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Science and Technology Perspectives

DEVELOPMENTS

Biotechnology

(USSR/West Europe) Under a 40 million ruble contract, the biotechnology firms Oweg GmbH (Austria), Gen-Bio-Tech (FRG), and Terasbetoni (Finland) have formed a consortium to establish a new facility at the Shemyakin Biotechnology Institute in Moscow. The facility will focus on animal and plant growth regulators, monoclonal antibodies, peptides, low molecular weight proteins, polymers, and pure solvents. (Slough CELL Data Base Mar 87) Antwerp Unit/Eva L. X2519

..... *Continued on Page 1*

FEATURE ARTICLES: Aviation Technology

REPORTS

PERSPECTIVES selections are based solely on foreign press, books and journals, or radio and television broadcasts. Some of the materials used in this publication will appear as abstracts or translations in FBIS serial reports. Comments and queries regarding this publication may be directed to the Managing Editor (Craig M. [redacted] or to individuals at the numbers listed with items.

STAT

DEVELOPMENTS

DEVELOPMENTS highlights worldwide S&T events reported in the foreign media. Items followed by an asterisk will be published by FBIS. The contributor's name and telephone number are provided.

Aerospace

(France/FRG/UK/Italy) Aerospatiale, MBB, Aeritalia, and the British Space Agency are working on a design for a hypersonic aircraft with a turbojet-ramjet engine (for atmospheric and transatmospheric flight), winglets, and retractable forward canard. Designated the AGV (High Speed Aircraft), it will be capable of transporting 150 passengers at Mach 5.5 and have a 12,000 to 15,000-kilometer range. SNECMA and SEP of France and BPD and Fiat of Italy are also involved in the feasibility studies. The design will be presented in June at the Paris Air Show. (Paris AFP SCIENCES 26 Feb 87; Rome AIR PRESS 21 Mar 87) Milan Unit/Arlene A. X2676

(Brazil/France) Brazil's Alcantara Space Center, a weapons test site and satellite launch center, will be equipped with Thomson CSF-manufactured instruments, notably the Adour and Atlas tracking radars. The Adour has a 200 to 2,000-kilometer tracking range, while the Atlas can track up to a range of 5,000 kilometers, guide long-range missiles, and determine satellite orbit parameters. Other Thomson equipment at Alcantara includes a telemetry station and a highly automated operations control center. (Paris AFP SCIENCES 12 Mar 87) Arlene A X2676

(Hungary/USSR/Austria) In support of the Soviet Phobos mission, Hungary's Central Physics Research Institute (KFKI) and the Budapest Technical University have built and tested ESTER, a package of three instruments that will measure low- and medium-energy ions in the solar wind. Hungary has also helped develop onboard equipment for plasma measurements and has delivered the craft's power supply system to the Austrian prime contractor (not further identified). Hungarian and Soviet experts at KFKI have completed a prototype of the Phobos lander computer that will control the craft's solar panels. (Budapest ESTI HIRLAP 15 Apr 87) Sari P. X2907

Biotechnology

(GDR) The current GDR Five-Year Plan (1986-90) calls for heavy investment in biotechnology R&D and applications—particularly in the food industry. The plan provides for the establishment of an industrial biotechnology research center, a chemical industry center for genetic engineering, and a technical school (not further identified) by 1990. In addition, genetic and immunological laboratories will be set up in advanced institutions and within the GDR Academy of Sciences. (Duesseldorf EUROPA CHEMIE 13 Feb 87) Rita S. X2609

Information Networks

(Hungary) The National Scientific Research Fund has allocated over 1 billion forints for the establishment of information and instrument centers during the Seventh Five-Year Plan. The Fund has budgeted 8 million forints for

instrument centers, 150 million forints for an information network, and 69 million forints for the purchase of computers and the development of a central computer network. Six new instrument centers will be built in Budapest with others planned for Veszprem, Pecs, Szeged, Debrecen, and Miskolc. (Budapest NEPSZABADSAG 15 Apr 87) Sari P. X2907

