, avoids arcing problems in waveguides or coaxial cables under partial vacuum, as power generation is distributed over many parallel modules and does not take place in a central high power amplifier.

- The realization of different polarizations is possible with less technical effort.
- The active antenna has an inherent system flexibility (beam control).
- As power amplification is distributed over many parallel amplifiers, in case of a failure of one or more



Electrical panel of the active antenna

amplifiers, the antenna performance degrades gracefully and the operation can be maintained.

- But the high development effort required for active antennas is only worthwhile when a certain operations flexibility is needed.

Mechanical Aspects

When comparing the passive antennas with the active phased array antenna, it becomes clear that there are no or only insignificant differences in many aspects from a mechanical point of view, such as panel arrangement, stowing in the launchers, mechanical and thermal stability, pointing accuracy, and the unfolding system. A significant difference, however, is the weight of the two concepts. The passive antennas have a weight of approximately 160 kg, the active antenna one of about 630 kg, mainly due to the electric feeding systems and the big number of amplifier modules. If the additionally required 200 kg power amplifier for passive antennas is taken into account, the active antenna has about twice the weight of the passive antenna.

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BMFT's Hypersonic Technology Program Outlined

3698M394 Munich DORNIER POST in English No 2, 1988 pp 45-48

[Article by Dr Eckart Steinheil and Wolfgang Uhse: "Technologies for Hypersonic Flight"]

[Text] The implementation of hypersonic aircraft—with cruising speeds above Mach 5—is being prepared in all major industrial nations. Advantages and basically new solutions for problems in aviation, military and space technology are expected from this development. For the Federal Republic of Germany, the creation of a cost-efficient and safe space transportation in international cooperation has the highest priority. Sponsored by the Federal Ministry for Research and Technology (BMFT), the industry, research institutes, and universities are working on solutions for an optimum overall concept and on the most critical technological problems with the aim of preparing for an international cooperation. The basic design is the "Saenger II" reusable two-stage space vehicle proposed by MBB with horizontal take-off and landing capabilities. Dornier has presented an alternative concept which is being studied more thoroughly under contract to BMFT.

Task Definition, Applications

Further research in, and the practical use of, outer space decisively depend on a significant reduction of the present exorbitant transportation costs. Hypersonic transport systems are an indispensable means to achieve this goal. In the field of military technology, too, attractive applications, for example in reconnaissance, can be envisioned. On the other hand, an economic use of hypersonic aircraft in long-distance air transport still seems to be fraught with problems. For example, the high transport capacity of such aircraft would result in a critically small number required worldwide.

The greatest advantage of hypersonic flight for cost-efficient space transport systems is the chance for a

significant payload increase or, in other words, a drastic reduction of take-off weight for the same transport capacity.

In fact, the oxidator accounts for half the take-off weight of existing, rocket-driven space transportation systems. If an air-breathing engine can be used for an essential part of the ascent stage instead of a rocket engine, only a fraction of the former oxidator quantity is required for the upper part of the ascent. Air-breathing engines, however, have a significantly lower thrust-to-weight ratio. The consequence is horizontal take-off with a winged vehicle which has, on the other hand, the advantage of long range capacity in atmospheric flight.

Saenger II has a lower stage with hybrid air-breathing engines and a rocket-driven upper stage. A maximum initial speed of the upper stage is crucial for a high pay-load fraction. The stages, therefore, are separated in 30 to 35 km altitude at nearly Mach 7. The long range of the air-breathing lower stage engine enables the vehicle to reach an orbit close to the equator from an European airport. Both stages will return to the take-off point.

The BMFT's Hypersonic Technology Programme

The implementation of a hypersonic transport system essentially depends on the development of the required technologies. Only based on a technological advance, will Germany's voice be heard and listened to in international cooperations. Therefore, the BMFT initiative must be welcomed as it unites the industry, state-controlled research institutes and universities in a hypersonic technology programme.

This programme is subdivided into three phases and planned for a duration of 15 years. By concentrating all resources under a firm leadership, it is to lay the technical foundations for the subsequent implementation of a space transportation system. The present Phase I (five years) consists of in-depth conceptual studies for the overall system and the propulsion system, and of so-called individual technological projects for the four main disciplines: propulsion, aerothermodynamics, materials-/structures, and flight guidance systems. This is a purely national phase. It is important insofar as its results will decisively contribute to the weight of a German demand for a leading role in the programme.

The second phase (seven years) will concentrate on construction and early testing of a demonstrator built in European or transatlantic cooperation. Phase III (three to five years) is characterized by extended and the start of the development of a complete powerplant. At its end, a decision on construction of a hypersonic aircraft can be made with competence.

Individual technological topics of Saenger—which is to follow the Hermes programme—the big technological challenges are in the lower stage and in the integration of the upper and lower stage. Both stages together form a complex hypersonic vehicle reaching seven times the speed of sound.

The air-breathing hybrid engine constitutes the biggest challenge. In the areas of aerothermodynamics and materials/constructions, fundamental problems must be solved as well before a technical and economic evaluation of the concept can be made. In addition, questions of flight guidance and individual system designs such as life support and secondary energy supply must be studied at an early stage.

Air-Breathing Engine

The entire vehicle (upper and lower stage) is accelerated by air-breathing engines of the lower stage from horizontal take-off to cruising speed of Mach 4.5 and, if possible, to the stage separation speed of Mach 6.8. The advanced rocket propulsion of the upper stage—supplied with fuel and oxidator of the lower stage—may also provide the final acceleration before stage separation. The lower stage returns to the take-off base, propelled by the same air—breathing engines.

The high velocity rang from Mach 0 to almost Mach 7 requires the combination of two engine types, in principle a turbojet engine for the lower speed range and a ramjet engine for the upper range. The air intake is being adapted to the relevant Mach number by a complicated system of mobile ramps, and combustion air is either supplied to the turbine or the ramjet engine.

The main of technological challenges are:

- Aerodynamic integration of airframe, air intake, powerplants, and thrust nozzle. A large area of the aircraft lower side acts as a "compressor" for the propulsion system. New calculation methods are required for internal and external aerothermodynamics.
- Materials and constructions for large air intake structures. At Mach 7, temperatures up to 1800C are reached in the air intake due to the extreme compression.
- Turbine powerplant with very high-temperature resistant materials
- Ramjet engine
- Adjustable nozzle segments

Aerothermodynamics

While aerodynamic forces generated by the airflow around the aircraft receive paramount attention in the design of conventional transport and combat aircraft, in the high supersonic and hypersonic ranges the so-called aerokinetic heating of the air caused by its friction on the aircraft surface gains in importance. In the ascent phase of the complete Saenger system, the relatively long

cruising phase at Mach 4.5 dominates, while in the re-entry phase of the upper stage heating profile is determined by speed and the time spent at various altitudes.

In cruise, the thermodynamic state of the air can be basically described by the equations of state for ideal gases, but there are uncertainties regarding the transition of the airflow from a laminar to a turbulent state because our present knowledge of the high-speed range is still limited. Such uncertainties severely affect the predictions of heat transfer. During reentry into the atmosphere, the upper stage will pass through a multitude of different flow patterns at various altitudes. It has been shown—mainly by the American Space Shuttle programme—that an experimental simulation of the flow states cannot sufficiently fulfill all laws of similarity. Therefore, paramount importance is attributed to the further development of numerical calculation methods.

These methods have to be adapted to the specific problems of hypersonic flight (high speed, great pressure differences, surface heat transfer, real-gas effects). The geometrical complexity of the configurations, mainly the complete ascent configuration and the configuration during the separation process, constitute a big challenge for the calculation methods. Finally the prediction of the transition and turbulence in the high-speed range make new demands on theoretical processes. Dornier will work on the following aerothermodynamic tasks:

- Preliminary design procedures taking special account of the determination of structural loads and heat transfer
- Calculation methods for the exact determination of load and heat transfer (numeric solution of Euler equations for friction-free flow and of Navier-Stokes equations for frictional flows, including real-gas effects; generation of calculation networks of complex configurations for these procedures)
- Flow-physical and thermodynamical basics with special regard to transition prediction in the high supersonic and hypersonic speed ranges and to three-dimensional interaction phenomena between shock waves, boundary layers, and eddies (these two conditions are critical for heat transfer because this increases considerably after the transition from laminar to turbulent flow and because interaction phenomena can give rise to extreme local temperature peaks, so-called hot spots).

There is a direct interdisciplinary data exchange with the "materials and structures" sector for structural load calculations and thermal analyses. Within the concept studies, engine air flow intake is analysed for the first stage and aerokinetic heating during the re-entry phase for the second stage.

Materials and Structures

The greatest challenge in the construction of the airframe and major components of the propulsion system is the minimization of structural weight. Aerodynamic heating increases the temperature to some 550°C in about 60 percent of the outer skin, in a further 20 percent to 700°C, and the nose and wing leading edge areas are even heated up to more than 1000°C. This influences both the selection of materials and the—generally complex—structures. A novelty, at least for the aircraft designer, is the required long-duration resistance of structural materials to high and extremely high temperatures, for which new technological terrain must be covered.

Ceramic materials technology is the key to the highest temperature range (1000°C to more than 2000°C). The unreinforced ceramics at present available, however, are too brittle for highly loaded structural components. The technological approach to increase the strength of ceramics and to obtain a ductility similar to that of metals is fibre reinforcement. Silicon carbide (SiC), carbon (C), and aluminium oxide (Al_2O_3) are suitable both as reinforcement and as matrix materials. While an unreinforced ceramic component will fail spontaneously and totally at a certain mechanical excess load, the embedded fibres will lead to a gradual failure corresponding to a quasi-plastic, metal-like behaviour.

Both the development of improved ceramics and the process of their adaption to structural components are primary research subjects at Dornier.

Large areas of the structural surface will be exposed to temperatures between 350°C and 700°C. For these components, temperature-resistant titanium alloys will be studied, which allow weight-saving and cost-efficient constructions with superplastic forming processes (SPF) combined with diffusion bonding (DB). High-temperature resistant alloys (produced by melting metallurgy or powder metallurgy), intermetallic phases, and metals with fibre or particle reinforcement (MMC—Metal Matrix Composites) are the prime choices. The know-how required for the complex task of combining external structures subjected to high temperatures with internal structures subjected to cryogenic temperatures must be acquired buy building and testing exemplary components. Extensive materials and production research for military aviation forms a basis for continued work. For the cryotank area, special attention must be paid to the further development of fibre reinforced composite technology. This technology enables the engineer to design structures with no, or at least small, thermal expansion in view of the problems associated with dimensional variations at changing temperatures.

To reduce the effects of critical temperatures on the structure, additional measures can be introduced: partial protection of the structure by a heat shield—a metallic multi-wall thermal protection system (TPS), for example, or ceramic tiles—or by passive cooling with heat pipes. A multi-wall TPS consists of several thin titanium or superalloy sheets which are bonded in sandwich technology and can be filled with a recirculating coolant,

if necessary. Heat pipes provide temperature compensation between structural areas subject to different thermal loads (principle of isothermalisation). The heat is transported without external intervention by a continuous evaporation and condensation cycle of the cooling agent. Especially in the field of heat pipe technology, Dornier can provide a qualified contribution on the basis of its vast experience.

The high-priority work in this technological discipline can be grouped under three main subjects:

Flight Guidance and Control Systems

Criteria for flight-mechanical characteristics and performances must be set up to form the basis for design evaluations. To verify these criteria, a model must be developed to stimulate longitudinal and lateral movements in controlled and uncontrolled flight.

Proposals for work-sharing between man and machine must be worked out with the goal of estimating the effort and risks of different variants. Then flight guidance principles can be derived, system components defined and critical parts identified in these components.

Thermal Balance, Cabin Concepts

A calculation model must be set up as a design tool in order to calculate heat flows in a realistic environment, that is including heat sinks and heat insulation in the airframe. The specifications for the components of active cooling systems must then be defined on the basis of these model calculations, and alternative proposals must be made which include the use of new technologies.

Supply and Monitoring Systems

This task concentrates on secondary energy supply. Within a large flight regime, no shaft power can be drawn from the propulsion system. Therefore, different physical principles have to be studied, possibly using the large amount of available excess heat.

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Future Operational Aspects of European Space Station Described

3698M395 Munich DORNIER POST in English No 2, 1988, pp 49-54

[Article by Gerhard Lippner: "Future Operational Aspects of the Space Station"]

[Text]

Scenario of the Space Station

The scenario of the European space station is structured in two phases

1. Operational phase from 1996 up to ca. 2005 (IOC: Initial Operation Capability) with the elements

- the European space laboratory (APM: Attached Pressurized Module), which will be docked to the International Space Station (ISS), and which will be launched in Ca. 1996 with the US Space Shuttle
- the Polar Platform (PPF) for earth research in a polar orbit, which will be launched with Ariane V (ca. 1997)
- the free-flying laboratory (MTFF: Man-Tended Free-Flyer) coorbiting to the ISS, which will be launched with Ariane V (ca. 1998). Servicing will be performed in the first period at the ISS. Hermes will then take over the international servicing every 180 days and the external servicing will be performed every four years at the ISS. Limited external services can also be performed by Hermes with Extra Vehicular Activity (EVA)
- the transportation system Hermes with the operational capability after 1999. Hermes will be launched with Ariane V
- the communication satellite EDRS (European Data Relay Satellite) as part of the communication net
- the Ariane V as the core element of the transportation system

2. in the phase after IOC (AOC: Advanced Operational Capability) the European autonomy shall be improved, e.g.

- servicing without ISS
—Use of an European Logistics Vehicle (LOVE)
—permanent manned European Space Station
- extension of the MTFF with an additional docking module (IEC: Inter-Connecting-Element) in order to be able to attach additional modules (e.g. habitation module).

Further the transportation systems of the next generation e.g. Saenger, Hotol, EARL (reusable vertical launching carrier) have to be included in the future operation.

Tasks of Operation

The tasks of operation include

- Planning/Management
—definition of user goals
—definition of the overall system scenario
—definition of the cooperation frame, e.g., European, cooperation with NASA, etc.
—set up of an overall mission plan
—task distribution between elements (incl. ground infrastructure)
—resource allocation (crew, power, data channels, etc.)

• System development
—operational analysis of the system design for the space segment incl. payloads and derived requirements and constraints for the design (e.g. logistics concept), automation concept).
—system development of the ground infrastructure
—basic astronaut training, training of ground personnel

• Mission preparation
—set up and verification of system and element time lines crew activity plans subsystem and payload time lines
—mission related astronaut training
—logistics, transportation planning
—specific training of ground personnel

• Mission execution
—system check-out during launch campaign
—execution/update of time lines
—monitoring and control of systems, subsystem and payloads
—health and fault management
—trend analysis
—servicing

• Post mission processing
—taking care of the astronauts
—deintegration, storage and distribution of payloads-/samples to the users
—mission evaluation, analysis
—production of proposals for improvement of systems, subsystems (H/W & S/W) operational procedures.
—refurbishment of elements/subsystems before next mission preparation.

Operational Concept

To achieve a systematic, clear structured operational concept the operational tasks will be presented in hierarchical control structures. Tasks and their planning/update periods are grouped into hierarchical levels:

1. Strategic management, the long term planning including political and technical goals.

2. Tactical management, the midterm planning considering the planned elements and resources.

3. Mission management, the highest level of mission execution for the realization of the overall mission time line. Control of interelement tasks (e.g. RendezVouz and Docking).

4. Element operation with the core task of execution of the element time line and the control of the modules.

5. Module operation with emphasis on execution of module mission time line and task distribution/control for sub-systems, crew, payload and between on-board and ground.

6. Subsystem operation including sub-system control.

Depending on the subsystem these levels will be extended down to the smallest executing unit (e.g. thruster, [word indistinct]).

The clear structure of hierarchical levels allows an exact definition of the task allocation between the control centres (e.g. Central Mission Control Centre, Element Control Centre, etc.).

Special topics of the operational concept are among others:

- Crew activities
- automation and robotics
- servicing cycles
- transportation needs.

In the area of crew activities Dornier puts special emphasis on the development of the EVA-System (Extra Vehicular Activity) inclusive space suit.

In the area of automation Dornier has the leading role within Europe for 'internal robotics'.

Special tasks for logistics are among others the evaluation, planning and organisation for the servicing cycles and the transportation needs.

Ground Infrastructure

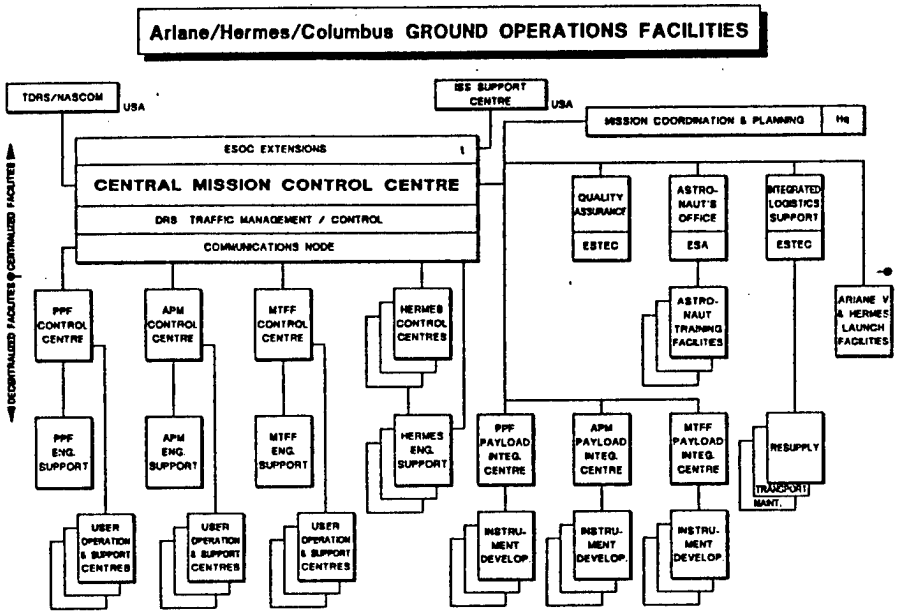
The operational concept will be implemented in an arrangement of decentralized control centres. The actual overview for the ground infrastructure is shown. According to the NASA/ESA 'Memorandum of Understanding' (dated 21 January 1988) the APM Control Centre will be directly controlled by the ISS Control Centre in Houston. The connection to the APM-'Engineering Support Centres' is not yet finally decided. Besides the participation in the mission control centres, the user centres and the Crew Training Centre, Dornier lays stress on the lead of the MTFF-'Engineering Support Centre'.

Optimization of Operational Costs

The operations are an important cost driver due to number of space elements, complexity of the ground infrastructure and the long mission life time. With respect to these constraints it is mandatory to reflect on means for the reduction of operational costs.

One important factor for cost reduction is the improvement of on-board autonomy. For the ground infrastructure the location of the man/machine interface is another driver for the required manpower.

Higher development effort is required for the improvement of the on-board and on-ground autonomy in order to reduce the overall system costs.



Columbus/Hermes ground infrastructure

Besides the application of conventional methods special emphasis should be put on the application of Artificial Intelligence. Possible areas for application of Knowledge-Based Systems are e.g.

- Health and Fault Management
- Mission Planning Systems
- Improvement of Man/Machine Interface.

The ground infrastructure will be defined in parallel to the definition of the space segment within the next years. Besides the space segment the participation in the ground infrastructure will be main contribution of Dornier.