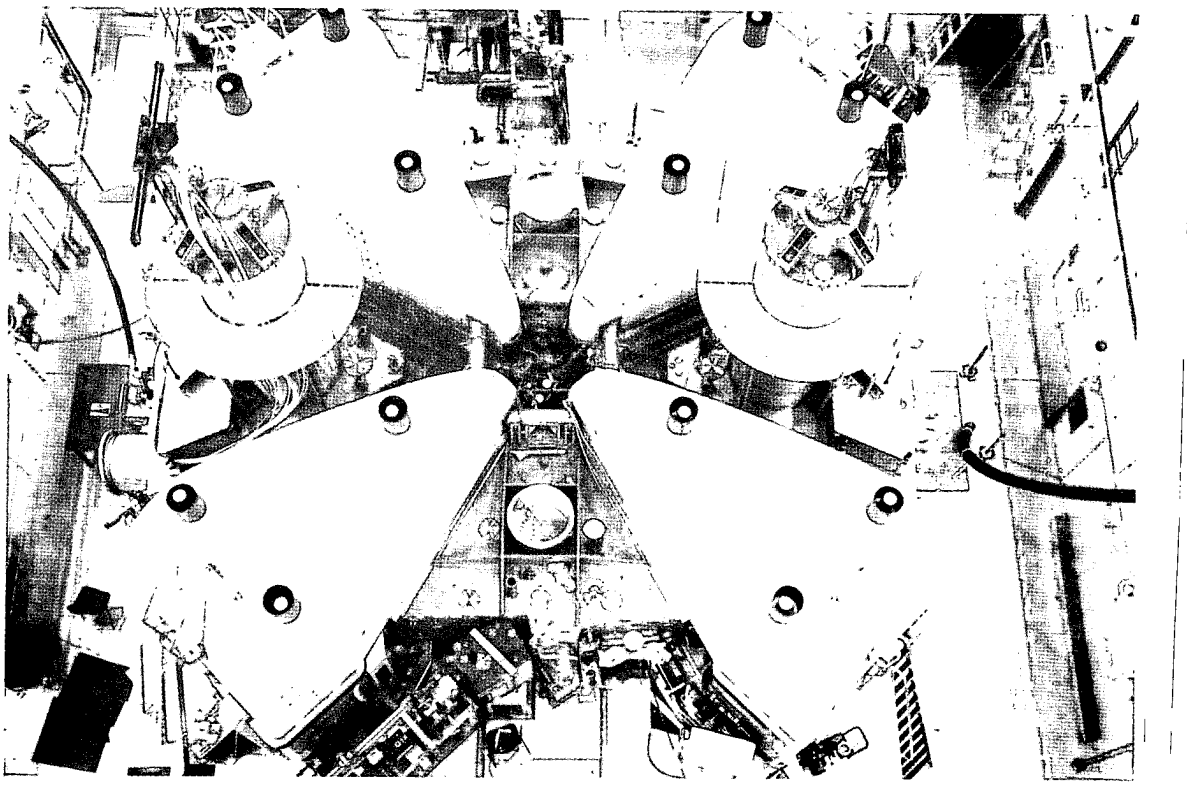
Microelectronics

(Sweden) Uppsala University researchers have developed a new type of CMES (complementary metal semiconductor) chip which is faster, quieter, and uses less energy than a CMOS chip. The CMES chip is resistant to radiation, thus giving it potential aerospace applications. (Stockholm TEKNIK I TIDEN No 1, 87; Sundbyberg MODERN ELEKTRONIK No 1, 87)* Elli M. X2519

(Japan) NTT's Electro-Communications Laboratory has increased tenfold its throughput of SOI (silicon on insulator) devices, which have aerospace applications because of their radiation hardness. Using a 100mA oxygen ion implanter, NTT has attained an output of 10 five-inch wafers per hour. Trial production yielded CMOS circuits that can withstand $2x10^6$ rad. (Tokyo NIKKEI MICRODEVICES Mar 87)* Andy R. X2726

Particle Accelerator

(South Africa) Late last year, scientists at the CSIR's (Council for Scientific and Industrial Research) National Accelerator Center (NAC) used the full design power (200 Mev) of a "separated-sector cyclotron" (separated-function synchrotron) to accelerate a beam of protons to 60 percent the speed of light. A NAC-designed and built apparatus (with "many" of the components manufactured domestically), the cyclotron is 7 meters high and 13 meters in diameter with a 1400-ton magnet divided into four sections. The device will be used in cancer therapy and in the production of radio isotopes for medical and industrial use. (Pretoria SCIENTIAE Dec 86)* Nate D. X2676



NAC "separated-sector cyclotron"

Pesticides

(USSR) The synthesis of 16 new potential pesticides from dinitrochloroanilines and various heterocyclic compounds, including the crown ethers diazo-18-crown-6 and monoaza-15-crown-5, is reported by researchers from the Physicochemical Institute, Ukrainian SSR Academy of Sciences. Previous studies have shown that the addition of macrocyclic ethers to pesticides significantly increased their toxicity. Compounds were also synthesized with triazole, imidazole, piperidine, and piperazine as the heterocyclic components. (Kiev UKRAINSKIY KHIMICHESKIY ZHURNAL Nov 86) Marilyn B. X2725