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Zone Melting Furnace for Experiments Under Microgravity Outlined

3698m397 Munich DORNIER POST in English No 2, 1988, pp 55-57

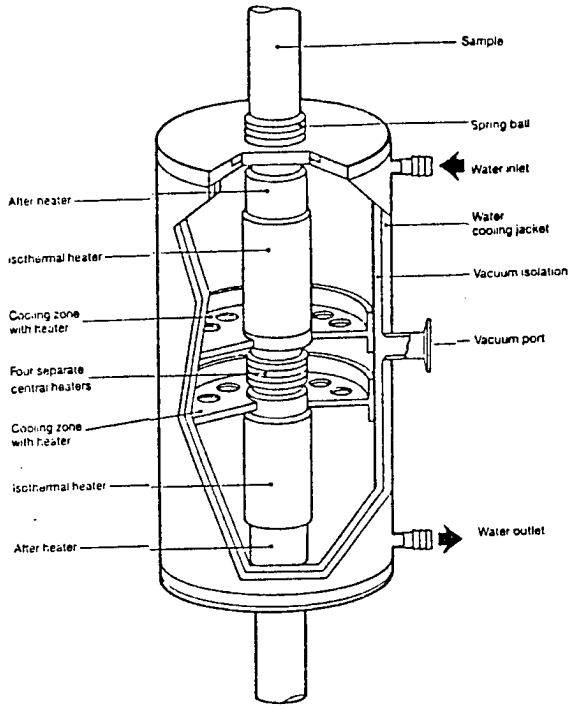
[Article by Dr Rainer Behrle: "Zone Melting Furnace for Experiments Under Microgravity"]

[Text] Unlike the light-heated facilities for materials research under microgravity conditions, such as ELLI, AMF of MHF (Mirror Heating Facility) the Zone Melting Furnace is a resistance-heated furnace with a maximum heater-temperature of up to 1500°C, much like the Gradient Furnace with Quenching Unit (GFQ) flown on the D1 mission. The ZMF contains ten separate heating or cooling zones, the temperatures of which can be separately controlled, while the GFQ has only two independently controlled zones. This is another advantage of a resistance-heated furnace over a mirror heating facility. When the experiment requires a special axial temperature profile in the sample, possibly with freely selectable temperature gradients on both sides of a variable-width melting zone, the subdivision into several heating zones will be preferable to the single light focus of a mirror heating facility.

In 1987/88, following detailed specifications compiled by crystal-growth researchers and many years of n-house research and development in the field of multizone furnaces, Dornier set up a ZMF laboratory model for DFVLR. This equipment is a fully functional crystal growth facility for research in a terrestrial laboratory. It does not pretend to be a model for later missions on board the Spacelab or Space Shuttle, it nevertheless permits testing and developing the essential part of a future flight unit, namely the zone heater. The very time-consuming development and testing by the scientific investigator can thus be advanced to an earlier stage. So experiences and performance data of the heater can be used immediately for Phase B (1988-89) which is just starting, and the facility may even be ready for the IML-2 mission (international Microgravity Lab) of Spacelab.

ZMF Heater

The performance data of the ZMF Heater are essentially characterized by the specifications of a GaAs crystal



ZMF heater

growth process. But many experiments with lower requirements regarding maximum temperatures in the individual heating zones or temperature gradients within the sample have also been taken into account in the heater design.

- Four central heating zones reaching up to 1500°C guarantee excess temperatures in the middle of the sample, representing the molten zone in the crystal growth process.

- The subdivision of the central heater into four individual segments offer the possibility of a flexible variation in zone width.

- As defined temperature gradients on both sides of the melting zone cannot be obtained exclusively by controlled heating in the range of the central heater, two symmetrically arranged cooling zones are provided to form a controllable heat sink. This means that the radial heat dissipation from the sample along these cooling fins can be controlled by counter-heating. Consequently in the area of the heater wall, a local temperature minimum is expected, while the axial sample temperature profile passes smoothly over into the adjacent isothermal range. The critical temperature gradients at the interface between melting zone and the growing monocrystal can therefore be controlled for different materials and heat conductivities.

- One isothermal heating zone at each side of the melting zone guarantees a flat temperature profile in the sample axis, on one hand to minimize the build-up of tensions within the sample and on the other to reduce the influence of heater movements relative to the sample for the duration of the crystal-growth process, which amounts to several centimetres.

- The support heaters at the heater front ends compensate for heat loss along the two sample ends. They are naturally slightly hotter than the expected isothermal temperature of the samples and contribute to a flat temperature distribution within the sample.

- Heaters including the spring mechanism for length compensation are enclosed in a water-cooled shell with an additional vacuum-insulated gap.

- During the crystal growth process, the whole heater is moved along the cylindrical sample (30 mm diameter) at speeds from one millimetre per day up to several millimeteres per minute.

Modular Design Concept

It has become clear that the heater design is much influenced by the planned experiment (especially for high temperatures and limited energy resources). Not every experiment requirement for a certain temperature profile can be fulfilled to the same degree, and a new requirement must not always lead to a completely new facility design for the lab model or flight unit. A modular design must allow the exchange of components on as low a level as possible.

Long-term operational considerations for the use of a high-temperature furnace aboard the Columbus space station support this concept. As the heater lifetime is limited, a regular exchange must be envisaged. Routine exchange and maintenance are, and should be possible in orbit to permit the sequential adaptation of the heater temperature profile to different experiment groups. To achieve these objectives, a modular constructions has been selected as the design concept for the zone melting facility. In the ZMF lab model the heater can be exchanged "with a single grasp" and it can be easily modified due to its internal modular structure.

Peripheral components like:

- cooling system
- gas/vacuum system
- temperature control
- power supply
- data acquisition
- motor control

remain unchanged, which last but not least reduces the cost of heater optimization.

The same should be for the flight unit to be developed. Data acquisition unit, power supply and gas supplies will complement the central modular furnace as separate

19-inch rack units to form a complete facility. Each of these components will be designed for the monitoring and supply of one ten-zone heater, while the selection of the individual heating zones needs not yet be fixed in detail.

The modular furnace will be constructed to a similar modular principle in order to permit a simple exchange of the heater. Heater, cooling shell, and the furnace drive together form the central furnace segment. The latter will be placed into the vacuum process chamber from the front side and connected to the new supply lines. The sample can finally be inserted from the front sides by the Spacelab payload specialist or, in the more distant future, by an automatic sample exchange mechanism aboard the Man-Tended Free-Flyer (MTFF).

Outlook

Although the described medium-term development aims at a flight possibility of the ZMF within one of the next IML missions aboard the Spacelab, the first operational considerations for Columbus form the background to all this.

Th first demonstrations of such a modular facility in operation, and maybe in addition some first tests of the interaction between the facility and a superior automatic sample exchange thus become possible.

/9274

FRG Develops Recoverable Capsule for Cost-Efficient In-Orbit Experiments

3698M396 Munich DORNIER POST in English No 3, 1988 pp 52-54

[Article by Klaus Jager: "Re-Entry Capsule for Experiments—The Space Courier"]

[Text] The interruption in the American Shuttle programme, caused by the known accident, led to a lack of flight time under microgravity. An alternative solution would be to carry such experiments in re-entry capsules. In spite of comprehensive experience with recoverable capsules, however, the U.S. do not offer such an opportunity. Other than the U.S., the USSR disposes of flight hardware for manned mission and for commercial unmanned missions. China, too, has re-entry capsules which are offered for industrial purposes. FSW and FSW2 are two capsules of different size of the "blunted cone type" (corresponding to the Discoverer shape) which are available on the world market to carry payloads as single or combined loads.

This situation is one reason for the interest in the Space Courier. Another reason is the necessity recognized in the meantime that the Space Station needs a rescue module. This is to be developed in several learning steps, starting with the Space Courier for pure payload transport, with the goal of European autonomy. In view of this situation, the requirements for the Space Courier system design were fixed as follows:

- Development of a re-entry capsule for payload transports as fast as possible (first flight 1991)
- Minimization of development costs by maximum use of proven hardware
- Consideration of aspects which will arise from the use in a later, manned scenario
- Flexibility with respect to launcher utilisation
- Minimization of operating costs.

Space Courier Design

The system design of the Space Courier capsule will be essentially determined by: shape and size of the capsule, re-entry mode (ballistic of controlled with lift), re-entry angle, capsule concept (expendable module or integral design) and subsystem designs.

One of the first tasks in the Space Courier design was the definition of its exterior form. Due to the design requirements mentioned above, the Space Courier development had to be orientated towards proven capsules and shall benefit from these. After critical review of proven capsule design, the remaining alternatives were the unmanned blunted-cone shape used within the Discover programme in the USA and the manned capsules from the Mercury, Gemini, and Apollo programmes.

Capsules of the blunted-cone type were the first re-entry vehicles because they were suitable as rocket nose cones and had a low aerodynamic resistance which allowed a fast return to Earth. Considerable heating had to be accepted. The manned Gemini and Apollo capsules are exposed to lower heating as they fly with the blunt side forward. Thus the conical side is less heated and lead doors and sensors can be installed here. It became clear that a Gemini type capsule was the optimum compromise for the special tasks of the Space Courier.

The capsule size must take into account both the user requirements for a certain payload mass and the conditions imposed by the launcher. From the payload point of view, where at present mainly materials sciences dominates with their relatively high demands on power supply and payload volume, a requirement resulted for a payload of about 400 kg at a volume of 0.7 cubic meters, with an average power supply of approximately 200 W. These requirements and the experience gathered n earlier capsule studies allowed to fix the capsule weight at approximately 1400 kg and the maximum capsule size at some two meters. These characteristics are also compatible with the requirement that different cost-efficient launcher systems should be used. At present, the only relatively efficient carrier systems are those of the Chinese (CZ-2) and the Soviet Union (Tsiklon). A Space Courier capsule of the size defined above will not need all the capacity of such a system. But a capsule of bigger

size would inevitably reduce the utilisation of launches which are planned in the USA for commercial applications. An example is the Amroc Industrial Launch Vehicle (ILV) with a payload capacity of 1400 kg and a maximum diameters of two meters.

All capsule systems utilized up to now were equipped with a so-called expendable module which could contain part of the subsystems batteries, radiators, and possibly the de-boost motor. This module was separated from the capsule before re-entry. For cost reasons, such a module has been given up and an integrated system preferred for the Space Courier. Only the de-boost motor is jettisoned when the parachute opens.

For the subsystems, the following design has been selected:

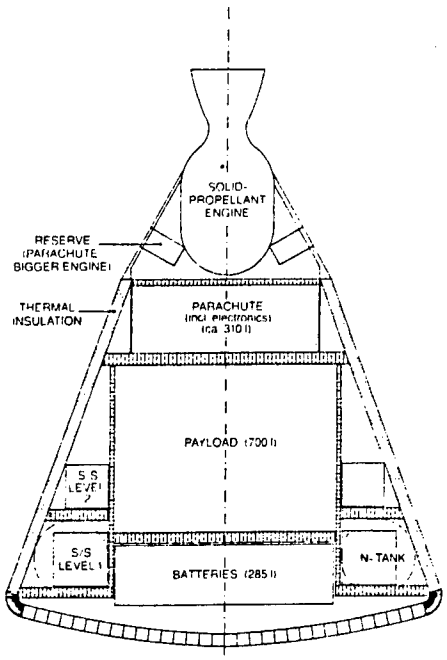
The structure consists of a heat shield, the cold load-carrying structure made of a aluminium, and, in the conical part, a cover made of high-temperature resistant material. The heat shield is made of an ablative material for cost reasons.

The thermal system will have a passive design with heat pipes in order not to influence microgravity conditions in orbit. Attitude and orbit control will be performed by a redundant computer which steers a solid-motor for the retrograde manoeuvre and a cold gas system for attitude control. The data management system will be designed as a bus system with a 128-Mbit data memory and another redundant computer. The S-band system will be used for orbit determination and telecommunications, batteries for power supply.

A conventional system is under consideration for the parachute system. As soon as gliding parachutes are qualified for the landing weights reached with the Space Courier, they will be used. The landing site has not yet been fixed: possible places are in China, Greenland or Australia. At present the preferred place is Greenland, where a landing shock damping system is not required because of favourable ground conditions.

The first detailed capsule design consider for subsystem integration on two levels around the payload container. The payload is fixed in a dedicated bay on two plates which, at the same time, represents the cold plate. As mentioned above the de-boost engine has to be separated before parachute opening. It is intended that it will land with a small parachute.

New technologies must be developed for the Space Courier in the re-entry field, both for operations and for the above-mentioned heat shield. Re-entry is initiated by a braking manoeuvre in orbit, with the braking direction and impulse essentially determining the ballistic re-entry



Conceptual design of Space Courier

and the resulting maximum deceleration, heat load, and landing precision. The re-entry of the Space Courier will be characterized by the following parameters:

- ballistic flight
- re-entry angle of 2.5°
- maximum deceleration of 9 g
- landing area of 20 x 5 km

The decision for a ballistic re-entry and an ablative heat shield are imperative if the required minimum development cost and time are to be respected. For later Space Courier versions, the design may be improved to obtain a better landing precision, lower loads, and reduced operating costs.

As the Space Courier system design shows, the main objectives are fast implementation and low development costs, as specified. This permits to quickly build a transport vehicle on the one hand and to enter into re-entry technology on the other. Care has also been taken that, based on the technological experiences with the first generation of the Space Courier, a continued development can lead to improved unmanned—and ultimately also to manned-versions.

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SFENA of France Produces Gyrolaser for Ariane IV

36980301b Paris L'USINE NOUVELLE in French supplement to 19 May 88 pp 19-20

[Article by Marc Chabreuil: "Ariane IV: Maiden Space Flight for Gyrolaser"]

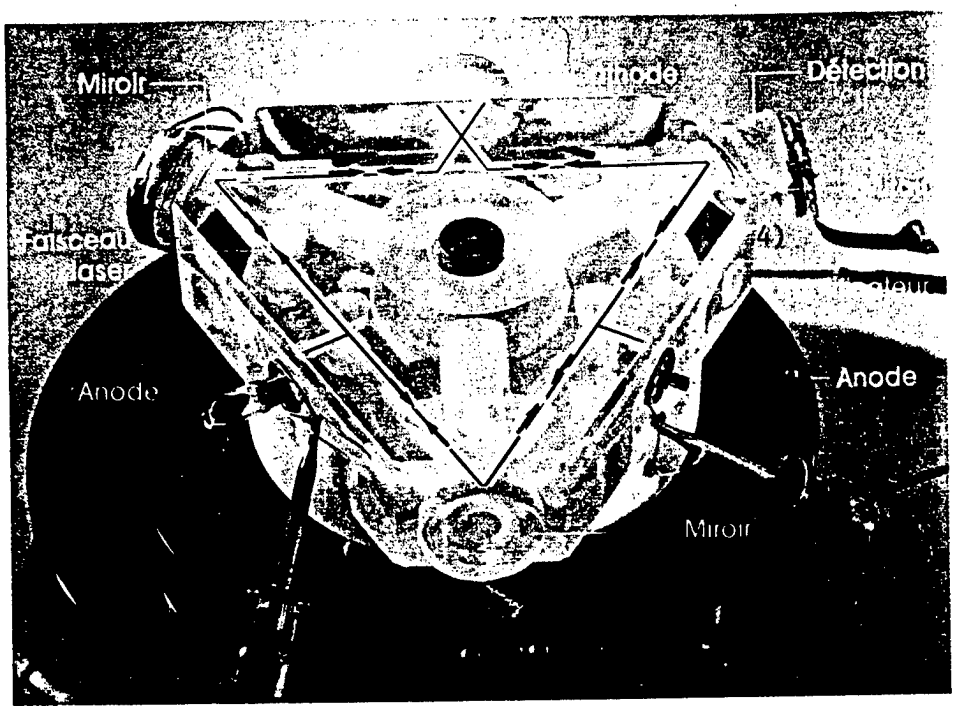
[Text] Ariane IV is packed with high-tech products. But one of them clearly stands out: SFENA's gyrolaser, which guides the rocket.

On 8 June, an Ariane rocket is expected to take off for the 23rd time from the Kourou center. Routine flight? Not at all. This firing will be crucial for Europe's space industry, which on this occasion will test its Ariane IV launcher.

Derived from preceding versions, from which it borrows many parts, notably its engines, Ariane IV is electrically a new rocket. Its more precise guidance system has been entirely digitized. Particularly, in order to enhance guidance reliability, a "gyrolaser" inertial unit was added to the conventional gyroscopic system of the Scottish company Ferranti. This is a world premiere.

Designed in less than two years by SFENA, the "gyrolaser unit" (CGL), which weighs only 21 kg with a volume of 18 l, provides four measurements: Ariane IV's altitude, speed, acceleration, and angular velocity. It consists of three pendulum accelerometers and three gyrolasers (one per axis of reference), as well as a process computer (400,000 to 500,000 operations per second) and a power supply (100 W). It is derived from prototypes studied for planes and missiles. Only the quality and sturdiness of the system have been improved to meet space requirements: the structure and installation of electronic components have been modified.

SFENA's Gyrolaser



Key:—1. Laser beam—2. Mirror—3. Detection—4. Amplifying medium

A gyrolaser is actually a double laser oscillator. For Ariane IV it consists of a triangular cavity with a perimeter of 33 cm. Surrounded by three mirrors, it is filled with a helium-neon mixture. The application of an electric potential (by means of two anodes and a cathode) excites the gas mixture and produces a plasma which acts as an amplifying medium. The optical circuit machined in the material—capillary tubes with diameters of one to several millimeters act as waveguides—is crossed in inverse directions by a double laser beam (0.63 microns) which converges on a mixer prism and a photoelectric detector.

If the cavity is motionless, the two light beams, which move in inverse directions, will reach the detector at the same time and will have the same oscillation frequency. But if the cavity has a rotating motion around a perpendicular axis, they will have to travel different distances; their frequencies will then no longer be identical. If the difference is a one-half multiple of the fundamental frequency (0.63 microns), interference fringes are created by superposition. These are detected by a simple photoelectric cell which "sees" the passage of dark and white bands. The process computer calculates the rotation velocity.

SFENA's gyrolaser inertial reference unit will be used as a stand-by system. Cautious, not to say conservative, the engineers in the space sector are skeptical of innovations; a gyrolaser however, offers many advantages, but only when its technology is mastered, which is not an easy thing. The construction of the triangular optical cavity, the heart of the system, requires an angular precision close to a second of a degree; its polishing approaches one angstrom so that its mirrors can be attached by molecular adhesion. The result is that a gyrolaser system is still a little less precise than a mechanical gyroscopic unit. Moreover, since it is not mounted on a moving platform, but instead is rigidly attached to the rocket's structure one month before launching, which offers an advantage over the mechanical unit, it is impossible to perform any calibration of the accelerometers at the last minute (they must be pivoted by 180° to measure 1g, the earth's gravitational acceleration, and -1g).

These few drawbacks are largely compensated by the many advantages of the gyrolasers. "To begin with, the absence of moving parts and the small number of component parts gives them unparalleled ruggedness. This simplicity also explains why they cost 30-40 percent less than the American gyroscopic platforms," states Yves Salles, SFENA engineer. Moreover, their accuracy depends only on immutable geometrical dimensions (the laser cavity is machined from Zerodur, a very stable material made by the German company Schott, whose expansion coefficient is of the order of 10^{-8}), whereas conventional gyrometers must take into account kinetic moments, torque, magnet strength, gyroscope balance, and aging. Another advantage is that because displacement is measured solely with interference fringes (successive bright and dark stripes), gyrolasers are naturally digital and therefore very precise, whereas conventional systems are based on the measurement of currents.