RPV Engine

(South Africa) Pretoria has publicly disclosed that in 1983 the Atlas Aircraft Corporation successfully tested a prototype of an RPV (remotely piloted vehicle) engine developed under a program called Project Apartment. The Apartment engine is a gas turbine, single spool, expendable turbojet engine with a maximum life of 20 hours. Project Apartment is viewed as an integral part of South Africa's military R&D effort "in view of the generally adopted international attitude towards the country." (Pretoria ARMED FORCES Feb 87)* Nate D. X2676

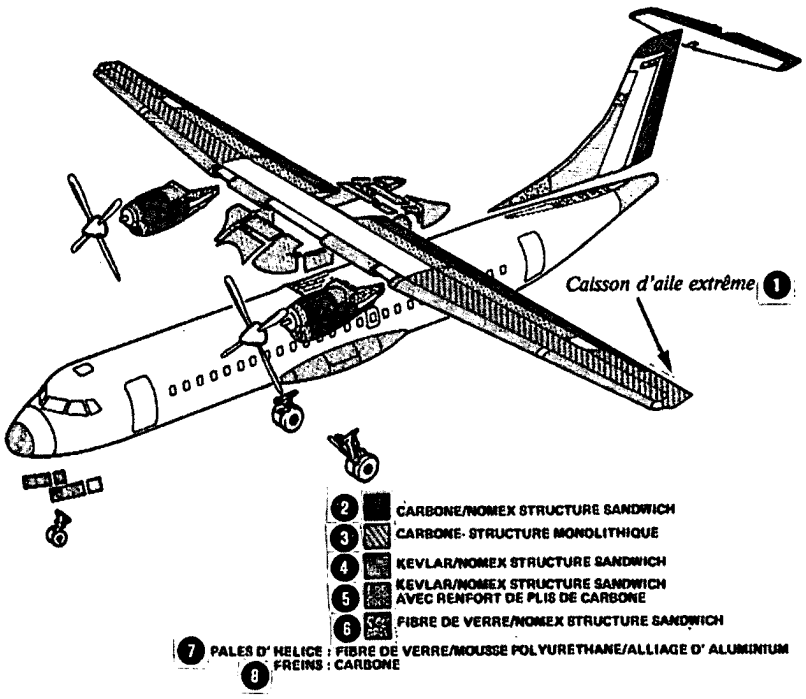
FRANCE: AIRCRAFT COMPOSITE TECHNOLOGY

Key Points: Aerospatiale's ATR 72 will feature the most extensive application of carbon composite technology to date in the development of a commercial aircraft. Slated for service in August 1988, the aircraft will be manufactured using advanced software and highly automated production equipment, according to reports in ZERO UN INFORMATIQUE (Feb) and AIR & COSMOS (Dec and Apr).

Composite Materials

Aerospatiale has designed 1,650 kilograms of composite materials into its ATR 72 passenger aircraft mainly in its primary structure. Most notably, up to 30 percent of the wings' structural weight will be carbon composites with particular emphasis on the use of these materials in the outer wing box (see graphic below for location of specific composites).

The outer wing box is a 1,500-liter fuel tank (8.415 meters long and 1.130 meters wide) comprising an upper and lower skin panel made of integrally stiffened carbon-reinforced composite materials, carbon-reinforced spars, and light metal alloy ribs. The skin panels are manufactured by stacking about



1. Outer Wing Box
2. Carbon/nomex sandwich material
3. Monolithic carbon
4. Kevlar/nomex sandwich material
5. Kevlar/nomex sandwich material reinforced with carbon plys
6. Glass fiber/nomex sandwich material
7. Blade leading edge: Glass fiber/polyurethane foam/aluminum alloy
8. Brakes: Carbon

100 layers—each between 127 and 140 microns in thickness—of precisely cut carbon fiber impregnated with epoxy resin. The carbon fiber is delivered as unidirectional sheets in 25, 75, 150, or 300 millimeter-wide rolls.

ATR 72

Manufacturing Technology

Aerospatiale has designed specialized systems for use in the design and production of the ATR 72 wing. It plans to perform wing design calculations using a Control Data ETA 10 supercomputer. Its ASELF (Structural Analysis by Finite Element) software, which is run by a Cray 1S supercomputer, assesses the durability of the composite layers against in-flight stress factors (such as airfoil flutter) to determine optimal wing design at minimum cost. ASELF also calculates the required shape and fiber orientation for each layer used in the wing box.

To ensure precision cutting and stacking of the composite layers, Aerospatiale is currently testing its ACCESS (Advanced Composite Cassette Edit Shear System) and ATLAS (Advanced Tape Laying System) equipment that will allow automated cutting and tape laying (stacking) of the approximately 100 layers, requiring 3,000 to 4,000 individual cuts for the larger sections of the aircraft. Using adjustable blades, ACCESS cuts strips of composite sheets 25, 75, or 150 millimeters wide into precise and at times complicated geometric shapes, removes scrap pieces, and places the layers sequentially on a roll of protective film in the reverse order from which they will be stacked in the final production process. The protective film is wound up as ACCESS deposits the cut layers and then unwound onto the ATLAS in the proper stacking order. The dual heads of the five-axis ATLAS stack the layers on a mold to produce the final wing part.