At present, 14 flight models are on order from SFENA, and a contract for about 50 units is being negotiated; a total of about 100 units should be fabricated. SFENA's Chatellerault plant has set aside 2,000 m^2, of which 1,500 m^2 as a clean room, for this production. The Ariane IV rocket, a true "variable geometry" launcher, will be Europe's warhorse at least until 1997. No less than 36 different versions out of the possible 42 have been investigated "in depth" by Aerospatiale, its industrial architect. This original concept will allow the launcher's characteristics to be adapted to a customer's exact needs in each case. The Arianespace company will thus be in a position to lower its prices by 40 percent compared to Ariane I, while waiting for the first firings of Ariane V and the flights of the Hermes space plane, which will also be equipped with gyrolasers, just as the Rafale, and probably the renovated Transall and some missiles.

Photo caption, p 19 [Photo not reproduced]

At Chatellerault, SFENA has built 1,500 m^2 of clean rooms reserved to gyrolaser manufacturing. The first operational application of this type of equipment will be on the Ariane IV rocket in June.

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Overview of R&D Activities at France's SNECMA

3698030la Paris L'USINE NOUVELLE in French 19 May 88 p 65

[Article by Marc Chabreuil: "SNECMA Invests in Research"]

[Text] In collaboration with about 100 laboratories, SNECMA prepares the technologies that will father the aircraft engines of the 21st century.

If there is one area of expenses that cannot be cut at SNECMA, it is research; in 1987, the French engine manufacturer spent 6 percent of its revenues (Fr564 million) on it. And despite the deficit that the company has just announced, its research budget will be very slightly higher this year.

The company certainly does not want to mortgage its future: the development of a new generation of aircraft engines corresponds to a genuine technological mutation, which needs no less than 10 or even 15 years of studies. "It is essentially at the start of a new program that our customers and collaborators establish their contacts with the company. They know our development efforts very well, but not our research. We must familiarize them with this upstream activity at all costs," points out Alain Habrard, director for research and advanced studies.

Vital for the future of the French manufacturer, this activity involves 600 people in the enterprise, and 100 researchers in agencies (ONERA—National Office for Aerospace Studies and Research, and so on), public laboratories (CNRS and universities), and engineering schools (School of Mines, Ecole Centrale de Lyon, and so on). Either directly, or through contracts from the ministries of defense, research, and others, SNECMA collaborates with more than 100 French or foreign laboratories. It directs 150 research projects on materials (the largest share), fluid mechanics, energy, combustion, and aerothermy.

Today, SNECMA is a full time member in the club of the world's large engine manufacturers. The largest among these, General Electric regularly asks it for transfers of its experience in aerodynamics. "Since this is one of our strong points, we obviously refuse," explains Mr Habrard. And as part of an association with the French company, the American manufacturer did not hesitate to entrust SNECMA with the construction of the "hot" (most critical) parts of the future fast propeller jet engine (THR) or propfan, which will reduce aircraft consumption by 20 percent.

"It is a difficult task. Despite a very high efficiency (the compression ratio will reach 36 instead of 25 in the future M-88 which will be installed on the Rafale), the gas generator will be very small. Because the turbine

blades will not be larger than 5 cm, tolerances acquire considerable importance," states Mr Habrard. And yet, Boeings with unfaired propellers will fly as early as 1991, to be followed by Douglas. SNECMA, which has already bench tested a high pressure compressor and a combustion chamber, has also started preliminary studies for a faired propfan, which could be installed under the wing (the THR can only be installed in the rear) and could interest Airbus Industrie.

Even though the development of the M-88 is not yet complete, SNECMA is already conceiving the military engines of the future. Their general architecture will likely be similar; however, the compressors will have fewer stages and operating temperatures will be higher: up to 800 °C instead of 600 °C at the compressor output, and up to 2500 °C at the output of the combustion chamber. In particular, variable parameters (steerable jets) will make the turboengine adaptable to various situations and will optimize its consumption; the engine will also be lighter. "Thrust to weight ratios of 20, namely twice those of the M-88, are not inconceivable around 2010," says Mr Habrard. It will be the kingdom of new materials: ceramic composites, niobium alloys, cast titanium, and so on.

Already, with support from CNES [National Space Studies Center], and with the collaboration of ONERA, SEP [European Propulsion Company], Aerospatiale, and Avions Marcel Dassault, SNECMA is thinking about a composite engine: one-half aircraft engine, one-half rocket engine, it will open the way for "true" recoverable space shuttles. "We are preparing a long range program which encompasses all the technologies that will have to be developed within the next 20 or 30 years," discloses Mr Habrard.

Despite its broad spectrum of research, SNECMA's research and development volume (25 percent of its revenues, two-thirds of it self-financed) is three to five times smaller than that of its English and especially American competitors. Definitely larger, the latter also benefit from more substantial public assistance. In the United States, research contracts receive more than 70 percent financing for civilian engines (40 percent in France), and 100 percent for military ones (75 percent for the M-88). Under such conditions, "it is difficult for SNECMA to do it all; and yet, that is essential when you want to appear as a major collaborator," states Mr Habrard.

11023

Fokker Seeks Japanese Cooperation

Rotterdam NRC HANDELSBLAD in Dutch 6 Jun 88 p 15

[Report: "Prime Minister Lubbers Wants Cooperation Between Fokker and Japanese Aircraft Industry"]

The Hague, 6 June—Prime Minister Lubbers pleaded in favor of closer cooperation between Fokker and the Japanese aircraft industry in the development of a new generation of airplanes. Lubbers said this on Saturday to the Japanese Prime Minister, Noboru Takeshita, who was visiting the Netherlands this past weekend. According to Lubbers a closer cooperation with Japanese companies will give Fokker a good boost in recuperating from the financial problems in which the company has landed during the past year.

Fokker's problems started with the development and production of the Fokker 100 and 50. The government earmarked 200 million guilders in support on condition that by 1990, Fokker would either merge or cooperate with a foreign aircraft manufacturer in order to spread the financial risk. Minister De Korte (Economic Affairs) said last year that the Fokker 50 and Fokker 100 would be the last airplanes to be built by the company under its own management.

Since that time, Fokker has been conducting exploratory discussions on cooperation with U.S. aircraft manufacturers such as Lockheed and with a number of European companies such as MBB in the Federal Republic of Germany.

The spokesman of the Japanese delegation, Y. Matsuda, stated on Saturday that Japanese Prime Minister Takeshita had not reacted directly to Lubbers' proposal. According to Matsuda, the plan will be discussed with the Japanese aviation industry. So far there has not been any form of cooperation whatsoever between Fokker and Japanese aircraft manufacturers.

8700

Finnish-Designed Device for Solar Research Satellite

36980334 Helsinki HELSINGIN SANOMAT in Finnish Jun 88 p 9

[Article: "Opening Opportunity for Our Space Research; Finnish Particle Detection Device into Space"]

[Text] A Finnish space research device, ERNE, and the research program associated with it, have been accepted as part of the Sun-Earth program by the European Space Association (ESA) and included as one of the devices for the SOHO [Solar Heliospheric Observatory] satellite. The ESA's scientific program committee approved the device in Paris on Monday.

ERNE which measures and examines explosive energy releases in the solar heliosphere is the first complete, Finnish-designed and -manufactured device approved for actual space use. Previously, Finns have participated in producing parts of space research devices.

The work for the development of the particle detectors to be placed in the satellite was initiated at the University of Turku for over two years ago. Already at that time it seemed likely that Finland would become an associate member of ESA in the beginning of 1987.

At the University of Turku, the cosmic radiation and space physics research team was familiar with the basic design of one of the 12 devices intended for SOHO. This one measures high energy particles. The team decided to participate in the design competition together with the Finnish Technical Research Center (VTT).

The design proposal for a particle detector was finished a year ago and contained five parts and 155 pages.

The research project leader, Prof Jarmo Torsti, says that the proposal is equivalent to two or three doctoral dissertations. It required intensive teamwork and close co-operation.

The name of the device, ERNE, is an abbreviation of the words that describe the project "Energetic and Relativistic Nuclei and Electron Experiment." The word also signifies a white-tailed eagle.

In addition to the University of Turku and the Finnish Technical Research Center, the following institutions will participate in the work on ERNE: the University of Helsinki, the University of Jyvaskyla, the Durham University in England, the Institutes of Technology at Helsinki and Tampere, and the Finnish Meteorological Institute.

ERNE wil cost 25 million markkas. It will be financed mainly by the Center for Technological Development and the Finnish Academy.

According to Torsti, ERNE's inclusion in the program leads the way for Finnish space research and space technology.

The Finnish design competed against an FRG proposal. Prof Vaino Kelha from the Finnish Technical Research Center describes the competition in the spring between the two as "a bloody battle for a place in the sun."

In the end, the experts at ESA and NASA suggested co-operation between the two projects. The Finnish ERNE-project and the German COSTEP-project have now signed a co-operation agreement.

ESA's experts accepted three of the six devices proposed by the FRG and two of the three Finnish devices. In addition, the Finns will be responsible for the construction of a joint energy source and a ground support device while the Germans will be responsible for a joint central processor.

SOHO's 12 research devices will gather data that can be used to study, among others things:
—the structure and processes within the inner portions of the sun;
—why the sun has a corona and what its mechanism is;
—how and at what distance from the sun the solar wind is created.

SOHO will be launched in March 1995 from Florida. After a voyage of several months, the satellite will stay at a distance of approximately 150 million kilometers from the sun.

13439

BIOTECHNOLOGY

EC Updating Biotech Program To Foster Cooperation

3698a187 The Hague TECHNIEUWS EUROPA in Dutch Mar 88 pp 25-26

[Unattributed article: "Updating Multiyear Biotechnology Program"]

[Text] The Commission of the European Communities submitted a proposal to the Council of Ministers for revising the multiyear program for biotechnology research (1985-1989). This research and training program has thus far been unable to set up an international cooperative network to investigate and evaluate the different levels of risk; i.e., a structure appropriate for handling various aspects of biotechnology in agriculture, industry, and the environment.

A budget of 20 million ECU's (1 ECU is approximately 2.32 Dutch guilders) is required to carry out and extend already planned activities. The proposals include:

—Intensification of risk evaluations related to modern biotechnology and more particularly to the release of genetically manipulated organisms;
—Intensification of processing the data concerning culture collection, sequence analysis of genomes, and protein modeling;
—Extension of current activities (visits, publications, electronic networks, meetings, summer workshops, etc.) aimed at the timely dissemination of all program information;
—Feasibility studies and pilot projects to prepare future Community R&D activities in the field of biotechnology over the 1990-1994 period;
—Extension of training activities in all divisions of the current program.

In the near future demonstration project proposals are expected in the field of clean technologies.

The EEC seeks the development of so-called clean technologies: a more economical use of natural resources, a decrease in waste materials production, and a reduction in environmental discharges.

In addition, clean technologies involve the development of new techniques and methods for measuring and controlling environmental quality. The call for proposals will probably be published in the EEC's OFFICIAL JOURNAL by mid-March 1988.

25068

COMPUTERS

EUREKA Image Synthesis Project Assessed

3698a250 Brussels EUREKA NEWS in English 19 Jun 88 p 3

[Article: "CERISE, Or 3D Europe"]

[Excerpts] In Japan, when an urban planner negotiating on an important contract must explain his project, he simply projects his 3D video pictures. In Europe, we are still in the era of large, cumbersome, hard-to-carry models.

While our "old continent" has held its ground in algorithmic output, it lags seriously behind in systems applications and their commercialisation. Japan and the United States have become the undisputed world champions in computer-generated images and image synthesis.

Yet this is a genuine market for the future, opening new prospects not only for architects, urban planners, and product designers (for cars, watches, etc.), but also for the vast field of communications and advertising.

Can the Gap Be Bridged?

This is the bet made by two European companies, SESA [Automation Systems Research Company] (France) and RTL [Luxembourg Radio and Television]-Productions (Luxembourg). These two groups have joined forces in a joint venture with the charming name of CERISE ("Cherry"), standing for "Centre Europeen de Recherche d'Images de Synthese" (European Centre for New Image Synthesis Technologies). CERISE's goal is to create a genuine European pole of attraction for image synthesis within 5 years.

CERISE is supported by France and the Grand Duchy of Luxembourg. One of its major strong points is definitely the EUREKA label granted at the London EUREKA Conference of Ministers in June 1986. CERISE was one of the Initiative's inaugural projects.

The Franco-Luxembourg project is not intended just to further basic and applied research, to develop ad hoc systems. The two partners want at the same time to train media professionals in image synthesis techniques. To do this, CERISE has associated with several university centres, including centres in Strasbourg (France) and Karlsruhe and Aachen (FRG), and is benefiting from support under the EEC-COMETT [Community Program for Education and Teaching in the Field of Technology] programme.

SESA and RTL-Productions have put all the advantages on their side in this ambitious joint venture, playing on the complementarity of their strengths. SESA is a French state-of-the-art DP engineering firm (belonging to Compagnie Generale d'Electricite) with 1,500 employees and a yearly turnover of 1 billion French francs. RTL-Productions (a subsidiary of Compagnie Luxembourgeoise de Telediffusion, operator of radio and TV stations under the RTL label) boasts a hefty annual turnover of some 300 million Luxembourg francs. SESA is the head of the operation, RTL-Productions the body. SESA brings as its dowry its automation systems know-how, computer facilities and such sophisticated tools as Bull's SPS 9s and three Silicon Graphics IRIS work stations. RTL-Productions provides CERISE with its infrastructure, ultramodern video studios and satellite and optic-fibre communications networks linked to television networks in other countries.

Stamped with the EUREKA seal of approval, the CERISE project actually got off the ground in May 1987. May 22, to be more precise, is the date that the project was inaugurated at Bertrange, Luxembourg, where a new 2,000 sq.m. building had been specially built on the very site of RTL-Productions to house CERISE's headquarters.

The two partners will invest a total of 370 million Luxembourg francs in CERISE, including 120 million for the first year. The initial 12-month phase will entail preliminary systems assessments, in addition to equipping the facility and settling in. The spring of 1988 marks the start of the second, four-year phase, which will focus on the heart of the matter, i.e. setting up a system to give Europe a dynamic 3D image!

Netherlands: Research Program on Natural Language Machines

36980323b Rijswijk PT AKTUEEL in Dutch 25 May 88 p 5

[Report: "New SPIN Program On Man-Machine Communication]

[Text] Man-machine communication is the subject of a large research project which was officially launched last week under the auspices of SPIN [Stimulation Project Team for Information Science Research]. In this project, a number of Netherlands universities and companies will work together for a period of at least 5 years. The focal point for carrying out the project will be the new Institute for Language and Learning Technology (ITK) of the Catholic University of Brabant.

The main goal of the new, seventh, SPIN project is the recruiting of technical and scientific knowledge for the construction of computer systems with which people can communicate by means of natural language. The program has been modeled after that of the American National Science Foundation, which comprises the execution of a thematic research program in an academic research center with participation by industry. It is a cooperative project of various research institutions and

companies. The initiators are the Language and Information Science research group of the Catholic University of Brabant, the Language Technology research group of the Catholic University of Nijmegen, the Institute for Perception Research (IPO), and the Language and Speech Technology research group of OCE-Netherlands. The industrial participants are BSO, Pandata, Digital Equipment, Van Dale Lexicography—subsidiary company of Wolters Kluwe, Fopax, Hewlett-Packard Netherlands, and Philips Telecommunication and Data Systems. These companies will each make a contribution of 75,000 guilders per year and, in return, they will obtain influence over the selection of the research projects and have access to the research results. Furthermore the project will be supported by a number of computer firms (Digital Equipment, Apollo Computer and Sun Microsystems) which provide equipment and software.

Natural Language

The man-machine communication program (MMC) is aimed at making computers accessible to a broad public through the use of natural language, such as Dutch or English. To a broad public, two computer applications particularly are of interest: the interactive information machine (systems for consulting large databases) and the interactive text machine (systems for designing, editing, correcting, translating, summarizing, transmitting and storing of texts in electronic form). The MMC program focusses on these two areas of application. Research on the interactive information machine is aimed at making possible dialogues for the exchange of business information, whereby the machine operates on the basis of a reasonable comprehension of what the user expresses in natural language. In the research on the interactive text machine it is a matter of designing those machines in such a way that the linguistic knowledge needed for the interaction is simultaneously used in processing the text.

The MMC program will be set up in such a way that at first not too much work will be done on the building of large, comprehensive systems, but rather on researching specific parts, which will generate knowledge on vital components for which knowledge is not yet sufficiently available. Fifteen project topics have been selected, which might offer approximately 100 man-years of work in the coming years. With the 20 million guilders now available for the program (of which 5 million guilders come from the SPIN pot), about 70 man-years of that can be carried out.

The research will be executed in the research laboratories of the four initiators and the recently established ITK in Tilburg will serve as the coordination center. On behalf of ITK, the university in Tilburg will invest over 13 million guilders, including government support. The new institute will be headed by professors Dr H.C. Bunt and Dr R.A. Meersman.

8700

FACTORY AUTOMATION, ROBOTICS

Status of EUREKA's FAMOS Automated Manufacturing Project

3698a251 Brussels EUREKA NEWS in English 19 Jun 88 pp 4-6

[Article: "FAMOS Reversing Europe's Industrial Decline"]

[Excerpts] "To reverse the decline in European manufacturing" is the ambitious aim of the FAMOS project, one of the most significant initiatives to have been set up within the framework of the EUREKA Initiative. FAMOS is a German acronym for Flexible Automated Montage Systems, a concept that could mean new life for European industry.

FAMOS is what is called an "umbrella project" within the EUREKA Initiative. A number of specific EUREKA projects are to be found under the FAMOS umbrella, although the programme itself defines the very distinct field of assembly automation technology and implements a strategy specific to this sector.

The seven FAMOS founding members are Austria, the Federal Republic of Germany, France, Italy, Spain, Sweden and the United Kingdom. Norway, the Republic of Ireland, Finland and Denmark joined the FAMOS ranks at the end of 1987. Portugal, The Netherlands and Luxembourg are expected to sign in the near future.

Priority has been given to implementing the FAMOS project in the following five sectors:
- machine construction,
- electrical engineering and electronics,
- motor vehicle construction,
- textiles technology and
- precision engineering.

However, in addition to the industrial sectors initially identified, further projects are sought in other areas, e.g., furniture, food, the building industry, pharmaceuticals/medicine, aerospace, pneumatics, hydraulics, ceramics, etc.

The first seven projects to obtain FAMOS/EUREKA approval involve the following areas of industry (the name of the leader enterprise responsible chiefly for project coordination is given in brackets):

—refrigerator compressor assembly cell (FIAR, Italy);
—flexible assembly systems for circuit breakers (Merlin Gerin, France);
—manufacturing cell for telephone subset assembly (Standard Electrica, Spain);
—integrated design with engineering and automatic manufacturing of telecommunication PCBs-Printed Circuit Boards-(Telettra, Italy);
—automated "washing machine" factory (Philips, France);

—mechanical product assembly for engine/transmission applications (Perkins Engine, UK); and
—CIM-assembly of FMS components (Bosch, West Germany)

The FAMOS initiative is rooted in a basic observation, namely, that advanced assembly technology will dictate the new conditions of competitiveness in all markets from now on. The manufacturing of small batch-production runs within extremely varied product lines is the order of the day. Manufacturing flexibility, with all that this entails in terms of automated assembly-line organisation and consequent stock management, plays a vital role.

FAMOS projects, which are considered pilot projects, are essentially market led, generating new technologies that can be exploited to benefit industrial advances throughout Europe. FAMOS is not just research. Companies and research institutes from several countries are now co-operating on a series of projects to make real products and profits. Successful FAMOS projects will be put into operation as full-scale pilot schemes, show-piece manufacturing operations with automatic assembly systems adapted to specific sectors, demonstrating new technologies at work, producing goods that can be sold at competitive prices, with good profit margins, to meet the needs of existing and potential markets.

In its first year of existence, FAMOS has not just chosen its first projects. It has also accomplished considerable organisational and project definition work: In line with the spirit of the EUREKA Initiative as a whole, FAMOS was organised according to an efficient, flexible and decentralised model. At the head of the structure and with representatives from all the participating countries is the Steering Committee, which is responsible for setting down the major guidelines for action and making the major decisions. It is assisted by a Secretariat, staffed by a different participating country in rotation (the United Kingdom for the first six months of 1988). A National Co-ordinator and a National Project Leader are appointed by each FAMOS country. They are entrusted with FAMOS management per se and backed up by a national resource team.

The project's goals and strategy were reviewed in a "Definition Study Report", completed in June 1987. The main points covered in this study include:

- an in-depth study of state-of-the-art assembly procedures. Besides analyzing the major trends observed in Europe's chief competitors (Japan and the US), the report identifies the manufacturing sectors in Europe that are currently the most threatened by international competition, as well as those that, due to substantial progress in assembly work, are most likely to migrate back to Europe;
- the drafting of the FAMOS Reference Model, a detailed picture of the project's concrete technology objectives, flexible automation of assembly processes involves many levels, the three main categories of assembly—planning, system and process—being further broken down into 120 detailed elements and technologies to fully describe the assembly reference model.

The FAMOS initiative has raised growing interest across Europe and has thus attracted a wide variety of projects, each of which seeks to address assembly-related aspects of products and production technology, ensure the co-ordination of efforts and the transfer of benefits and avoid duplication. Finally, a central database called the "Technology Matrix RD^3" has been set up for each national resource team to enable them to monitor FAMOS projects, avoid duplication and assess further submissions.

Generally speaking, financing aid for EUREKA projects is governed by the rules in effect in each FAMOS participating country. EUREKA also gives companies the opportunity to request other supportive measures from their Governments.

[Box, p 5]

The FAMOS Relevant Technologies

For assembly planning and system:

- CAD (computer-aided design) for detailed design of products conducive to advanced automation methods and equipment;
- New concepts for parts and consumables feeding;
- Integrated processing of quality control data, etc.;
- CIM (computer-integrated manufacturing) control in flexible assembly environments.

For machinery:

- Industrial robots and other programmable transfer and handling devices;
- Advanced sensing and recognition systems;
- Improved assembly techniques and materials, such as new adhesives and bondings, simplified fastenings, self-locking components;
- Use of automatic guided vehicles, etc.

France's Industry Ministry Presents Factory Automation Projects

36980305b Paris ELECTRONIQUE ACTUALITES in French 6 May 88 p 3

[Article by J. Marouani]

[Text] The 6th Automation Show, which closed its doors on 29 April, covered all aspects of the automation environment: programming, supervision (dialogue between man and machine), networks, maintenance, etc.... But, the event that attracted the most attention was the first participation ever by the Ministry of Industry as an exhibitor. The projects being financed by that

Ministry were exhibited by the Ministry at its own stand, with particular emphasis on the PTA [Automation Engineer Workstation] project, which is at a very advanced stage as of now, in that a prototype will have been completed within a few months.

Towards Specifying the PTA

The BASE-PTA [Basic Applicational Model and Standard Data-Communication-Exchange Language for Automation Engineer Workstations] project encompasses a community of industrial groups (end users, suppliers of automation components, and builders of CAD systems). Its objective is to define a conceptual model of the data representing an application of automation, and a standard language of exchange and transfer of these data between different CAD workstations.

Another important aspect of this project relates to its inherently normative nature. The different objectives manipulated in automation engineering must be subjected to a draft norm suggested by the users. It has been agreed to conventionalize this norm under the designation SET [Standard Language of Exchange and Transfer]. SET is a standard language for the describing of data, whose technical characteristics are not specific to any industrial sector in particular. It is currently being used, notably by the aeronautics, automobile and armament industries.

The sharing of data common to each by means of several tools will eliminate many causes of errors, such as: multiple acquisitions, nonhomogeneous modifications, problems of versions and configurations. It will also facilitate the defining of a single documentation function that will be capable of automatically generating coherent documents with the different versions and configurations.

A call for bids on "Automation of Continuous Process (APC)" has also been launched. In addition, several large industrial firms have formed the ACERLI [French Association of Industrial Local Area Network Test Centers], with the backing of the Ministry. And a number of industrial firms are developing a floating bus (FIP) with specific industrial applicability, also with the backing of the Ministry.

'An Industry Worthy of Special Attention'

During the coming months, requests are expected to be launched for proposals on STRIN [Real-Time Solutions for Industry], computer-aided management of maintenance, training in industrial data processing, methods and components for optic-fiber RLI's [Industrial Local Area Network(s)], and demonstration platforms for automation systems and devices.

Mr Charrier, assistant director for industrial electronics and industrial data processing at the Ministry of Industry, has stated that "the automation industry is worthy of special attention, because it generates a preponderant part of the competitiveness of tomorrow's enterprises." Moreover, the Ministry of Industry is endeavoring to create in that industry the best possible developmental environment. In part through the supportive actions we have referred to above, and in part through actions intended to ensure broad diffusion of the backing and services involved. Thus, the operation designated "Logic" will, by 1998, facilitate for some 1,000 small- and medium-sized enterprises the acquisition of CAD-/CAM and computer-aided production management softwares, and the training of the persons who are to use them.

Second-Generation LAC Network

Automation 88, was, as expected, centered on the programmable automaton environment. We were particularly impressed by Compex's presentation of its second-generation LAC network. It is based on a family of communicators called Volubilis (ease of installation and maintenance, increased memory, storage of malfunctions, etc). The OSI model's ISO layers 1 and 2 are provided by the MVBS, a large-scale-integration macrocomponent. LAC 2 confirms Compex's objective, which is to impose LAC as a standard on the European scale.

9238

Computer-Integrated Manufacturing Systems From Siemens of FRG

36980305a Paris ELECTRONIQUE ACTUALITES in French 13 May 88 pp 1, 3

[Article by J. Marouani]

[Text] Siemens is continuing to press its growth in the computer-integrated manufacturing sector, and already offers a very complete CIM package for the integrated manufacturing plant of the future. The German firm is devoting Fr1 billion annually to R&D for this activity and intends to play a major role in its evolution. It is participating as prime contractor in current standardization projects, proposing homogeneous and compatible products based on open communication, and is doing everything possible to identify with the users (technical assistance, training, regional centers, etc)....

In France, in 1987, the company's CIM activity alone employed some 100 persons, supported in turn by the branch's worldwide headquarters staff, and had a revenue of around Fr250 million. This year, it expects to attain revenue of Fr325 million. Its growth over a 4-year period has averaged 40 percent annually (60 percent for its programmable automatons). Communication between man and machine with respect to computer-aided installation, operation and maintenance, as well as communication between systems by means of industrial LAN's [local area network(s)], are the principal strong points of the Siemens product line.

The company is today the leading European manufacturer of programmable automatons, especially with its Simatic S5 line, which ranges from the S5-100 U micro-automaton to the S5-150 U super-automaton. Particularly worthy of note are its Model S5-135 U multiprocessors, 25,000 of which have already been installed.

It prefigures the "very top-of-the-line" programmable automatons of tomorrow, which are already being readied (Simatic 155U). In France, Siemens' share of the market has grown from 0.5 percent in 1984 to 12 percent in 1987 and will probably be 15 percent in 1988.

15 percent of French API [Application Program Interface] Market

Simatic S5 automatons offer the advantage of being programmable on the basis of a single language, which has existed since 1979—the STEP 5—and by means of programming consoles that are common to the entire line. These automatons are all connectable to Sinec L1 low-speed network (the price of a 100 U automaton connection point is around Fr1,600). For heterogeneous high-bit-rate communications, Models S5-115 U, S5-135 U, and S5-150 U are directly connectable to the Sinec H1 high-speed (10 Mbits/sec) network, which, for the first four layers of communication, conforms to the IEEE 802.3 (Ethernet) and ISO international standards.

At the forthcoming CIM Exposition (26 May-2 June 1988), Siemens will show a "top-of-the-line" central processor for the 115 U (48K instructions memory, processing time of 3 mn for 1K instructions), and a 16-bit industrial PC that can be plugged directly into a programmable automaton having a hard-disk memory capacity of 20 Mo [million 8-bit bytes].

In the NC [numerical control] domain, Siemens is present not only in the machine-tools sector but also in robotics. With 38 percent of the market, the German firm occupies first place in the European machine-tools sector. The number of NC machines installed for purposes of end-use now totals some 70,000. The most recent models—the Sinumerik 820 and 880—will be shown at the CIM Exposition. The 820 controls 4 axes and 1 spindle and has two programming channels and 64 Ko [thousand 8-bit bytes] of programmable memory per piece. The 880 can develop up to 30 measuring circuits, including 6 spindles. It has 16 channels, 8 groups of operating modes, and 1 Mo of programmable memory per piece.

Robot NC's Control Up To 10 Axes

In robotics, Siemens has fast attained a production of 1,500 NC units per year. The models it will show at the Exposition are the Sirotec RCM 1K at the low end of the spectrum (6 NC axes, designed for materials handling) and the Sirotec RCM 3S at the high end (up to 10 axes). A coupler permits the control function of the latter to be connected directly to the Sinec H1 network. Over 3,000 Sirotecs have been sold to date, some 250 of which for use in France, mainly pertaining to the automobile industry.

Siemens' programmable automatons, its NC's for machine tools and robots, and its LAN's, comprise the various links in its chain of CIM product lines. They permit the creation of standard interfaces with the upper level of control and supervision. It is to be noted that Siemens cooperates with over 20 manufacturers of machine tools for flexible production workshops. Its strategy now is to develop sufficiently open software packages on the basis of medium-term planning, rather than to approach software development systematically, as heretofore, as a function of the application involved. As for equipment, it represents a mere 10 percent of the cost of a system.

Towards the MAP 3.0 Standard

In addition, Siemens has participated in the work of the MAP Task Force since its creation, to define the standards on which this communication protocol is to be based. A number of pilot exhibits (Autofact at Detroit, CNMA stand at Hanover in 1987) have demonstrated the feasibility of protocols of this type. The number of connection points into the Sinec H1 network in Europe now totals over 6,000. This network will be supplemented by Sinec H2 plant-network conforming to the MAP 3.0 standard, the first versions of which are scheduled to become available in October 1988. The complementarity and intercommunicability of these two systems have now been ensured by an identicalness of certain layers of communication.

Siemens offers technical assistance to it clients as well as classroom and on-the-job training courses. Its CIM and automation training school is staffed by 10 instructors who shuttle among four regional centers at Lille, Marseille, Strasbourg and Paris. In 1987, some 600 persons attended 70 courses on automatons and networks, and some 200 persons attended 25 other courses (Machine Tools, Robotics, and Data Processing).

9238

LASERS, SENSORS, OPTICS

EUREKA Projects Yield Nondestructive Testing Equipment, Laser

Automated IC Inspection Machine

3698a234 Paris FTS—FRENCH TECHNOLOGY SURVEY in English Apr 88 p 1

[Text] The EUREKA Imagia project is the result of French-Swiss cooperation. The Inspection Machine for Automated and Genuine Intelligent Analysis of Semiconductors Project aims at devising a system capable of inspecting integrated circuits automatically as opposed

to the purely visual methods employed today. The system using Artificial Intelligence should be marketed by 1992. Two French companies, Bertin and Electronique Serge Dassault and the Swiss Electronic and Microelectronic Centre as well as the Wild Leitz group are working on this project which is aimed at on-request inspection of circuits which cause very specific test and inspection problems: an expert system will utilise the knowledge of semiconductor manufacturing specialists and the computer data that was used for the actual production of the circuit. Finally, the system will incorporate the most advanced image acquisition technology in order to distinguish elements smaller even than a micrometer.

Neutron Radiography Device

36980305c Paris L'USINE NOUVELLE in French, supp to 19 May 88 pp 72-74

[Article by Odile Esposito: "Mobile Neutron Radiography Imminent"]

[Text] Neutron radiography, a method of nondestructive testing used by some industrial firms, should experience a rapid rebirth of interest with the imminent development of a mobile unit. This system, baptized Diane, is being developed jointly by Sodern (annual revenue of Fr200 million) of the Philips Group, the German company IABG, and the Spanish company Sener, under a EUREKA project. Completely robotized, this unit should render possible the in situ testing of, for example, the wings of planes and the rotor blades of helicopters, by means of neutron radiography. The robotics portion of Diane poses few, if any, technological difficulties. Its source of neutrons, however, constitutes a sensitive problem area. Until now, neutron radiography has required the use of radioactive sources (californium, for example) that emit continuously, or of nuclear reactors, which cannot be transported. Sodern is presently putting the finishing touches on a tube that generates neutrons at a sufficient power output level. In addition to its mobility, the principal advantage of this tube is that it can be stopped at will. The precautions required for its use are therefore relatively insignificant, being similar to those used in radiography.

A Technology Applicable to Plastics, Powders and Explosives

Neutron radiography will thus become a technique bordering closely on, and with complementary applications with respect to, radiography. Its principle is analogous to that of an X-ray examination: A a neutron beam of uniform intensity is attenuated to a greater or lesser degree by its travel through the object being examined. It then acts upon a detector which furnishes an image corresponding to the "neutronic shadow" of the object. However, this image is far different from that obtained with X-rays or gamma rays, since the physical process is not the same. Actually, X-rays interact with the electrons that surround the nucleus, in accordance with a probability that increases with the atomic number, hence with the density of the material. This is why radiography proves especially effective for heavy elements such as lead. Neutrons, on the other hand, act directly upon the nuclei with a probability that depends only on the material being examined. Thus, hydrogen attenuates neutrons some 1,000 times more than does lead. Hence, neutron radiography proves particularly effective for "seeing" hydrogen compounds (explosives, powders, plastic materials) contained within a metallic enclosure. It looms as a preferential method for detecting corrosion, defective bonding, and the presence of lubricants in metal parts. The CNES uses it for testing pyrotechnical devices that must function during rocket launchings and during the injecting of satellites into orbit.

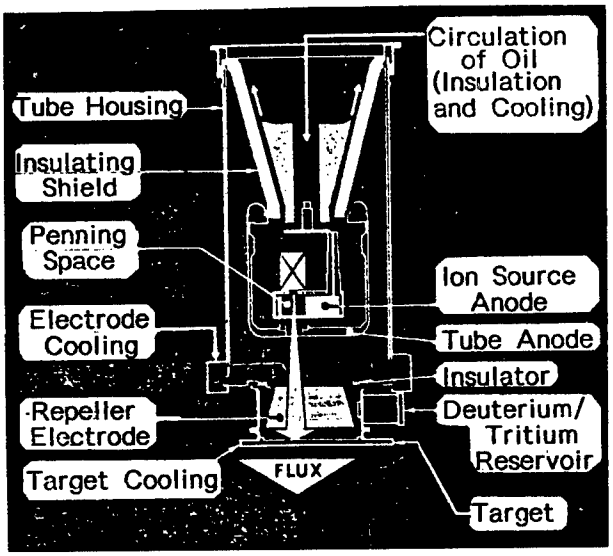
Certain metallic elements, which owing to the closeness of their densities are difficult to differentiate by means of X-rays, can, on the contrary, be clearly detected by means of neutron radiography. This is the case with silver and copper; and neutrons are capable of detecting a diffusion of one within the other.

To obtain a useful image within an acceptable time of exposure (on the order of 1 second to 5 minutes), the neutron flux striking the object must be around 6×10^5 neutrons per square centimeter. Considering the distance between the source and the target, the tube must produce around 10^{12} neutrons per second. Sodern has, as of now, the know-how to manufacture tubes emitting 5×10^{11} neutrons per second with an operational life of 800 hours in the laboratory, and looks forward to obtaining 10^{12} neutrons per second and a satisfactory operational life in an industrial environment by the end of next year. This tube, which is 20 cm in diameter and 80 cm long, will form, together with the detector, a robotized unit weighing approximately 500 kg. The system will be capable of being positioned with an accuracy of around 2 cm.

Mobile Tube To Be More Accessible but Less Accurate Than Reactors

With a flux of 6×10^5 per square centimeter, the image obtained by means of this unit will be less accurate than that provided by experimental reactors. Orphee, at the Saclay Center for Nuclear Studies, produces around 10^8 neutrons per square centimeter, hence an excellent neutronic image. This is why many industrial firms do not hesitate to send batches of parts they produce to the AEC [Atomic Energy Commission] for testing. These parts are placed on a mobile platform which conveys them across the neutron flux. Negatives similar to those obtained with X-rays are then made on argentic film.

Although the overall testing of a production in its entirety by this means may appear somewhat impractical, this method is nevertheless often used to test a particular manufacturing or assembly process. By using a neutron guide, the Saclay installation was decoupled from the Orphee reactor and is situated outside the



restricted zone. This installation will remain complementary to a mobile unit, since it will enable evaluation of use of the method. Clearly, if neutron radiography by means of reactors has proven to be ineffective, there will be no point in using an alternative system should the latter's performance prove somewhat less effective.

On the other hand, the mobile system should interest those industries in which neutron radiography has already been put to the test: powders and expiosives, space, aeronautics, shipbuilding, and engine manufacturers desiring to study visually the deformation of the oil film between piston and cylinder. It is a unit that should expand the use of this method in industry.

How the Neutron Generator Tube Works

The neutron generator tube consists of three parts: An ion source, the housing of the tube, and a target enclosure which hermetically seals the unit. The tube contains a mixture of deuterium and tritium. After pressurization, obtained by heating a tritium hydride, deuterium ions are created on an anode. This source, mounted on an insulating bushing, is cooled by circulating oil flowing at the rate of 10 liters per second under a pressure of 2 atmospheres. The ions are extracted, then accelerated by applying a potential of 300 to 350 kV. Upon striking the target, they produce, together with the tritium, a nuclear reaction: Freeing of the binding energy, and ejection of a helium nucleus and of a neutron carrying 14 MeV [million electron volts]. This reaction takes place within a thickness of 1 to 2 microns, and the target is water-cooled. Since the neutrons cannot be aimed, a collimator is installed to eliminate those that are off course.

9238

'Eurolaser' Project Results in YAG Laser

36980304c Paris ELECTRONIQUE ACTUALITES in French 13 May 88 p 11

[Text] In the context of the formulation phase of high-power lasers within the Eurolaser EU6 project, the JK division (Ruby in the United Kingdom) of the Lumonics group announced that it had developed a YAG [yttrium-aluminum-garnet] laser that for the first time in the world exceeds the 2 kW average power barrier. The first tests with this laser, which were very encouraging, confirmed predictions of the advantages provided by a pulsating YAG laser in comparison with carbon dioxide gas—CO_2—lasers of equivalent power in welding applications.

The Lumonics company is now pursuing development of this program so as to be able to market such a laser at the beginning of the 1990 decade.

Today, the experimental equipment that has been developed is intended for investigation of the application possibilities for such a laser at this power level.

9920

MICROELECTRONICS

Information Technology Certification Advancing in EC

3698a189 Amsterdam COMPUTABLE in Dutch 12 Feb 88 pp 1, 14

[Article by Peter Mom: "Surprisingly Much Interest in European Certification Institute"; first paragraph is COMPUTABLE introduction]

[Excerpt] Brussels—Today, Friday 12 February, the European Committee for IT Certification (ECIT) is having its first meeting. At this "inaugural meeting," additional form will be given to a European structure for testing and certifying information technology products and services. Of the 17 members of CEPT [European Conference of Postal and Telecommunications Offices] and CEN/CENELEC [European Standardization Committee/European Committee for Electrotechnical Standardization], 14 immediately approved ECIT. "A surprisingly large number," said Wiechers, an engineer who presided over the first meeting.