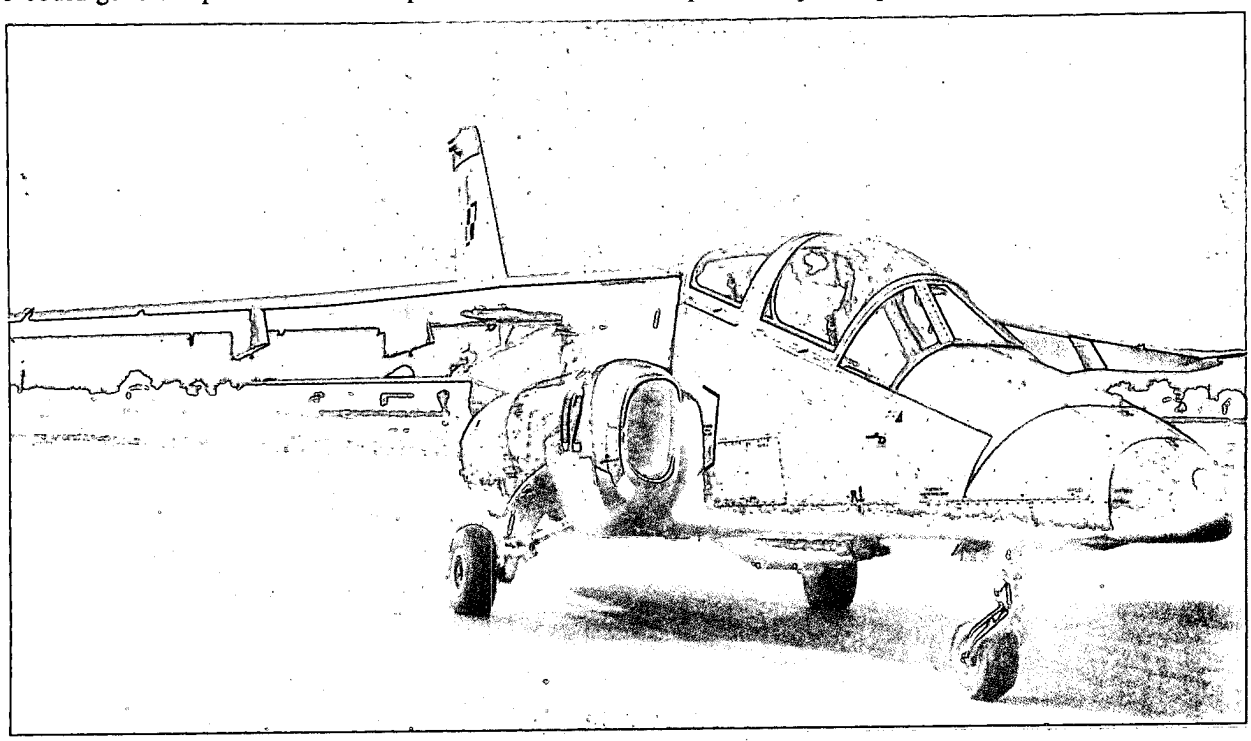
ACCESS and ATLAS will be run by direct numerical control using Aerospatiale's PAOMAD (Computer-Aided Programming for the Tape Laying Machine) software package. PAOMAD automatically calculates the optimal geometry of the ACCESS cut and directs the path of the ATLAS heads in stacking the cut layers. It also ensures precise placement on the protective film to avoid layer overlap, calculates the cutting and tape laying time as well as the amount of material needed, and provides instructions to the operator (although the operator can intervene at any point to correct a PAOMAD error).

Eva L. X2519

POLAND: "ALPHA JET" LOOK-ALIKE FIGHTER/TRAINER

Key Points: Late last year Warsaw produced a flight-test model of the I-22, a tandem two-seat advanced jet trainer for the Polish Air Force with a helicopter-hunter/escort capability. The dual-turbine, high-wing trainer/fighter displays a close resemblance to the Franco-German "Alpha Jet" (although slightly larger and somewhat heavier) and is designed for comparable performance and combat roles, according to AVIATION MAGAZINE INTERNATIONAL (15 Feb). The I-22's designer, however, stressed in a December PRZEGLAD TECHNICZNY INTERVIEW that his aircraft is the product of Polish engineering and manufacture.

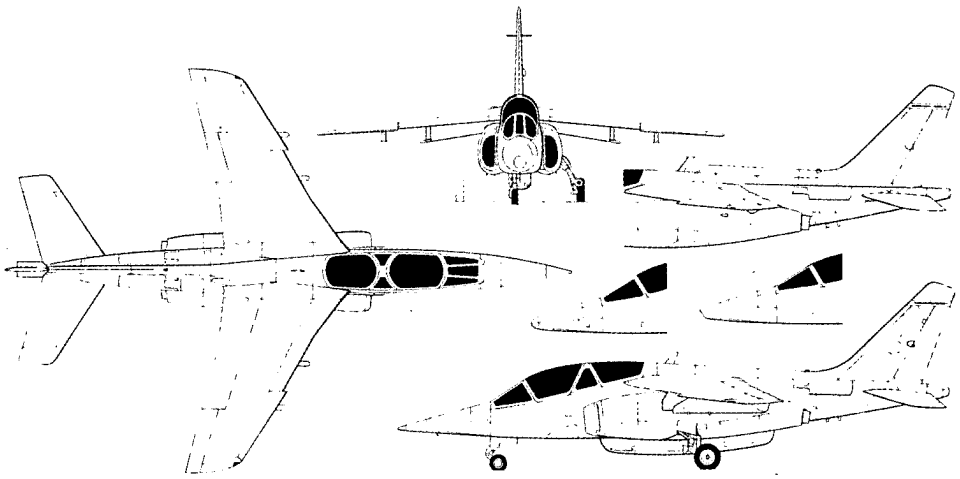
Details of the I-22's turbines have not yet been released, although the aircraft's designer, Dr. Alfred Baron, has stated that the fighter/trainer was "100 percent" the product of Polish design and manufacture. Press reports have suggested that the turbines may be an improved version of the SO-3 developed by the Rzeszow Polytechnic Aviation Institute and manufactured at the Rzeszow division of the WSK (Transportation Equipment Manufacturing) firm. Production models of the SO-3 generate an output of 10.8 kN at 15,600 rpm T/O and 9.8 kN at 15,100 rpm T/O. A 10 percent enhancement of the standard SO-3 could generate performance comparable to that of the Alpha Jet's power plant.



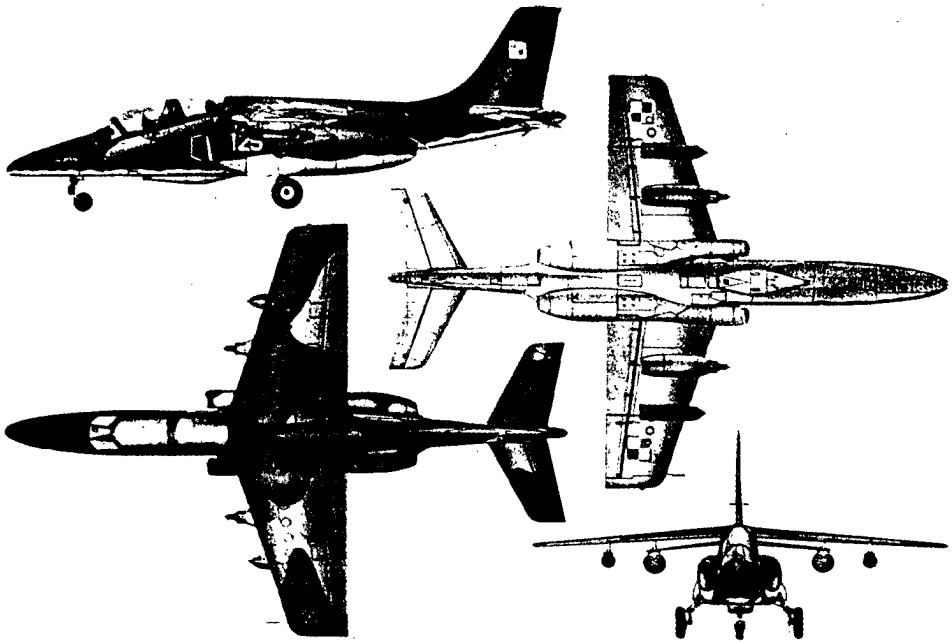
The I-22 Fighter/Trainer

The I-22 flight-test model was designated as 02, with its sister 01 apparently destined for bench testing. Four unloaded weapon rack pylons were evident on the I-22's composite-angle wings and a twin-barrel GSh-23 gun was mounted in the fuselage as in the MiG-21 and MiG-23. The I-22's test pilot, Ludwik Nataniec, was quoted as saying that the aircraft needed less than 1,000 meters for take-off and landing.

In an interview last December, Baron stressed the I-22's Polish design origins and the large-scale use of domestically produced electronics, including control and navigation instrumentation, data and early warning systems, radios, and radio signal receiver. Insisting that there were "not many aircraft in this category," he expressed confidence that "demand in foreign markets would be high."