ECIT is at the top of a certification system which was developed by an advisory group of the Information Technology Steering Committee (ITSTC) of CEN/CENELEC and CEPT. In March 1987,the ITSTC accepted a proposal from this advisory group (the "M-IT-03" memorandum) calling for mutual recognition of harmonized certifications issued by national institutions.

In the meantime, 14 of the 17 members of CEN/CENELEC and CEPT reacted to the request to assign a coordinating member to regulate and coordinate IT certification on a national level and to represent their country within ECIT. Three countries—Greece, Luxembourg, and Spain—have not as yet assigned a representative.

A Different Approach

The member states are given maximum latitude for the regulation of some items at the national level. Hence the different coordination approaches in the participating countries: Coordination is done by the national standardization institute in one country, by the ministry of trade and industry in another, while in some countries special institutions have been formed. Together France, with its Steering Committee for Information Technology Certification, as well as the Netherlands are examples of this. The Netherlands is represented in the ECIT by the ICIT [Institute for the Certification of Information Technology]. ECIT also hosts delegations from Belgium, Denmark, FRG, England, Finland, Ireland, Italy, Norway, Austria, Portugal, Sweden, and Switzerland.

25063

Belgium Heading Submicron Technology Production System

3698a202 Groot-Bijgaarden DE STANDAARD in Dutch 16 Mar 88 p 27

[Article signed B.V.: "Spin-Off of Louvain-Based IMEC Outstripping IBM: Cobrain Achieving World's First in Microfabrication with DESIRE Process"; first paragraph is DE STANDAARD introduction]

[Text] Cobrain NV, which originated at IMEC [Interuniversity Microelectronics Center] in Louvain, has developed a fabrication process for submicron memory chips which is twice as fast as existing production systems. The process is particularly valuable in the production of megabit chips with a capacity of up to 64 megabits. Other applications should not be ruled out.

The international chip market is moving towards less expensive products. Cost reductions are sought not only by using larger wafers but also by packaging more chips on a single wafer, which implies a shift toward submicron technologies.

Given its modest financial resources (30 million Belgian francs) Cobrain's technological impact is all the more impressive. It wants to begin the design, production, and marketing in Flanders of advanced, fully automated production machinery for use in high-tech environments where microfabrication technologies are used to produce very small (less than a few tenths of a millimeter [as published]) structures via photolithographical processes and surface treatment. This requires the knowledge of several disciplines such as software, robotics, optics, and chemistry.

Cobrain's first product resulted from collaboration between UCB [Belgian Chemical Union] (Drogenbos) and IMEC's semiconductor processing division. Plasmask is a photomask which can be developed using a plasma. In combination with the DESIRE [Diffusion-Enhanced Silicon Resist] process, it is capable of reliably producing small structures (as small as 0.4 micron nowadays) using optical equipment.

DESIRE is a dry etching technique which doubles production speed. Cobrain is currently developing a device for the dry etching of polymers which will cost 12 to 18 million Belgian francs. With this product Cobrain is a step ahead of IBM, which has been doing research into analog techniques for years.

In addition to semiconductor fabrication—which gives Cobrain an international mission, since the United States, Japan, and Korea are potential markets—the new company wants to expand the application fields of the DESIRE process toward laser technologies and surface treatment, such as metal surface conversion and materials cleaning.

Markets

F. Coopmans and G. Brasseur, both ex-IMEC researchers, founded Cobrain with the support of the Flemish Regional Investment Society (as a venture capital supplier with experience in electronics) and IMEC (as the technological backbone). Coopmans expects memory chip manufacturers to move to submicron production, i.e., Cobrain's target market, by 1990. Coopmans seeks to sell 20 units of production equipment per year in Europe. Afterwards, the United States and Japan can be tackled. In order to gain a foothold in Japan, Cobrain will almost certainly have to sell the technology; in the United States, it will probably be possible to set up an agency.

"Europe is slightly behind the United States in production technologies and equipment," says Professor Roger Van Overstraeten, chairman of the board of directors. "That is why Cobrain is so important. IMEC will continue looking for spin-offs such as Cobrain. We are currently studying five dossiers to that end. First, we try to instillentrepreneurial initiative in our own people; afterwards, we try Belgian industry."

25063

Background, Status of LETI, CNS Labs in France

36980328a Paris INDUSTRIES ET TECHNIQUES in French 1 Jun 88 pp 62-65

[Article by Philippe Le Coeur: "Integrated Circuits: Looking Beyond the Borders"]

[Text] While it is clearly essential to continue public research on silicon integrated circuits in France, it no longer makes sense for that research to be geared solely to the national market. Our laboratories must impose their trump cards on the European market. They have many, but taking the first steps is hard.

"Stopping all research on integrated circuits in France? That is out of the question!" Researchers, manufacturers and the authorities now all have the same reactions. Opinions have not always been as clear-cut as they are now. And for a very good reason! In the past few years, prospects for sales to French industries have shrunk considerably. The deep crisis which has rocked the world of semiconductors (market and price decline) has in fact profoundly affected the French integrated- circuit industry. To such an extent that top executives and officials wondered at times whether it made sense to ensure the survival of the "dying" industry. Today, there no longer is—if there ever was—any national "leader". The Thomson group, which played that role for a long time, has practically left the sector. After merging its semiconductor activities with those of the Italian company SGS, in April 1987, it abandoned to the latter all initiative concerning SGS-Thomson Microelectronics (STM), the company issued from the merger. As a result, the new company now looks far more Italian than Franco-Italian. As for Matra Harris Semiconductors (MHS), with 1987 sales of Fr370 million (55 percent in France, 35 percent in Europe), it remains a small and highly-specialized company playing a very limited part on the international scene, and its financial future is still uncertain.

Microelectronics: Sustained Effort Needed

The French integrated-circuit industry is shrinking away... Some, therefore, questioned the opportunity of continuing research in France. Especially as it is carried out mostly by public research centers. This is a specifically French characteristics; in most foreign countries, research teams belong to industrial organizations. However, "research must not reflect the ups and downs of the integrated-circuit industry. Just because the latter is not doing well in France does not mean that we should stop our work," warned Jean-Pierre Lazzari, head of the microelectronics department at the Laboratory for Electronics and Data- Processing Technologies (LETI). "To give up on mastering integrated- circuit technologies would mean taking a considerable risk, that of losing forever any expertise in the field," Michel Camus, head of the Norbert Segard Center (CNS), the CNET [National Center for Telecommunications Studies] center specialized in integrated-circuit research and development, added. This loss of expertise would also be accompanied by an increased dependence of equipment manufacturers on rival economic zones and, therefore, a loss of competitiveness. With no privileged access to the most advanced integrated-circuit technologies, it will actually become increasingly difficult for consumer product manufacturers, industrialists, civil and military professionals, to innovate or play a leading role.

In view of this dual problem—constantly decreasing French markets and the need to retain technological expertise—French researchers have found a new sphere of activity: Europe. "In the future, European manufacturers will increasingly engage in cooperative projects," they say. Only through such projects will they be able to go on manufacturing integrated circuits in spite of the increasingly larger investments required: a modern plant with a daily production of 500 silicon wafers 150-mm in diameter will cost about 200 million ECUs [European currency units], and manufacturing techniques change so fast that a production unit must be replaced every 5 years, and will cost more every time.

Prototype Workshop and Technological Workshop

Also for cost considerations, if European manufacturers want to remain at the leading edge of progress they will have to intensify their cooperative research efforts.

And French laboratories have every intention of being a party to these efforts. For this, they point to the value of their recent research.

Take the LETI for instance. This research laboratory of the CEA [French Atomic Energy Commission], located in Grenoble, started working on microelectronics problems already in 1965. In 1972, its work led to the creation of EFCIS [Integrated-Circuit Study and Manufacturing Company]. After that, the LETI had trouble recovering, as 150 of its researchers had left on that occasion. The Grenoble laboratory continued its efforts and, in 1982, the CEA, supported by the government, decided to create a suitable technical environment for its research on submicron integrated circuits, which had started one year earlier. A microelectronics research center was thus created and provided with a "technological workshop" and a "prototype workshop". These were used in particular for joint research with Thomson Semiconductors. Following an agreement signed at the end of 1984, the LETI actually became the French group's regular research center on CMOS [complementary metal-oxide semiconductor]-technology integrated circuits. As such, the technological workshop, entrusted with the development of new technologies, developed a 0.8-micron CMOS technology (set of elementary techniques leading to the creation of an integrated circuit, validation, characterization). As for the prototype workshop, it developed components in 1.2-micron CMOS technology. It was a success, since these components enabled Thomson Semiconductors to deal as an equal with the Mostek laboratories when it acquired the U.S. company and when the developments of the two parties were brought into line. Today, this research continues under an agreement with STM. Signed in March 1988, for a period of 6 years, this new agreement covers the development of CMOS, BiCMOS and advanced bipolar technologies. CMOS research should lead to a new 0.8-micron process, to be set up in Italy already by the end of 1988 to produce 4-Mbit EPROM memories.

The development of CMOS circuits, however, was not the only contribution made by the LETI microelectronics center in recent years. It distinguished itself by its research on new production machines on the one hand, and on silicon-on-insulator (SOI) technology on the other hand. The former led to a collaboration with the

former Semy Engineering Company on diffusion furnaces and deposition techniques; with Micro-Controle on lithography; and with CIT-Alcatel and Nextral on dry etching. As for SOI research, it has enabled the LETI to perfect the oxygen-ion implantation technology. The research was carried out on behalf of the CEA and Thomson Military and Space Division; it recently led the LETI to invest Fr35-40 million in an SOI-wafer production center. It will be the first workshop of this kind in Europe.

The Norbert Segard Center (CNS) of Grenoble is more recent (it was created in 1978), but it too can boast of research of international quality. Created by the government in order to enable France to catch up in silicon microelectronics, it was entrusted with research on integrated circuits (development of design tools, processes and production machines, and component prototypes). To this end, it was equipped with a pilot production plant. In 1983, after some initial research, it launched a 4-year program designed to develop a 1-micron CMOS technology, the so-called "Telecom" technology (circuits capable of processing both logic and analog signals) to be transferred to the industry and validated by a circuit.

Super CMOS Technology Transferred to Production

Late in 1984, a cooperation agreement with Matra Harris Semiconductors (MHS) was added to this program; the goal was to develop a 1-micron CMOS technology, a purely logic one at first, but with better performance characteristics, the so-called Super CMOS technology. Its development is now completed.

A video decoder, i.e. a mixed logic/analog circuit making it possible to restitute an image from a D2-Mac standardized signal, and a 64-Kbit SRAM [static RAM] memory were developed last year. And the transfer into production of the Super CMOS technology was completed at the end of 1987/early in 1988, thus placing MHS on a par with the leading manufacturers worldwide, according to experts. Although this operation represented a major event for the CNS, it should not overshadow the results obtained by the center in its other fields of activity. Many transfers made in recent years testify to these results. For example: laser-cutting equipment (Bertin); laser-marking and resistivity- measurement equipment (SET [Extrusion and Fabrication Company]); quartz- tube cleaning machines (Sappi, Coillard); plasma nitriding machines (Lemer); ellipsometry machines (Sopra); or again automatic line-width measuring machines (Micro-Controle); multipolar plasma etching machines (Alcatel, Electrotech; and machines to make silicon-on-insulator wafers (Micropolish, HEF). Besides machines and materials, computer-aided design (CAD) tools have also been the subject of many transfer agreements: Eldo (Apsis, Anacad); Iman (Anacad, RSI), Gasp (Apsis); Titan and Jupin (Nucletudes), to name just a few.

As for upstream research, it has been the province of the Scientific Group on Silicon Integrated Circuits (GCIS) since 1978. This organization, on the board of which the CNRS [National Center for Scientific Research], the LETI and the CNET are represented along with manufacturers (MHS, STM, RTC [Radiotechnique Compelec] and Bull), managed to coordinate research at university laboratories and to encourage them to work along well-defined orientations. Thus, the GCIS, whose research was initially devoted solely to "physics as related to technology," soon diversified into CAD and circuit design. And whereas its former activity (research on etching/lithography, dielectrics, aging and thin films) still predominates, with the equivalent of 100 researchers, the latter (research on silicon compiling tools, testing methods, new architectures) now mobilizes the equivalent of 50-60 researchers, and the quality of their research seems to be increasingly appreciated. True, the "design" teams received a serious boost from the Ministry of Industry. About 2-3 years ago, it decided to finance the purchase of CAD design tools of the same quality as those found in the industry.

LETI, CNET, GCIS... All French research laboratories are otherwise already more or less engaged in research at European level. Working on Esprit community programs for instance. But today they want to go one step further. For instance, the LETI initiated an Experimental Workshop (AEC) project. The participants are manufacturers of production equipment, integrated circuit and clean rooms with facilities in Europe; the project will offer an opportunity to test the machines and facilities required to implement new integrated-circuit generations. Construction of the building that will house the workshop started on the LETI site. The laboratory has every intention of turning it into a major asset in establishing a European research pole in Grenoble.

It is also with this in mind that, late in 1985, the LETI embarked on the JESSI project (Joint European Submicronic Silicium Initiative). Initiated by the French and German governments, the project brought together first Siemens, Telefunken, public laboratories, etc., on the one hand, and LETI, CNET, GCIS, MHS, Thomson Semiconductors and SGS France on the other hand.

Controlling Submicron Technologies

The Dutch government and a consortium of Dutch manufacturers (led by Philips) soon joined the project, the goal of which was very clear: to give European companies, in 1985, the means to master the submicron technologies (between 0.5 and 0.3 micron) that will be required to make circuits nine times more integrated than those of today. The project was to last about 10 years and cost about Fr15 billion. In December 1986, the JESSI project received the Eureka [European Research Coordinating Agency] label and DM10 million were granted for a research definition stage that was to last 6-9 months. To-date, the definition study is not completed yet... because of a quarrel opposing Siemens and STM.

In an interview published late in March by TRIBUNE DE L'EXPANSION, Hermann Franz, the German group's manager of semiconductors, gave to understand that Siemens and Philips ought to be the leaders of the JESSI project. The management of the Italian-French company did not fail to react; they acknowledged that, in the past few months, they have been more busy reorganizing their company than working on the project definition, but that does not mean that they will let themselves be pushed aside. Apart from this quarrel about leadership, the two sides also entertain radically different views on research. The German want to build a research center in the FRG. But the French believe that it would be less expensive to use existing research centers. No matter what the outcome of the negotiations is, a decision must be made soon; otherwise Europe will have definitively spoiled its chances to remain in the race with the Japanese and the Americans.

All the same, these problems are a lesson for French research in more than one respect. Certainly, laboratory research must now consider the potential of European rather than national markets. But for all that, "French teams should not believe that European cooperation will solve all problems. If they want to play a leading role on the European integrated circuit market, they must keep up their own efforts and build a very solid foundation," Mr Beixeras, a member of the GCIS management, indicated.

[Box, p 65]

Laboratories: Some Figures

In France, close to Fr1 billion is invested every year in integrated- circuit research by the industry (exclusive of U.S. companies) and public laboratories. Alone, the latter account for a little over 500 researchers.

At the LETI, for instance, 150 people are working on silicon microelectronics. This research is financed 51 percent by the CEA, 34 percent by government bodies (the former DGT [General Directorate of Telecommunications], DGA [General Delegation to Armament], Ministry of Industry, Ministry of Research and Higher Education) and 15 percent by industrial contracts.

Of the 380 people employed by the Grenoble CNET, 250 are working on integrated circuit research. They are divided about evenly between upstream research, design and manufacturing. This research is financed by the former DGT.

As for the GCIS, it employs the equivalent of 150-160 researchers. These teams, working in various university laboratories, have an annual budget of about Fr80 million. Financing is provided mostly by the CNRS and also by the Ministry of Research and Higher Education.

9294

Molecular FET Developed at French School

36980304a Paris ELECTRONIQUE ACTUALITES in French 6 May 88 p 11

[Article by S. Dumontet: "Molecular Compound Enables Development of 'High Performance' Field-Effect Transistor"]

[Excerpts] Still in the field of research, the development of a "high performance" field-effect transistor thanks to a molecular compound, diphtalocyanin of lutecium, represents a significant step forward in feasibility. A step that draws attention to molecular semiconductors, the advantages they offer in terms of cost and ease of use, and the prospects they open up, particularly in the field of neuron circuits as a result of their seven different states of oxydation. These seven states (two for silicon) would make it possible to obtain a logic other than 0-1, thus a new logic.

GRIMM [Interdisciplinary Research Group on Molecular Materials], which has about 150-200 members, has developed a field-effect transistor with insulated grid with performance of -2 volts threshold voltage (compared to -1 to -5 volts for a transistor made of amorphous silicon), mobility of charge carriers of between 10^{-4} (value calculated by transconductance) and 6 (value found by electrical measurements) (values of 0.1 to 2 for a silicon transistor), transconductance of 10^{-9} ohms^{-1} (compared to 50 10^{-9} for a silicon transistor) and an amplification coefficient of 15 to 100 (maximum value found, 140) (A=65 for the reference silicon transistor).

Easily Synthesized Molecular Compound

Professor Simon of ESPCI [Higher School of Physics and Chemistry of Paris], who is also director of CNRS [National Center for Scientific Research] and coordinator of the GRIMM program, explained the method of producing a molecular transistor: preparation of a conductive surface to serve as grid (insulated), for example, with silicon, which offers the advantage of easy oxidation, then depositing an insulator. The source and drain electrodes are then produced using gold. The whole unit is then covered with a layer of diphtalocyanin which serves as a semiconductor. The source drain intensity is modulated by the grid voltage. Professor Simon indicated that an initial field-effect transistor had been produced about a year ago, but that the performance achieved at that time was mediocre. The first research dates back to the 1970's. In fact, it was organic chemistry, and more specifically dye chemistry, that originated these molecular compounds. These electroactive organic materials have the property of changing color with loss or gain of an electron. Thus, they can be red or blue. According to Professor Simon, they are inexpensive and easy to synthesize using products available on the market. Diphtalocyanin of lutecium (whose chemical formula is $C_{64}H_{32}N_{16}Lu$) is vaporized at 400 degrees centigrade, and can be deposited without particular difficulty in thin layers. It could be used with impurity

levels markedly higher than with silicon, about 1 percent compared to 1 in 1 million for silicon. Its foreseeable applications include production of the classical CMOS circuits. On the other hand, for use in bipolar transistors, it is necessary to dope it, to about 10 ppm of doping agent, which, according to Professor Simon, is difficult to do and poses further technological problems.

A new possibility provided by diphtalocyanin of lutecium, in comparison to silicon, is related, as we previously mentioned, to its seven states of oxidation, which make it possible to envision new logic applications. One outcome could be in neuron circuits, and Professor Simon said he was in contact with Professor Dreyfus of ESPCI, who is a specialist in this field.

Among the centers working on organic materials in France, we should mention, in addition to ESPCI, CNRS of Strasbourg, Claude Bernard University in Lyon, and CNET in Lannion. The CNET has also registered a patent on synthesis of diphtalocyanins of rare earths, as well as a joint patent with ESPCI on synthesis of phtalocyanin-base electrochrome liquid crystals.

ESPCI is in contact with two French industries whose names have not been revealed.

9920

Netherlands: IPSE Concept Promoted

3698a212 Amsterdam COMPUTABLE in Dutch 25 Mar 88 p 3

[Article by Jan Bosdriesz: "Interest Group To Promote IPSE"; first paragraph is COMPUTABLE introduction]

[Text] Amsterdam—Representatives of several companies and organizations, including DCE, NMB, CMG, BSO, SFB, WVC, and Delta Lloyd, have established an interest group which is concentrating on the Integrated Project Support Environment (IPSE) concept. Among other things, the group will promote the IPSE concept by publishing a bimonthly newsletter, organizing monthly meetings, and publishing reports.

As there is as yet no generally accepted definition for this new concept, B. Smith of DCE in Amsterdam, chairman of the interest group, tentatively describes the Integrated Project Support Environment as an integrated set of automated tools supporting the various systems development phases.

Concept

According to Smith, IPSE represents a much broader concept than partial solutions such as analyst workbenches, application generators, 4G [fourth-generation] languages, and project management packages. Smith considers these partial solutions as an intermediate step toward an integrated IPSE, which is not yet fully available. IPSE also goes further than the now widespread CASE (computer aided software engineering) concept. Whereas CASE mainly involves product-oriented automated tools, IPSE also supports the organizational aspects of systems development. Promotion of this concept is the new interest group's major aim.

The group originated in seminars organized in 1987 by DCE on the IPSE concept, Smith says. Following these seminars, some participants decided to continue meeting as they considered IPSE to be a major development. This led to the interest group, which is now meeting monthly with 12 active members. The group also has less active members who receive information on IPSE through a newsletter and a series of reports.

The group has four objectives:
—to draw up specifications for an IPSE architecture;
—to check commercially available IPSE systems against the architecture specifications;
—to exchange knowledge and know-how; and
—to promote the IPSE concept.

Therefore, the group seeks to reach all automation professionals in the Netherlands. Those interested may contact the IPSE group secretariat, which is provisionally located at DCE in Amsterdam (NGI [Netherlands Association of Information Science] affiliation will be considered if there is sufficient interest). Phone: (020) 26 44 00.

25063

SCIENCE & TECHNOLOGY POLICY

Inner Workings of EUREKA, ESPRIT Analyzed; Directors Interviewed

Analysis of Program Operation, Implementation

36980300b Paris ZERO UN INFORMATIQUE in French 9 May 88 pp 40, 47

[Article by Hakim Remili and Philippe Guichardoz: "Between ESPRIT [European Strategic Programs for Research and Development in Information Technology] and EUREKA [European Research Coordinating Agency]"]

[Text] The organization of European technological cooperation in the data-processing sector does not always seem very clear. We wanted to review the situation now that ESPRIT-2 is being launched and one month before the next EUREKA ministers conference, which will be held in Copenhagen.

Is it desirable to have several programs in Europe? When President Reagan launched the SDI, somewhat prematurely called "star wars," it gave the U.S. scientific community an impetus which had significant economic repercussions. Conversely, the diversification of European objectives could de-motivate researchers and manufacturers on this side of the Atlantic.

This diversification is particularly obvious when one considers the prevailing division between, on the one hand, community (EEC) programs and, on the other hand, EUREKA, a cooperation framework for West Europe as a whole.

The Community's large programs, as far as information technology is concerned, are ESPRIT and RACE [Research on Advanced Communication in Europe].

Next to these large programs, the Community is implementing projects in which data processing plays a significant part, although the sectors covered are different. This is the case of DRIVE, a 60-million-ECU [European currency unit] program on data-processing applications for the automobile and road transportation, which was just adopted by the Community Commission on 11 April.

In 1986, the European Parliament warned European partners of the dangers of a simplistic dichotomy between basic research (ESPRIT, RACE) and market-applied research (EUREKA). EUREKA could be efficient only if complementarity with community programs was maintained.

This may the reason that the Community is represented on the EUREKA secretariat. But "this secretariat plays a rather neutral part," according to Jean Poireau, who is responsible for coordinating the various EEC programs; "its main task is to ensure the circulation of information." This is a vital function, as it is a prerequisite to any coordination.

The part played by the Commission is not entirely neutral. The Commission is a full-fledged EUREKA member, just like the 19 participating States. Although its actual participation is relatively small—it participates in a single project, COSINE, on the standards used between the data-processing systems of European research centers—it has the important and difficult task of standardizing current standards as best as it can.

Therefore, presenting the ESPRIT and EUREKA programs as rivals or excessively diversified initiatives might just be a non-problem. Indeed, "EUREKA projects show rather marked continuity compared with community projects," Jean Poireau explained, "and this is all the easier as EUREKA is a rather flexible structure leaving much latitude to private initiative."

We could also note, as does Michel Pasquier, a member of the EUREKA coordination team in France, that "since ESPRIT had started operating first, EUREKA projects on information technology took off, on the whole, rather fast because manufacturers and researchers already knew one another."

Compared with RACE, for instance, which was delayed by changes in the telecommunications sectors, or with biotechnology, for which community programs came only later, EUREKA projects on information technology are experiencing a more rapid development than telecommunications or biotechnology. It is therefore rather clear that, between the two programs, ESPRIT and EUREKA, there are cause and effect relations which cannot be ignored.

These relations are easy enough to identify to the extent that the spheres of activity of the two program types differ.

ESPRIT has a marked pre-competitive pursuit; however, it was toned down after ESPRIT-2 slightly modified its goals so that it would no longer be barred from getting involved in any industrial applications. On the other hand, EUREKA is entirely dedicated to research for industrial purposes, in direct relation with the market.

This complementary nature is only waiting to be reinforced by the good will of businesses. Their good will is the basis of any success. Pre-competitive projects, such as PCTE [Portable Common Tools Environment], conceived as part of ESPRIT with the participation of Bull, ICL [International Computers Limited], Siemens, GEC, Nixdorf and Olivetti, have been followed directly by EAST, a EUREKA project on the development of software engineering workshops.

All in all, relations are quite pragmatic, and it is up to businesses to make the most of the possibilities offered by European programs.

Choices will reflect not only the fields in which businesses wish to cooperate (basic research or industry-oriented research), but also the financing and selection processes. In this respect, there are marked differences.

For the ESPRIT and RACE community projects invitations to bid are issued after priorities and strategic fields have been clearly defined by the European ministers council. Thus, consumer electronics was excluded from ESPRIT, as community authorities believed it was too open to competition. Once the invitation to bid is over, a very rigorous selection takes place, according to a process which is "very effective and known to all," Emmanuel de Robien, head of prospective development studies at Bull, indicated.

Finally, financing too is a significant asset since, due to the pre-competitive character of the projects, which makes possible a large contribution from public authorities, the financial support granted is equal to 50 percent. In addition, this support is protected from any vague attempts by Community member governments, since ESPRIT is financed by the Commission from the proceeds of the European value-added tax.

Nevertheless, there are a few shadows on this apparently idyllic scene. The Commission itself acknowledged in a recent report that administrative sluggishness and

delayed payments may sometimes penalize certain businesses. To acknowledge failures, however, amounts to start correcting them; from this point of view, ESPRIT-2 should operate more efficiently.

In addition, although public financing was doubled for ESPRIT-2 it remains modest compared with the research and development budgets of large U.S. corporations. But maybe we should go beyond a strictly comparative point of view. As Emmanuel de Robien pointed out, "the most interesting results are to be expected not just from the scientific and technical point of view, but also from the point of view of cooperation among European manufacturers and researchers." These effects will be felt much longer and will exceed by far the lifetime of ESPRIT. In this respect, we can already say that ESPRIT is a success.

Our analysis of the results can hardly go any farther. For nearly all ESPRIT projects, we shall have to wait until about 1990 to make a material evaluation of the success of the undertaking, although the Commission's mid-way assessment is encouraging. Bull confirmed this, through Emmanuel de Robien who pointed out how remarkable the results were for the French company, especially in the field of software engineering, office automation and computer-integrated manufacturing; he added: "We now have software prototypes running in Renault, British Aerospace, and Alitalia factories."

Bull's satisfaction resulted in its doubling its stakes for ESPRIT-2. Whereas the leading French computer manufacturer had devoted "on the average" 200 men per year to ESPRIT-1, its participation in ESPRIT-2 will involve some 450 men per year.

Besides, the number of proposals received in answer to the first invitation to bid for ESPRIT-2, which expired on 12 April, was 10 times greater than what the EEC budget can support. This fact alone testifies to the success of ESPRIT.

The same is true of EUREKA, a still more recent program, and one of a different nature. Closer to the market, the results of the research undertaken under this project, launched by Francois Mitterrand 3 years ago, are designed to be marketed directly and will therefore require much less public financial support. Once the "EUREKA" label is awarded, there remains to find the "sinews of war" and, in practice, it all depends on the good will of the governments and the skill of businesses in finding private financing sources.

Under these conditions, it is not surprising that France is the country by far the most involved in EUREKA projects, since its government is the one best disposed toward them. Yet, the government's contribution to EUREKA projects will not exceed 35 percent of the total budget, a figure which lies well within the range of European national participations (30-40 percent).

What, then, is the use of the EUREKA label? Actually, it sanctions a very simple fact: cooperation between businesses, manufacturers and researchers. The advantage of such official-level recognition is of an incentive and informative nature: incentive, because there exist a simple procedure and a flexible framework to contact companies or laboratories working on similar projects; informative, because all projects and proposals are collected in a database.

EUREKA also provides for project follow up. "Our work is a sort of aid to manufacturers in liaison with the administrations," Michel Pasquier indicated. EUREKA provides support to ensure that products are introduced on the market under the best possible conditions.

The flexibility of this tool has already attracted many businesses (162 projects have been adopted to-date, including 32 on data processing and 15 on components). The very fact that it works is already a miracle and warrants some optimism. Also, some medium-size projects are about to be completed: for instance, the GTO Thurystor [gate turn-off thyristor] project adopted in London in June 1986, which involves the application of data-processing to railway traction. Another project, ADA, on which Alsys, Logica and IST are cooperating and which involves the development of software engineering stations, is already yielding results: by-products of the project are being sold and finished products will certainly be available by the end of the year.

The advantage of EUREKA is its flexibility: the manufacturers set their own strategic and technological objectives. It is therefore not surprising to see "smaller" projects coexist with "larger" ones such as Prometheus (data processing applied to the automobile) which involves 700 million ECU and would never have existed without EUREKA!

The fact that manufacturers retain the initiative is somewhat ironical if one considers that the United States have chosen a public program entirely financed by the State (the SDI), although they had been denouncing the granting of subsidies by European governments.

The approach which consists in allowing manufacturers to make major strategic decisions in the field of information technology may have unsettled national and European officials. But it was necessary, as European institutions have already enough to do to implement an effective research policy without having to worry about an industrial data-processing policy, considering that the 12 member States must be satisfied to the largest possible extent.

This being said, flexibility has its drawbacks. Apart from the fact that financing is ill defined, actually depending in part on the good will of the States, the uncertainty which prevails after the label has been granted presents an hitherto-unknown risk for these projects: they may slip toward cartel agreements liable to come under

anticompetitive [sic] laws and regulations. From this point of view, the rigor with which ESPRIT projects are selected is undeniably more efficient, as the procedure is not open to attack. This possibility may be pure speculation; nevertheless, it must be considered.

Which should we choose then, ESPRIT or EUREKA? Both, of course, as each program possesses its specificities, characteristics and advantages. They are complementary, and necessary each in its own way. And, above all, they are catalysts, unequalled instruments to create synergism among European researchers and manufacturers.

[Box, p 47]

European Programs in Short

ESPRIT-1

From 1983 to 1987: 227 projects; 1.5 billion ECU (1 ECU = Fr7).

Principal fields and budget:
components (300 million ECU);
software (290 million ECU);
processing systems (180 million ECU);
computer-integrated manufacturing (300 million ECU);
office automation (290 million ECU).

ESPRIT-2

From 1987 to 1991: 3.2 billion ECU.

Open to European EFTA countries (Switzerland, Austria, Sweden, Norway, etc.). The expected effort will amount to 20,000 men per year.

Main research orientations:
microelectronics and peripherals;
data-processing systems;
technology integration;
office automation;
computer-integrated manufacturing.

EUREKA

Four billion ECU. Participation of 19 European countries in addition to the European Community. Open to third non-European countries under strict conditions.

Project adoption procedure:
—joint industrial proposal (object, cost, schedule, sharing of work, public financing desired);
—examination at national level (timeliness, amount of public financing granted, compliance with EUREKA goals);
—examination at international level (consultation and project approval, presentation to the high-level representative committee, 45-day waiting period: information to prevent duplications);
—notification of the countries involved at the EUREKA ministers conference.

9294

Director Assesses Achievements, Goals of ESPRIT

36980300a Paris ZERO UN INFORMATIQUE in French 9 May 88 pp 36- 37

[Interview with Jean-Marie Cadiou, Director of ESPRIT [European Strategic Programs for Research and Development in Information Technology], by Jean-Marc Chabanas: "Europe Is Becoming Credible"; date and place not specified]

[Text] Director of information technologies at the European Community Commission, as well as director of the ESPRIT program, the second stage of which was started a few weeks ago, Jean-Marie Cadiou explains how European manufacturers and researchers discovered that they could work together and save time.

Jean-Marie Cadiou: "It is still not all roses for the European data-processing industry, but its collapse has been halted and there is some hope of making a comeback." Concealing his pride under a cautious humility, Jean-Marie Cadiou, at his Brussels headquarters in Archimedes Street—a symbolic patron—believes that he has "found the fulcrum that is starting to move the mountain."

"ESPRIT," he recalls, "is an industrial tool. Research and development are meaningless unless they lead to an industrial strategy. This does not mean that manufacturers, who by definition are competing with one another, will agree on everything, but that they will find enough points of agreement to benefit each of their specific strategies."

The initial idea behind the ESPRIT program, in 1982, was to "have the leading manufacturers in the field work together. Actually, nobody really believed they would but, to quote Professor Aigrain, even if the chances of success were only 10 percent, it was worth trying."

Jean-Marie Cadiou: "All precedents—the Unidata case, for instance—had ended up as huge failures. In 1982, the political doctrines of the principal partner countries diverged appreciably. A priori, everything was against the project, and we could hope for nothing short of a miracle."

"However," Jean-Marie Cadiou goes on, "the originator of the project, viscount d'Avignon, enjoyed great personal credibility. I, coming from the industry, was getting along well with manufacturers. The administrations received us well. To cut a long story short, a succession of mini-miracles resulted, if not in our winning the battle, at least in our gaining enough credibility to fight it."

ZERO UN INFORMATIQUE: Why is it to the advantage of European manufacturers to work together?

Jean-Marie Cadiou: "To reduce the disadvantage resulting from the lack of a critical mass. To progress faster on certain subjects. Four partners, for example, have visually the impression of working each on a project that is four times as important. Of course, it is possible that not everything is reusable directly, but the multiplication effect is undeniable."

"Business managers will look first at the financial benefit derived from it. But that is not the most important," Jean-Marie Cadiou insists. "What matters is the sharing of resources, and this is probably where the key to success lies."

"Indeed, team cooperation can never be imposed from higher up; 'the rank and file' must be willing to participate. Now, field personnel have discovered that sometimes they worked better together with people from different companies than within their own company. Because they would meet colleagues interested in the same subjects and because they could have discussions with more people."

"There emerged a dynamics of an almost sociological nature. Team cooperation filtered up through the hierarchies."

Jean-Marie Cadiou backs up what he says with a few figures: a poll of the 3,000 people working on the 220 ESPRIT-1 projects revealed that 97 percent supported the methods of implementation of this cooperation. "That is because, in spite of competition among partners, in spite of the competitive nature of the subjects, each feels intuitively that the real battle will be against the Americans and the Japanese."

Still more figures: "ESPRIT-1 started with 12 industrial partners. Now there are more than 400. The invitation to bid for ESPRIT-2 resulted in 675 offers."

ZERO UN INFORMATIQUE: How is the selection made?

Jean-Marie Cadiou: "We have set up a procedure that is somewhat unwieldy, but which guarantees our absolute independence. For ESPRIT-1, four offers out of five could not be accepted; as a result, many were displeased, but no one ever questioned the procedure."

"To begin with, we gather experts, and it is true that with 600 projects and 5 or 6 partners for each project it is impossible to find a competent expert who is not himself involved in one project or the other. But we start anonymously. Each project is submitted to three experts who work separately, do not know the authors of the project and provide a first evaluation. This is then given to a group of about 10 people whose responsibility it is to suggest choices. At this stage, it is very difficult to influence the group."

"For instance, for ESPRIT-2, we are now gathering 203 outside experts who are going to work for 3 weeks in a row. Their conclusions will then be handed to a first committee of 18 persons, the 'ESPRIT Advisory Board,' which is somehow the equivalent of both a scientific committee and an industrial committee. This committee will forward its conclusions to a second committee, the 'ESPRIT Management Committee,' and eventually a choice will be proposed to the Commission, which will make the final decision."

ZERO UN INFORMATIQUE: Isn't that a source of haggling among member countries, based on their financial contribution?

"In principle, of course, each country is represented in both committees. At scientific and technical level, these are supercompetent individuals. Not one figurehead. At management level, the administrations' representatives obviously have their national interests in mind. But all act in a reasonable manner and decisions have always been unanimous."

All this, according to Jean-Marie Cadiou, works in a very positive manner:

Jean-Marie Cadiou: "It has never resulted in our financing a bad project; and no good project has ever stumbled over diplomatic considerations. There are very competent people in all countries. And, finally, hardly 6 months elapse between proposal and contract. Many countries might envy such dispatch, for their own national management."

ZERO UN INFORMATIQUE: And how are the projects managed after their adoption?

Jean-Marie Cadiou: "What is involved, as you know, is 50-percent financing. The contracting parties agree to share the results and either to implement them directly or, if they do not wish to do so themselves, to make them available to others. No repayment is expected in case of success" (according to Jean-Marie Cadiou, systems of this type are nothing more than 'failure-manufacturing machines'), "nor in case of failure" (which would be far too great a disincentive).

"The management mechanism is rather restricting; for a 5-year project, it provides for a mid-way assessment. We have thus stopped five or six projects that had not produced anything and we have considerably reoriented many others. About 60 people are following up the 226 ESPRIT projects, on which about 3,000 engineers and researchers are working. Among them, the 'project officers,' who each monitor seven or eight projects, end up as

much sought-after specialists. All are highly motivated and share the conviction that they are making a contribution to the building of Europe."

ZERO UN INFORMATIQUE: Will ESPRIT-2 use the same methods?

Jean-Marie Cadiou: "A major change was made: the Single Deed. It explicitly provides for technological projects. A 5- year framework program is adopted unanimously, under which individual programs—ESPRIT-2 is one of them—require only a qualified majority."[1]

"In this context, I am happy to note that ESPRIT-2 has been given top priority in all member countries. This shows that it is not realistic to attempt, as has been done occasionally, to oppose smaller and larger countries, smaller businesses and larger companies. Besides, in information technology, over one half of all participating companies are small and medium-size businesses. Everybody can find grounds to express themselves."

ZERO UN INFORMATIQUE: In the light of ESPRIT-1 and its 226 projects, does Jean-Marie Cadiou now actually believe in the chances of the European data-processing industry?

Jean-Marie Cadiou: "Over one half of all ESPRIT-1 projects have already yielded substantial results: products, manufacturing processes, standards, etc. Therefore, the chances are there."

"If I had to identify three reasons to be proud, I would select pure technology, federating impact and indirect effects. In pure technology, the Supernode project, to be implemented in France and Great-Britain, will give Europe its first commercial foothold in the kingdom of mini- supercomputers. A low-end 25-Mflop computer that will sell for 35,000 pounds, that is a remarkable success."