Alpha Jet



I-22

	Alpha Jet	I-22
Length	12.29 m	13.22 m
Height	4.19 m	4.30 m
Wing Surface	17.50 m^2	19.92 m^2
Wheelbase	4.72 m	4.90 m
Wheel Track	2.71 m	2.71 m
Weight, empty	3,345 kg	3,962 kg
Maximum weight, with external stores	8,000 kg	7,493 kg
g limits	+12/-6.4 ultimate	+8/-4
Maximum level speed at S/L	1,000 km/h	980 km/h
Mach, max.	0.85	0.85
Service ceiling	14,630 m	12,800 m

Looking toward the future of Poland's aircraft industry, Baron emphasized his country's commitment to "continuous research and refinement of a proven aircraft system," citing France's "world-famous 'Mirage' class of aircraft as a good example of this." Baron remarked that the 1962 closing of the aircraft design office headed by Tadeusz Soltyk, one of Poland's preeminent postwar aircraft design engineers, was the cause of Poland's not "producing and flying advanced jet aircraft."

BIOGRAPHY

According to PRZEGLAD TECHNICZNY, Dr. Alfred Baron (DOB unknown) was born in France to emigre parents, returned to Poland in 1946, began his university studies in Kazan (USSR), and received a master's degree in aeronautical engineering with a major in airframe structures from the Moscow Aviation Institute in 1957. He was involved in the design of numerous aircraft, including the M-4, M-7, M-10, and M-12. Since 1979 he has been deputy director of design engineering development at the Aviation Institute in Warsaw and chief design engineer for the I-22. He received his doctorate in aerodynamics in 1977.

Richard C./Mark D./Eva L./Rita S. X2617

SOUTH AFRICA: MEDIUM SPEED WIND TUNNEL

Key Points: Slated for completion in late 1988, the Medium Speed Wind Tunnel (MSWT) will provide Pretoria's Council for Science and Industrial Research (CSIR) with an enhanced aircraft design and development capability. Described as a state-of-the-art facility, the tunnel, which will be operated by the National Institute for Aeronautics and Systems Technology (NIAST), is part of South Africa's effort to bolster its commercial aircraft industry, according to the Pretoria journal SCIENTIAE (Mar 87).

The MSWT is designed to provide a testing environment at subsonic and supersonic speeds. The tunnel will be a modified version of a US design for which the Pretoria firm Sverdrup Technology, Inc. was granted an export license in 1984. Sverdrup reportedly has altered the original design to provide for improved tunnel air flow and an operational versatility that will permit future expansion of the tunnel's testing capabilities. In addition, modifications were made to ensure that over half of the facility could be manufactured domestically.

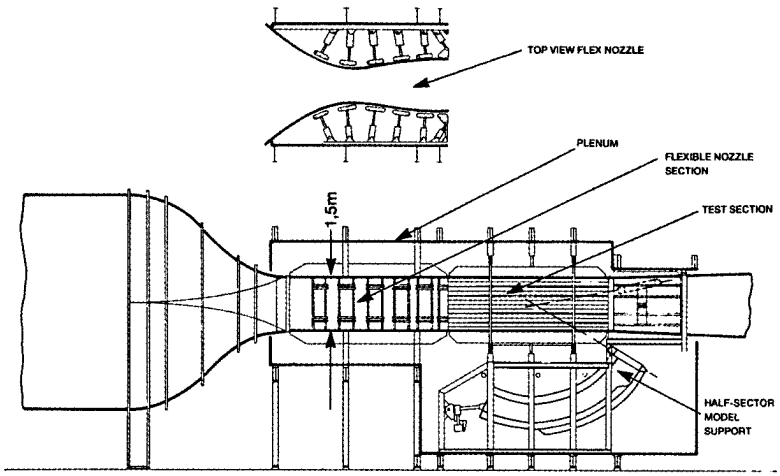
The MSWT is described as a state-of-the-art facility with flow quality, data production, and test capability "comparable to the best wind tunnels of its kind." The facility is designed to operate over a range of Mach 0.3 to 1.4 and 0.2 to 2.5 atmospheres. The primary subsystems include the:

— Nozzle, comprising stainless steel flexible plates with multiple computer-controlled jacks on each wall capable of providing fine speed control in the test section. It was designed to use viscous corrected nozzle solutions coupled with full-flexible plate equations .

— Slotted Wall Test Section, containing stainless steel slotted walls with removable panels for viewing, removable slot inserts, and a sidewall which lifts up for full access to the test model. The size of the test section was not specified.

— Main Model Support, a rugged, highly damped, low deflection, and accurate positioning half-sector with roll head.