"As a project that has had a uniting impact, I would mention, for instance, CNMA (Communications Network for Manufacturing Applications), a beacon project in computer-integrated manufacturing, the highlight of the Hanover Fair, which is already being implemented by companies as prestigious as Airbus, BMW, Elf and Peugeot. Finally, as far as indirect effects are concerned, mergers like that of Thomson Microelectronics and SGS, which now ranks 2nd in Europe and 15th worldwide, would have been impossible without the impetus provided by ESPRIT."

"ESPRIT has already brought about a psychological reversal in Europe. Much still remains to be done, but where a few years ago you heard: 'It's no use,' you now hear: 'It can be done.' That is not so bad."

[Box, p 37]

A Former Employee of IBM

A graduate from the National School of Mines of the Polytechnic Institute (class of 1960), a Stanford PhD in data processing, Jean-Marie Cadiou is a former employee of the IRIA [Institute for Research on Data Processing and Automation] (which has now become the INRIA [National Institute for Research on Data Processing and Automation] and of IBM. One of the creators of IBM's Scientific Center in Paris, he also headed the programming technology teams in San Jose.

Appointed director of new technologies at the European Community Commission in 1981, he now is at the head of the whole information technology sector.

Footnotes

1.The principle of qualified majority consists in weighting the number of votes to reflect the size of the countries (France, Spain, Luxembourg, etc.). The total is 76 votes. The 'qualified' majority must represent at least 54 votes.

9294

EUREKA Chairman Interviewed

3698a249 Brussels EUREKA NEWS in English 19 Jun 88 p 2

[Interview with EUREKA Chairman Bertel Haarder, Danish minister of education and research: "The Only Alternative to EUREKA Is a Better EUREKA"; date and place of interview not given]

[Excerpt]

EUREKA NEWS: What are EUREKA's main areas of advanced technology?

Bertel Haarder: At the outset we focused on a number of specific areas. They comprised information and telecommunications, robotics, materials, manufacturing, biotechnology, energy technology, lasers, environmental protection and transport technologies. However, the intention was never to make an exhaustive list, and experience has shown that practically any innovation in advanced technology can benefit from the EUREKA framework. I therefore welcome the more market-led initiation of EUREKA projects in other areas where the European dimension has been recognised as well. I am referring here to many of the areas covered by the more pre-competitive R&D efforts of the EC.

EUREKA NEWS: What will be the major outcome of the Danish Chairmanship?

Bertel Haarder: During our Chairmanship, we have explicitly focused on project-related work. The group of National Project Co-ordinators has met approximately

once a month to improve the transparency of the project work and to permit an early detection of problems in both generating new projects and, during later stages, their implementation.

This has also allowed a more even flow of new EUREKA projects. Several initiatives are being undertaken by participating countries, e.g. the Belgian work on legal and formal aspects of compiling a check-list when negotiating the conditions for co-operation, and the French work of establishing a possible risk-insurance scheme for part of the private external financing. Italy has held a conference in Milan on the contribution of the research world to the EUREKA Initiative. The Chairmanship has continued the work on management development, a topic brought up by the British Chairmanship, and a conference on this issue was held in Copenhagen on 10 May, 1988.

As you know, small and medium-sized enterprises (SMEs) have been an integral element in the EUREKA concept because of their unique industrial value and because a considerable part of Europe's industry belongs to this group. The Chairmanship has focused on this issue in order to present practical ways and means of strengthening the participation of SMEs in EUREKA.

Co-operation with the Commission of the EC has been extended in order also to investigate whether activities within Community R&D programmes can be put to use in EUREKA projects and vice versa. A similar effort is being looked into as regards COST [European Cooperation in Scientific and Technical Research]. The Chairmanship has also assisted the European Parliament's Committee on Energy, Research and Technology with information about the EUREKA Initiative.

EUREKA NEWS: How do you see EUREKA in the future?

Bertel Haarder: It is important to bear in mind that the work during a Chairmanship does not represent a target in itself but rather a long-term process of collaboration and development.

I hope that the work during the Danish Chairmanship, together with future chairmanships, will contribute to meeting the challenge of technical co-operation in Europe and thus also prepare European business for the completion of the single European Market by 1992.

The ultimate aim is still to strengthen the basis for lasting prosperity and employment in Europe. I therefore believe that the only alternative to EUREKA is a better EUREKA.

TECHNOLOGY TRANSFER

Philips Transfers Electronics Know-How to Soviets

3698a203 Amsterdam COMPUTABLE in Dutch 26 Feb 88 p 17

[Article: "Philips Provides IC Production Know-How to Soviets"]

[Text] Nijmegen—After 2 years of negotiations, Philips has signed a contract with the USSR Ministry of Electronics Industry to supply know-how and equipment for the manufacture of electronic components used in domestic appliances, in particular color television sets. The contract must still be ratified by the authorities involved, among them the Netherlands Government. The agreement was officially concluded by the discrete semiconductor business group within the Elcoma product division and will run for 5 years. It is estimated to be worth 26 million guilders. Philips thinks that Cocom [Coordinating Committee for Multilateral Export Controls], which is strongly dominated by Washington, will have no objections to the transfer of the know-how and technology needed for consumer electronics manufacture to the Soviets.

Tomilino

Semiconductor production will probably be set up in an existing factory at Tomilino, near Moscow. Philips says it is still negotiating with the Soviets in other fields; it is confident that these talks will lead to more such agreements. However, no further details were provided on this subject.

25063

TRANSPORTATION

EUREKA'S Prometheus Project Criticized

Amsterdam COMPUTABLE in Dutch 19 Feb 88 pp 3, 14

[Article by Nigel Tutt: "Prometheus Misusing EEC Funding"; first paragraph is COMPUTABLE introduction]

[Text] Brussels—A. Turner, a British Conservative member of the European Parliament, thinks that the consortium which is developing computer systems for road transport is misusing EEC financial support. Therefore, he wants to reduce the research budget involved from more than 140 million guilders to 34 million guilders.

Turner's anger is aimed at the consortium which works under the pretty name of Prometheus. Prometheus is led by West German industry, but companies active in transport, automobile manufacturing, and computers from Great Britain, France, Italy, and Sweden are also

participating. The consortium is working within the EUREKA framework on the DRIVE [Dedicated Road Infrastructure for Vehicle Safety in Europe] project, for which it already received some 40 million guilders in subsidies. Unlike EUREKA, which is aimed at marketing high-tech products, DRIVE is limited to R&D.

Standards

In addition, the EEC is developing a project which is explicitly aimed at R&D into computer applications for supporting road transport. The EEC has already allocated some 140 million guilders for this over a 30-month period. The aforementioned consortium, however, refuses to cooperate in this project, which makes Turner conclude that it is misusing the subsidies for financing its own research. Turner even uses the phrase "bleeding dry" in a report recently presented to the European Parliament.

Turner also calls for closer involvement of national authorities in the EEC project, because they will have to purchase many of the products to be developed. Moreover, he thinks it is very important that more preliminary agreements be reached on which computer standards to use and on how future products will reach the authorities.

Research within the DRIVE project concentrates on computer-assisted systems which can be installed both aboard vehicles and along transport routes. They should automatically guide the driver to his destination along the fastest route, thus avoiding road accidents and other bottlenecks. If Turner gets his own way, the EEC project would only be allocated 35 million guilders over 18 months and would not go further than the definition phase. The EEC would still be able to decide on a 5-year follow-up program at a later stage. In the meantime, Prometheus might be convinced to join in the project.

25063

COMPUTERS

Analysis of Computer Availability, Future Plans, in CEMA

36980311 Munich COMPUTERWOCHE in German
15 Apr 88 pp 52-53

[Article by Egon Schmidt: "Computers Still Have Rarity Value in East Bloc: Many Months' Wages for a Simple PC"]

[Text] If we are talking about fast computers for guiding missiles and satellites, then everything is still pretty much OK, even in the distant expanses of the Ukraine. For this purpose, Gorbachev's engineers have at their disposal, among other things, an "SM-1210" large computer, which even jaded visitors from the West can appreciate.

But if we are talking about daily applications of modern electronics, below the highest echelon of technology and outside the military, then the scenario becomes darker. Russia's computer users have to deal with a level of adversity that their Western colleagues know almost only from the history books: standard system calculating power well under the one MIPS threshold, memory capacities not in the megabyte, but rather in the kilobyte range, data-transmission rates of at most 200 to 300 bits per second. As well as data-transmission bit error rates that at long distances result in wrong characters millions of times more frequently than what is standard in the West...

Research Without Competition

Oppressive backwardness in the very technology to which the central, key role for all economic prosperity is increasingly being ascribed throughout the world—a situation that calls out for changes, thus for perestroika. This is the reason that the states of the East Bloc drew up a plan 3 years ago that is intended to bring rapid progress in the field of information technology by the year 2000, primarily by avoiding unproductive duplicate developments in the individual East Bloc states and promoting the concentrated application of the various scientists and technicians: Everyone is supposed to pool efforts.

One might question here whether eliminating competition between researchers and developers is in fact the optimal means for bringing the East up to the level of the dynamic West, with its creativity-inducing competitive pressure, but be that as it may: As a result of the 1985 decision on the "Complex Plan for the Development of Science and Technology Up to 2000," an organization known as "IEIM"—the International Institute for Computer Systems—is currently taking shape in Moscow. It is supposed to coordinate the work of computer specialists in the East Bloc and also guard against wasteful duplicate work in the development of user programs. It should be interesting to see how this is supposed to happen without the simultaneous emergence of a new bureaucratic hydrocephalus that eats up creative energy and valuable time.

GDR in the Lead

However, while leaders in Moscow and the other capitals of the East Bloc are still thinking about the best way to advance computer technology the fastest, the arrears of the socialist countries is becoming greater and greater. Because even an instrument as common—in the West—as a PC is practically unknown throughout the entire USSR, with rare exceptions. And a little closer to home, in Poland, such machines are in fact available on the Warsaw black market, but only for DM 5,000 in hard currency or DM 17,000 in zloty—a nearly prohibitive price.

Things are somewhat better in the GDR, Czechoslovakia, and Hungary. There, the normal private household at least has a slight chance of being able to afford a computer. Prague has begun importing machines from Japan for hard currency and selling them for around DM 1,000, which is, on the average, three to four months' wages...

One step above the PC level, the following obstacle is typical of the problems with the current situation. A programmer at a Prague software institute that is developing CAD-CAM systems is waiting for money from his government, because he wants to finally, officially get the modern machines that he and his colleagues themselves make ready for applications and install elsewhere.

Perhaps the computer-technology landscape looks best in the GDR, which the other East Bloc countries enviously accuse of profiting from its special relationship with the FRG. The Robotron combine in Dresden has produced computers for decades, which are primarily used in industry. Here, modern computer technology is being introduced, within the framework of data processing training courses, but also to an increasing extent among the population at large.

Observers today estimate that there are around 5,500 computers in industrial use in the GDR alone, to which can be added a number of CAD-CAM systems and robots. And while according to official information the Dresden facility is already producing 32-bit computers, Poland, Bulgaria, and Czechoslovakia are for the time being producing only AT and XT compatible 16-bit computers with a more or less independent design. However, these are machines whose general technical standards still leave much to be desired.

Both the Bulgarian "Pravet" and the Czech "Tesla-Orava" computer are already notorious in Eastern Europe for their unreliability. They break down very frequently—which is somewhat worse with a computer than with a television set. And to the extent that they

have been exported to other Eastern European countries, these duds immediately become a genuine catastrophe for their owners: There are no servicing stations and technicians for them abroad.

Bulgaria Hopes for Exports

The producers of the Bulgarian Pravet computer are not only exporting to neighboring East Bloc states; they are hoping for business with the West, after 3 more years of forced expansion of the country's computer production. They have been doing business with Western sources for some time now—even though the CEMA embargo provisions are actually intended to prevent this. According to official Bulgarian sources, chips for their computers originate in part in Hong Kong, in part in the FRG. And as components of assembled small computers, they are to be passed along in the future to Greece, provided that all the agreements are reached and complied with.

Fear Held by the Powerful

Many leaders in Sofia or even in Moscow are quite happy that these export plans mean that computers produced in the East will leave the country quickly, since the backwardness of those countries in the area of computers can be attributed only in part to technological and economic backwardness.

A good deal of it has to do with the fear held by the "nomenklatura"—the powerful strata in the party and state—that computers could become a powerful instrument of information in the hands of the people. An efficient tool, the use of which can scarcely be controlled. And the effects of which could be explosive.

Even today, small computers are used in the USSR to put together "samizdat" publications outside the official information channels, which circulate among dissidents. And while a certain Lev' M. Timofeyev, for example, already writes his critical articles for the samizdat publication REFERENDUM using a Toshiba computer instead of the traditional noisy typewriter, he secretly dreams of further progress: a fast laser printer, at the very least...

This kind of dream can scarcely become more than a dream, as long as primitive data processing systems are all that is accorded ordinary citizens throughout Russia, while military equipment remains many magnitudes better. For example, wherever young people are allowed to take the first step into the wonderland of computers, they have to be content with rickety keyboards, keys that bounce and stick, and monitors that seem ancient. Scarcely better than standard television screens, they torture the new generation of computer users with an appalling flicker, and show any observer that the East-West discrepancy in the "computers for everyone" issue is much greater than mere statistics indicate. After all, the statistics simply match up unit to unit.

Given this background, it is truly daring that Bulgaria, for example, hopes to be able to produce an ample number of small computers with 20-megabyte hard drives in 2 years—including some to its own citizens. And that Russia would not only like to expand its telecommunications system, but also equip its enterprises with office computers, including table calculation programs, word processing and data base systems. This is a project for which the cooperation of American software houses will probably be sought. One major result could be that the goal of decentralizing the decision-making structure in the East would be encouraged.

15 Marks an Hour

Experts estimate that around 300 16-bit minicomputers are produced each month in Russia. They are intended to supplement the approximately 10,000 large systems of the standard 370 make, which are still in operation in many enterprises to this day. Naturally, for a country with the population of the USSR and a monthly production level of 300 computers a month, a great deal remains to be done before it can catch up with computer-smitten countries like the United States or even Japan.

The GDR seems to have better prospects in that regard; last year it began production of memory units with 256 kilobit capacity, and it already produces not only 8- and 16-bit units, but also the 32-bit computer.

At the end of 1987, 43,700 CAD-CAM stations and 78,800 industrial robots were in operation in the GDR, according to official statistics. However, since even the best computers are useless as mere machines, the GDR is promoting the development of programs as a sideline. At the same tax rate as a normal self-employed person, any worker or retiree can develop programs on the side—provided that he does not exceed 600 working hours a year. And the rate of payment—at least officially—is 10 or 15 marks an hour; the top rate is reserved for those who produce "especially high-quality" software.

Perhaps the GDR, with this mobilization of creativity in program technology, will avoid the disaster experienced by the Bulgarians as a result of the socialist division of labor, before the East Bloc IEIM was formed.

For years, Bulgaria waited for data base software to be delivered from Hungary, which is particularly well-known for its expertise in software. It was intended that further programs be developed on the basis of the Hungarian products. However, instead of punctually delivering the desired software to the Bulgarian Lewa, the Hungarians drew up table-calculation programs, games and even a computer version of Rubik's cube: These programs could be sold in the West for hard Deutsche marks, francs and pounds....

12271

CEMA Countries Present New PC's, Minicomputers at Leipzig Fair

Systems Compatible with IBM/AT, XT Shown

39680310 Paris ZERO UN INFORMATIQUE in French 2 May 88 pp 89-90

[Article by Josip Rajman: "Seen at the Leipzig Fair: East European Products"]

[Text] A tradition in the socialist world, the Leipzig fair enables all CEMA [Council for Economic Mutual Assistance] countries to present their latest data-processing innovations.

It has now become a tradition. Each spring, the Leipzig fair adopts a new slogan. This time, it was: CAD/CAM in the service of economy, development, and social progress. In fact, the exhibit of the Robotron combine—in the USSR, a combine is a group of industrial facilities whose operations are interdependent—associated with other plants (Nachrichten Elektronik, Mikroelektronic, in particular) was significant.

Unix-compatible operating systems, and compilers for the most common programming languages (including C) were another dominant characteristic of the fair. In addition, a mass of application software was listed in the Software Catalog 88 available to all visitors. It contains adaptations of programs well known in the West; the Tabcalc software, for instance, is very much like Lotus 123.

As expected, Robotron introduced many products (see article below). A few last-minute innovations even made their appearance. The 32-bit Robotron K-1840 supermicomputer was shown to the public for the first time and was awarded a gold medal. It is a work station designed for complex engineering tasks, such as the development of new-generation circuits, 3-D graphics and, of course, complete CAD/CAM systems.

A Showcase for CEMA Countries

The PC-1834, an IBM-PC/XT compatible, possesses a memory capacity of 256 to 640 K 8-bit bytes, and the 7150 work station (with the Siemens architecture), 256 to 768 K. Both machines will support two disk drives and one hard disk.

Traditionally, the Leipzig fair serves as a showcase for hardware made in CEMA countries. Thus, Bulgaria is known mainly for its disk production. In recent years, this country has also become a major player on the robotics scene. Bulgaria produces over 2,000 robots per year. It has already exported over 5,000 robots to the Soviet Union, and hundreds to European socialist countries. Last year, the Boroe robot factory of Stara Zagora started manufacturing robotized production lines in collaboration with the giant Soviet machine-tool manufacturers, Krasnoi Proleter.

Also produced in Bulgaria, the new Pravets 286 computer, an IBM-PC/AT compatible, offers a memory capacity of 3 M 8-bit bytes. A 15 M 8-bit byte external memory is available on disks—Bulgarian disks of course.

Hungary for its part is more interested in software production. It counts no less than 50 software-engineering institutes and firms. Approximately 25 percent of the software production is exported, mostly to the FRG (45.5 percent in 1985), Australia (18 percent), Kuweit (7.2 percent), and the United Kingdom (5.5 percent). We should mention that the largest electronics manufacturer in Hungary has set up a mixed company in the United Kingdom: the VT Computer Ltd.

Another firm, a venture capital company set up jointly with the French, was set up in Paris; the Hungarian partner is the Szki (Institute for the Coordination of Data-Processing Techniques). Other importers of Hungarian software are Iraq, Syria, Sweden, Norway, and Finland. Since 1983, the Szamalk Institute has been selling special software for the IBM-PC, and in 1985 it signed a software engineering cooperation contract with Siemens.

Gold Medal for the Hungarian VT-32 Last Year at Leipzig

As far as hardware is concerned, the Hungarian VT-32 microcomputer, a 16/32-bit machine with 1-4 M 8-bit bytes of memory, is running with 80, 40, and 21 M 8-bit byte disks and two disk drives. Thanks to a VME [Motorola]-compatible bus, direct addressing of 16 M 8-bit bytes is possible. The VT-32 can be used in 32 user countries, and the Usos operating system (compatible with Unix) will run with C, Fortran, Cobol, and Pascal. The VT-32 was awarded a gold medal at Leipzig in 1987.

Poland is not to be outdone. The Elwore-801 computer, an IBM/AT compatible, is the first computer of this category manufactured in a European socialist country. Built around the Intel 80286 microprocessor, it uses diskettes (1.2 M 8-bit bytes) and a 20 M 8-bit byte hard disk. A smaller system, the Junior 800, was developed for schools.

The Polish model compatible with the IBM-PC/XT is the Mazowia-1016 PC. It is built around a microprocessor which is the equivalent of the Intel 8086, at 4.77 MHz. Its internal memory capacity ranges from 256 to 640 K 8-bit bytes. Note also the presence of a 2 K 8-bit byte cache memory. The Mazowia PC also supports a

magnetic tape unit with a capacity ranging from 45 to 60 M 8-bit bytes. The tape read/write speed is 90 inch per second, thus complying with ISO standard 8462.