— Plenum, a large chamber (necessary for achieving tight flow quality requirements) that houses the nozzle, slotted wall test section, and main support model.



— Main Compressor/Motor Drive, a three-stage variable geometry compressor designed for high efficiency, minimum flow disturbance, and low noise. It has a synchronous electric motor drive system with a variable frequency inverter for speed control. The compressor was designed and built domestically.

— Auxiliary Compressor System, composed of two 3,000-kilowatt centrifugal compressors that provide plenum exhaust flow up to 4 percent of the main tunnel flow. This plenum exhaust is returned to the main tunnel circuit downstream from the main compressor. This system also provides tunnel circuit pressure level control to 0.25 kPa, dehumidification, pump-up, and pump-down. These compressors were imported (country of origin not specified).

— Water Cooling System, composed of an evaporative tower and a twelve-row finned tube cooler in a corner of the wind tunnel circuit that prevent overheating of the air, which circulates at a rate of up to 1 ton per second.

— Instrumentation and Control Systems, based on a distributed processing network of three minicomputers that are linked with communications facilities and special-purpose application software to provide system supervisory control, testing, calibration, data reduction, and data analysis capabilities. The instrumentation includes over 200 general-purpose pressure measurement channels, 64 high-speed analog force measurement channels, and 64 general-purpose force, temperature, position, and pressure channels. In addition, more than a dozen high-accuracy closed-loop control systems were installed to ensure main drive and compressor control to within 2 rpm, model positioning to within 0.1 degrees, nozzle positioning to within 0.5 millimeters, and overall Mach number and pressure control.

— Tunnel Circuit, a complex pressure valve containing a large compressor, a finned tube cooler, and a test section. Special precautions (not further described) have been taken in anchoring the tunnel circuit and in allowing for thermal and pressure stress.

The South African firm Projects Expedited (Pty), Ltd., specializing in project management, construction, and quality control, took over the MSWT last November and began subcontracting (not further described). The CSIR's Estates Services Department is managing construction and utilities support services.

Nate D. X2676

REPORTS

REPORTS surveys science and technology trends as detailed in articles, books, and journals. It also includes summaries and listings of articles and books which may serve as potential sources for future research. Conference proceedings will occasionally be presented in this section.

FRANCE: INTERNATIONAL AEROSPACE CONFERENCE

A conference will be held in Paris from 9 to 10 June on international cooperation in the aerospace industry. Jointly organized by the FINANCIAL TIMES and AIR & COSMOS, the conference will feature speakers from Airbus Industrie, Fokker of the Netherlands, Aerospatiale of France, British Aerospace, Boeing and McDonnell Douglas addressing commercial aircraft issues. Speaking on military cooperation will be representatives from Eurofighter Jagdflugzeug GmbH and Panavia Aircraft GmbH. Participating engine manufacturers will include Rolls-Royce, SNECMA, Eurojet Engines, and General Electric. In addition, helicopter, avionic, and space technologies as well as cooperation with developing countries will be discussed. For more information, contact:

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Eva L. X2519

USSR: FIFTH-GENERATION PRE-PROTOTYPE

Soviet researchers under Viktor Kotov, deputy director of the USSR Academy of Sciences' Siberian Department in Novosibirsk, are developing a feasibility demonstrator of the MARS fifth-generation computer. Part of the CEMA program to develop a fifth-generation personal computer, the MARS project is being spearheaded by Kotov and a team of 120 engineers and programmers at the "Start" VMNTK (a temporary interbranch scientific-technical complex established in 1985 for a three-year period), according to MOSKOVSKAYA PRAVDA of 17 March.

The MARS is described as having a 32-bit architecture with several hundred processors (designated KRONOS). Each processor can be used independently as a high-performance computer with speeds of 2 to 4 million operations per second. The number of processors can be expanded to suit user needs. MARS will interface with two supercomputers, one with a pipeline structure and the other with a "matrix structure" (array processor). MARS users will access the computer through workstations equipped with advanced software that recognizes natural language and speech.

Under the VMNTK arrangement, scientists were drawn from several Soviet research facilities and assigned specific project functions. Siberian Department project scientists developed the processors, the operating systems, and portions of the software. Team members from the Academy of Sciences' Computer Center in Moscow developed software for personal work stations that are designed for use by economists. Personnel from the Institute of Cybernetics of the Estonian SSR developed various software packages that will provide an integrated control of the entire system and engineered a personal station for interfacing with the supercomputer, according to the Yerevan KOMMUNIST of 24 March. The "Impuls" Production Association of Severdonetsk will build the MARS prototype. These organizations have also provided funding for "Start" salaries and the purchase of equipment.

Although MARS component development reportedly has been completed, the system has not been tested as an integrated unit. If a feasibility demonstrator of the MARS is approved by the state commission in 1988, "Start" will receive a large bonus and will initiate work on development of a commercial prototype. Soviet industrialists have already expressed interest in the system. The Kama Automotive Plant is introducing KRONOS processors in assembly line automation and reportedly will buy the MARS computer as soon as it becomes available.

Irene A. X2723

DATA BASE SURVEYS

DATA BASE SURVEYS presents an annotated list of citations compiled by FBIS Antwerp and Milan Units from searches of European commercial data bases on specific technical topics suggested by consumer requirements. Additional searches and full-text translations of the records cited below can be provided on request.

The information below is derived from searches of the Italian National Research Council (CNR) data bases for updates on European semiconductor and computer R&D. CNR data bases describe national level R&D programs and projects conducted by individual institutes in collaboration with industrial and university research centers.

TECHNOLOGY	DESCRIPTIVE
Semiconductors	Non-destructive testing methods to identify defects in semiconductors for optoelectronic and microwave devices are the subject of a 1984-88 R&D program at the Italian Institute of Special Materials for Electronics and Magnetism, in collaboration with Selenia, Italtel, and Telettra. Scanning electron microscopy and solid state cathode luminescence detection are being used to study the generation of lattice dislocations and the propagation of defects from substrate to epitaxial layers in III/V materials such as gallium arsenide and indium phosphide. A 1985-87 project run by the Italian Institute of Special Materials for Electronics and Magnetism and the Enichimica company is developing computerized methods for growing gallium arsenide single crystals using the liquid encapsulation Czochralski process. The goal is to achieve a high degree of reproducibility of GaAs crystals and to refine wafer processing techniques.
Microwave Integrated Circuits	Fiar, Siemens, the EC, and the Italian Research Center for Propagation and Antennas are managing a 1985-87 software libraries project to describe discontinuities in planar waveguide structures, particularly microstrips, for nonlinear components of microwave integrated circuits.
Optoelectronics	The Italian Research Institute on Electromagnetic Waves is conducting a 1985-87 project with Selenia to develop holographic reticles for integrated optical circuits and optical diffraction components of display systems. The project also seeks to optimize the processing of dichromate gelatin used in the production of high efficiency holograms, which have applications in aeronautical display systems.

Milan Unit/Eva L. X2519

PREVIEWS

PREVIEWS is an annotated list of selected science and technology items being published by FBIS. The list may also contain previously published items of wide consumer interest.

EUROPE/LATIN AMERICA REPORT: SCIENCE AND TECHNOLOGY

S&T COMMITTEE ISSUES POLICY RECOMMENDATIONS TO CRAXI

Text of the Science and Technology Committee's "Report to the Prime Minister" includes sections on Recommendations, Training, Research Personnel, Financial Resources, Incentives, Research Management, and International Scientific Cooperation. (Rome IL TEMPO 27 Dec 86)

BIOTECHNOLOGY RESEARCH AT MAX PLANCK INSTITUTE

Article briefly describes 43 of the plant genetics research projects at West Germany's Max Planck Institute. (Milan BIOTEC May 86)

RESEARCHERS INTERVIEWED ON ITALIAN BIOTECHNOLOGY

Six prominent Italian scientists discuss biotechnology research programs in Italy. (Milan BIOTEC May 86)

ITALY'S EFIM GROUP FINANCES R&D

Article by Breda Research Institute president C. Tribuno summarizes EFIM [Ente Partecipazioni e Finanziamento Industria Manifatturiera] Group's extensive involvement in R&D in aerospace, defense systems, transportation, and advanced materials. EFIM's policies and strategies are also detailed. (Rome NOTIZIE AIRI Jul-Oct 86)

BIOTECHNOLOGY COMMITTEE RECOMMENDS POLICIES FOR ITALY

Article discusses the recent government-sponsored report of the National Committee for Biotechnology discussing biotechnology research and application in Italy. The committee's proposals for government assistance to biotechnology research are also summarized. (Rome NOTIZIE AIRI Jul-Oct 86)

SGS-THOMSON FIRM TO COORDINATE CHIP R&D

Article outlines the structure and goals of a joint holding company established by the Italian and French microelectronic firms SGS and Thomson to coordinate their semiconductor R&D and production. The new company will be the second largest European firm in this sector after Philips of the Netherlands. (Milan ITALIA OGGI 20 March 87)

SUB-SAHARAN AFRICA REPORT

EFFORTS TO BUILD SOUTH AFRICA'S HIGH-TECH DOMESTIC MARKET

Article details Council for Scientific and Industrial Research (CSIR) strategy to increase S&T sector revenue through development of a broader domestic market for high-tech products. (Johannesburg SOUTH AFRICAN JOURNAL OF SCIENCE Nov-Dec 86)