Among the many microcomputers exhibited at Leipzig by CEMA countries, there was also one made in Romania: Model I (I for independent) 102/F4M. Its main memory ranges from 1 to 4 M 8-bit bytes. Add-ons include a processor for floating-point operations, a dynamic microprogramming unit, disk drives, etc.

The Romanian matrix printer Impact was designed for micro- and minicomputers and for PCs. It operates in 3 modes: normal, at 300 characters per second (cps); letter quality, 66 cps; and graphics, offering various possibilities, with a maximum density of 240 x 216 dots per inch.

As for Czechoslovakia, its SM-52/12 is the first 32-bit minicomputer made in CEMA countries. It was awarded a gold medal at Brno in 1986 and is still the most interesting item offered by Czechoslovakia. The new MP-16 system includes 17 microprocessors of the UD-880-D type, the equivalent of the Zilog Z-80. With a memory capacity of up to 1 M 8-bit bytes and a speed of 4 million operations per second, it runs under a CP/M-compatible operating system.

Other personal computers are available in Czechoslovakia, e.g. the Tesla PC-88 and the PP-06B, 16-bit machines compatible with the IBM-PC/XT. The PP-06B uses either the Philips RGB monitor or the monochrome monitor manufactured by Orava. The PP-06, built around the equivalent of the 8088 processor, with a minimum capacity of 64 K 8-bit bytes, works equally well with cassettes as with diskettes.

Finally, last but not least on our list, the Soviet Union introduced several products at the Leipzig fair. The new MS-1212 microcomputer, a 16-bit machine with a memory capacity of 4 M 8-bit bytes, can use 3 different operating systems and 7 programming languages. It is a multiprogrammable system which can be used for time-sharing. Four interrupt levels are available.

The DVK line includes models with a memory capacity of 56 to 248 K. They use 256 K 8-bit byte diskettes. Future DVK models will support 5-M 8-bit byte disks, and the process-control version of this hardware will contain a magnetic bubble memory with a capacity of 1 to 4 M 8-bit bytes.

For its secondary schools and universities, the Soviet Union has developed the Korvet system. Using a PC—720 K 8-bit bytes of diskette memory—the professor communicates with 15 or so students, each using a PC equipped with 64 K 8-bit bytes of memory, a cassette reader and a color or black-and-white television for a monitor. Computer-assisted instruction may be in vogue now in the USSR.

'Ryad' Computer Series Summarized

39680310 Paris ZERO UN INFORMATIQUE in French 2 May 88 p 90

[Article by Josip Rajman: "Data Processing in East Europe: The Robotron Line"

[Text] Each spring, the large Leipzig fair and exhibition takes place. A good opportunity for Robotron, the East German manufacturer, to present its new line.

The Leipzig fair is held each year, early in spring. It is an important event for East Germany (the GDR) and for all CEMA countries—the common market of East Europe—as it gives them an opportunity to present their products to potential buyers from over 100 countries. It is also a good opportunity, for East Europe as well as for the West, to demonstrate to each other their most competitive hardware and their most sophisticated software.

Supervised by the Ryad

Most of the GDR data processing industry is supervised by the Ryad, a CEMA institution in charge of coordinating the main data processing activities of socialist countries.

How was the Ryad created? Already in 1969 an agreement on data processing was signed by Bulgaria, Hungary, Poland, the GDR, Czechoslovakia, and the Soviet Union. Later, in 1973, Cuba and Romania also ratified it. An intergovernmental committee was then created to coordinate research, development, production, and use of data processing equipment. An executive body is in charge of coordinating the activities of the various standing committees: principal manufacturers, economic affairs, services offered to users, standardization, consulting on optimum resource utilization, microelectronics, etc.

An organization was issued from this agreement: the Unified System of Electronic Computers (USEC) in English, better known in the West as Ryad. Its official acronym in the CEMA is EC. EC is also the prefix used to identify all mainframe computers and their peripherals. As for the SM prefix, it identifies all mini- and microcomputers and the peripherals manufactured by these countries.

All-purpose systems are classified in three groups according to their technological level and performance characteristics. Thus, the EC-1 series is comparable to the IBM 360 models; the EC-2 series to the IBM 370 line; and the EC-3 series is above the IBM 43XX models. The EC-2M series, consisting of improved EC-2 models, corresponds to the IBM 43XX (see table).

All the systems listed in the table below may include a virtual memory of 16 M 8-bit bytes, and most of them are compatible with the corresponding IBM machines. There is one exception: the Hungarian systems manufactured under a Mitra license.

EC-Prefixed (Ryad) All-Purpose Computers

EC-Prefixed Hardware	Series	Country	Main Memory (in K or M 8-bit bytes)	Millions of Instructions per Second (Mips)	Remarks
1015	2	H	64-160K	0.18-0.32	-
1016	2M	H	64-512K	0.18-0.032	400Minexternal memory
1017	3	H	Upto2M	01	-
1025	2	C	128-256K	0.03-0.04	-
1026	2M	C	128-512K	0.05-0.077	800Minexternal memory
1027	3	C	1or2M	0.21-0.47	-
1034	3	P	2-16M	0.42	-
1035	2	S/B	256-512K	0.125-0.2	Withadigital matrixprocessor: upto10Mops
1036	2M	S/B	2-4M	0.4	-
1045	2	S/P	256-3072M	0.55-0.99	Similartomodel 1035
1046	2M	S	4-8M	1.3	-
1055	2	D	1024-2048M[sic]	0.24-0.47	-
1055M	2M	D	1024-2048K	0.24-0.47	Withabuilt-in matrixunittoprocessnumbers,with 5.2Mflopsand2.6-Mopsoperation controls
1056	2M	D	1024-4096K	0.5	-
1057	3	D	Upto16M	0.85-1	-
1060	2	S	2048-8192K	0.36-1.1	-
1061	2M	S	8M	1.5	-
1066	2M	S	8-16M	5.5	With256channel-addressableperipherals

Countries: B=Bulgaria; C=Czechoslovakia; D=GDR; H=Hungary; P=Poland; S=Soviet Union.

As a result of this cooperation, systems may include parts manufactured in different countries. For instance, the leading hardware manufacturer Robotron uses not just its own OEM parts and peripherals, but also disks manufactured in Bulgaria, magnetic tape from Hungary, control units made in the Soviet Union, line printers from Czechoslovakia, and communication processors from Poland.

Robotron exports 70 percent of its production to some 60 countries. Most of these exports are destined to other CEMA countries, primarily to the Soviet Union (close to 400 million rubles per year), followed by Czechoslovakia, Poland, Romania, and Hungary.

The leading customer in the West is the FRG, followed by France and the United Kingdom; they import mostly printers, personal computers, and typewriters.

The largest Robotron system is the EC-1057 computer, which has a 16 M 8-bit byte memory. It has a speed of 1 Mips (million instructions per second) or 1.5 Mips with a double central processing unit. It has a clock cycle of 216 nanoseconds. The main memory consists of 64-Kbit units obtained in MOS technology. It has up to 256 I/O channels and each can support up to 10 peripherals.

Among the peripherals, we find disks with capacities of up to 317 M 8-bit bytes, disk drives, a laser printer printing 20 pages per minute, a line printer printing 900-1,500 lines per minute, and graphics peripherals; 352 lines are available for connections: a remote-diagnostic system is available.

Robotron Uses Microprocessors Compatible with Zilog's

The virtual memory is managed by an OC-7.1-EC operating system. The Robotron D-7941 graphics subsystem can also be used on other EC mainframes. Connection to other peripherals makes it possible to add on freely various CAD/CAM work stations in various configurations.

Rolanet is a network very much like the Ethernet network, with a throughput of 0.5-1 M 8-bit bytes per second; it is used mainly in the office-work enhancement process and for improved tool integration.

When it comes to image processing, the new A-6472-E model has an image memory of 2 M 8-bit bytes which can store 8 images.

The Mamo 1-M matrix computer, which can be added on to mainframes, will speed up purely numerical operations. It will increase performance to 5.2 Mflops (millions of floating-point operations per second).

PC-1715-W Awarded Gold Metal in 1987 in Leipzig

The new Robotron 87 minicomputer is an 8-bit machine with a capacity of up to 48 K 8-bit bytes; it is built around the U-880 microprocessor, compatible with Zilog's.

The 16-bit work station (A-7100), with a memory capacity of up to 768 K 8-bit bytes and an external memory of 1.2-10 M 8-bit bytes, possesses compilers for 9 languages, including C. Its Mutos operating system is compatible.

The PC-1715-W (which was awarded a gold metal in 1987 at Leipzig) is also built around a Zilog-compatible 4-MHz microprocessor. It has a memory capacity of 256 K 8-bit bytes. Depending on the peripherals used, it can become a CAD/CAM tool, a word-processing machine or, of course, an intelligent terminal in a larger system.

9294

MICROELECTRONICS

Hungary To Establish Two New IC Production Facilities

MOS, Bipolar Technology Involved

25020050 Budapest DELTA IMPULZUS in Hungarian No 7, 9 Apr 88 p 7

[Article by K. K. G.: "Intermos—Interbip"]

[Text] At the end of March a briefing was given at the Ministry of Industry concerning the conception adopted for the development of microelectronic parts manufacture. Deputy Minister Sandor Bognar said that as the degree of integration of electronic parts increases more and more intellectual work is built into the chips. For reasons of economy alone, the domestic industry cannot let this intellectual work input, amounting to about 40-60 percent, out of its hands. In addition it can be observed around the world that while earlier equipment manufacture counted as the driving branch now, because of the greater intellectual work embodied in the products, the scale is beginning to tip to the side of parts manufacture.

So development of it is a strategic goal as the structural transformation of industry requires a swifter spread of electronics in the manufacture of finished goods and in the modernization of technology. Both the security of domestic production and the embargo limiting import of developed Western European technology argue for the development of domestic parts manufacture. All this requires the coordinated use of central and enterprise assets. Sandor Bognar noted that there is also need for a sort of change in attitude, because the domestic market approach—and generally that in CEMA—is centered on finished products rather than parts.

At the briefing they also gave some figures characterizing the branch. Electronic parts manufacture covers 40 percent of the domestic needs; these came to almost 12.5 billion forints in 1986, 3.5 billion of this for semiconductors. Of the parts used 4.2 billion forints worth came from capitalist import and 3.1 billion came from socialist import. Without domestic electronic parts manufacture we would have to rely entirely on convertible import because we would also lose the socialist exchange base.

So at its February session the planned economy committee approved the conception worked out for reconstruction of microelectronics parts manufacture. An element factory being realized with central investment will be built within the framework of the Intermos Kft. [joint stock company] along highway M3 near Budapest or in the vicinity of Budaors. According to a proposal by the Soviet participants in the company they will provide the modern technology while the domestic side will participate by providing the building and infrastructure. The costs will be divided up 50-50 and will come to 3.5 billion forints each. According to the plans the plant will begin to produce in 1992. According to what was said at the briefing the modernness of the manufacturing capacity of the MEV [Microelectronics Enterprise] which burned down lagged behind the world level by 10-15 years but the new factory will approach the leaders by 2-3 years. Another unique factor of the investment is that it will be realized with domestic capital investment (and not with credit support). But the plant will manufacture only IC's made with MOS technology although traditionally bipolar circuits have had the chief role in domestic use (these IC's make up 70 percent of the use today).

At the briefing Lajos Koveskuti, president of the Communications Engineering Cooperative, reported on plans for a bipolar plant to be built independently of the above. This investment would be realized from enterprise moneys in the form of a joint stock company and would be based entirely on Western European technology. According to preliminary surveys domestic industry could undertake economical manufacture of 60 types of integrated circuits. This Interbip undertaking would cost about 1.5 billion forints and the plant could be producing by next year. After it was in full operation it would produce 200,000 4-inch wafers per year with a 3 micron technology.

8984

More Details

25020049 Budapest FIGYELO in Hungarian
24 Mar 88 p 8

[Article by G. T.: "IC Producing Stock Companies"]

[Text] Public opinion long awaited the decision of the Council of Ministers concerning a renewed organization of microelectronic element manufacture—about which a press conference was held last week at the Ministry of Industry.

Domestic use of electronic parts in 1986 had a value of 12.4 billion forints of which the value of microelectronic parts and semiconductors was 3.5 billion. The preparation of statistics for 1987 is not yet complete. Thirtynine percent of the parts used, but only 25 percent of the semiconductors, came from domestic manufacture. Capitalist import had a value of 4.2 billion forints and socialist import had a value of 3.1 billion. Socialist parts export, serving as a basis for exchange, came to 2 billion forints and capitalist export parts sales came to 400 million.

While the production of domestic electronic equipment manufacturers increased more than 11 times from 1965 to 1987 that of parts manufacture increased only 6.5 times. These are the data leading up to the decision of the Council of Ministers.

Electronic parts manufacture, mentioned as an emphatically important element of the industrial structural change, is being expanded by two investments with different technologies and being realized independently of one another. This "independence" is justified in part by safety reasons—a possible technical failure or breakdown will damage only one of the plants. On the other hand they are also counting on the development of competition between the two bases for integrated circuit manufacture.

In the recent past the Soviet side made a bid for the expansion and further development of the recently formed Intermos Rt [joint stock company]. According to this, with 50-50 Soviet-Hungarian participation, they will establish a high resolution, high capacity MOS technology integrated circuit manufacturing plant for which the Soviets will provide the technology and the Hungarian share will be the building and infrastructure. The Hungarian state will not loan the money but rather will invest capital and share in future profits from the undertaking, which will have the form of a joint stock company. The Industrial Development Bank will organize the company and it naturally counts on shares being purchased by the MEV [Microelectronics Enterprise], the Communications Engineering Cooperative, by such electronic equipment manufacturers as Videoton, MMG [Mechanical Measuring Instruments Factory], BHG [Beloiannisz Communications Engineering Factory], BRG [Budapest Radio Technology Factory], the Telephone Factory and Elektromodul and by the commercial banks. The estimated cost of the Hungarian participation is 3.5 billion forints of which about 800 million forints will fall in the time of the Eighth 5-Year Plan. The plant will be built near the lead-in to highway M3 or in Budaors. Soil mechanics studies are being done now to select the site. According to the plans manufacture will begin in 1992 and the new technology will represent a lag of only 2-3 years behind the world level. (The lag for the MEV technology was about 10 years.)

The other joint stock company is being organized by the OKISZ [National Federation of Artisan Cooperatives] under the name Interbip Rt., not with state money but with state attention—as was mentioned at the press conference. The goal is construction of a plant to manufacture integrated circuits using bipolar technology. For it they will purchase from a capitalist country technology and technical equipment capable of processing 120,000 silicon wafers per year, with a resolution of 3 microns. At present the experts are studying the bids of three Western firms. The Western contractor winning the commission will hand over the turn-key plant, together with on-the-job training of workers, by the end of 1989. This investment will require about 1.5 billion forints. A plant building is available; they would like to collect the money from enterprises using the parts and from banks and on the basis of preliminary talks it appears that despite the great indebtedness of the communications engineering enterprises this will succeed also.

In domestic use of integrated circuits the ratio of bipolar technology elements is now about 60 percent as compared to the more modern ones made with the so-called MOS technology. After construction of the two manufacturing bases this ratio is expected to be 50-50 percent. Hungarian electronic parts manufacture is jumping "two generations" with all the technical, training, receptivity, etc. problems of this, and after production begins there will probably be an over-supply of integrated circuits in Hungary.

8984

SCIENCE & TECHNOLOGY POLICY

Interelektro Spurs CEMA Cooperation in Electrical Engineering

23020014 East Berlin PRESSE-INFORMATIONEN in German No 59, 20 May 88 p 6

[Article: "INTERELEKTRO—Successful Cooperation Between CEMA Countries in the Area of Electrical Engineering"]

[Text] Electrical engineering products, instruments, and equipment are of great significance to the intensification of the national economies of the CEMA member countries. The pace of development of numerous industrial branches is substantially codetermined by the quality

and quantity of the products of the electrical engineering industry. The product mix encompasses turbo-and hydrogenerators, transformers, and high-voltage equipment, electric motors, cable products, high-voltage insulators, as well as electrical insulation materials, lighting products, semiconductor components and convertor equipment, specialized technological equipment, electrical feeder devices for numerically controlled machines tools, and much more.

It is the business of INTERELEKTRO—the international organization for economic and S&T cooperation within the electrotechnical industries of the CEMA countries, which was established in December 1973, to jointly utilize all opportunities for the demand-justified development and production of electrotechnical products, instruments, and equipment.

Membership countries of INTERELEKTRO include the USSR, the GDR, the CSSR, the Hungarian People's Republic, the People's Republic of Poland, the People's Republic of Bulgaria, the Socialist Republic of Romania, as well as the Socialist Federal Republic of Yugoslavia, and the Republic of Cuba.

During the first years of the organization's existence, the partnership between the combines, production associations, and foreign trade establishments was primarily oriented toward increasing the production of individual products. Bilateral and multilateral specialization and coproduction agreements contributed substantially toward this end. The share of specialized products encompassed a total of 347 individual products during the 5-year plan of 1976-1980. Currently, 622 products are involved. Due to increasing specialization it was possible to decisively raise production. In comparison to mutual deliveries in the years 1981 through 1985, the goods turnover during the current 5-year plan will be increased by 20 percent in this area.

Cooperation within the framework of INTERELEKTRO is also particularly aimed at making increasingly more intensive use of existing production capacities so that the demand for individual product assortments on the part of the participating countries can be met better. Around 35 percent of the products involved in mutual deliveries are the result of S&T cooperation. A focal point for all is constituted by the acceleration of scientific and technical progress in the overall cycle of science-technology-production-marketing. This is equally true of such unified products as motors, switching gear, and high-capacity structural components, as it is for projects undertaken within the framework of the comprehensive program of S&T progress among CEMA member countries through the year 2000. In this regard, the many years of experience collected by the INTERELEKTRO organization in the area of plan coordination will be utilized.

Currently, INTERELEKTRO attention is focused particularly upon the tasks emanating on the principal direction of "comprehensive automation and electronification" as formulated in the comprehensive program. The 15 topics in this area include, among others, the creation of flexible fabrication modules for electric arc welding, the processing of plasma, the assembly of low-voltage equipment, as well as the fabrication of entire series of unified accessory products such as synchronous motors for variable speed electric drives, switches, protectors, and semiconductor components with improved mass-performance ratios. With respect to all topics, the member countries coordinated technical requirements which orient all efforts to the highest technical levels, programs have been worked out, and the division of labor has been determined.

One of the priority projects is the joint development and introduction into production of unified designs for light wave conductor cables. The Soviet partners are responsible for coordinating the division of labor; simultaneously, the USSR took over the responsibility for working out the technical parameters as well as the principal requirements for the design of light wave conductor cable, as well as for the technological special equipment for the fabrication of this cable. The GDR, as well as the People's Republics of Bulgaria and Poland are developing the required equipment; Yugoslav specialists are designing the cable.

Leading enterprises and research institutes in the individual countries are cooperating in realizing these tasks. They include, for example, the "Svetlina" Combine and the cable plant at Sevlievo in Bulgaria; the Center for Optical Fibers in Lublin in Poland; the Research and Production Association of the Union Research Institute for the Cable Industry in the Soviet Union; the Kablo-Svetzarevo Combine in the SFRY; and the VEB "Wilhelm Pieck" Cable Plant Combine at Oberspree.

The unification and standardization of products is taking on increasing significance with respect to research and production cooperation in the area of electrical engineering. From 1981 through 1985, some 93 CEMA standards were confirmed; they involved 80 percent of the products included in agreements on specialization and coproduction. By 1990, other standards are to be added so that more than 90 percent of the products specialized within the framework of the CEMA organization will be covered.

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