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West Europe Report

SCIENCE AND TECHNOLOGY

(FOUO 13/82)

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INDUSTRIAL TECHNOLOGY

REVIEW OF CAD/CAM USE IN FRENCH AEROSPACE INDUSTRY

New Terms Coined

Paris AIR ET COSMOS in French 24 Apr 82 p 23

[Excerpt] Say "XAO" ["CAX"] and you enter into a world where all human activity is assisted, or aided, by a computer: Design, drafting, manufacturing, maintenance, documentation, etc. A whole bevy of disciplines grouped generically under acronyms such as CAO [CAD: computer-aided design (design)], DAO [CAD (drafting)], FAO [CAM: computer-aided manufacture], CFAO [CAD/CAM], etc. Multiform and extremely rapid developments that for some years now have been in a fair way to transforming industries, and especially the aeronautics industry, into other sectors of which their advance is continuing. The "CAX" era is upon us, to the extent that numerous are those who prefer to talk in terms of "computer-aided engineering," thus covering at one fell swoop the gamut of high-level technico-economic activities and bringing all subcategories under a single heading, and, what is more, integrating industrial sectoral activity from its uppermost well-spring downstream through post-sale support and maintenance.

AIR ET COSMOS offers this week a bird's-eye view of these spectacular developments in the aerospace industry, particularly in France.

This review is presented as a number of articles exploring methodically the upstream side of the aerospace industry and bringing to our readers a more detailed overview of it.

This set of articles has been authored by Nicole Beauclair, Gerard Collin and Pierre Langereux.

Some Major Users

Paris AIR ET COSMOS in French 24 Apr 82 pp 28-31

[Article by Gerard Collin: "Having Begun with Aircraft Builders and Avionics Companies, CAD/CAM Is Rapidly Spreading"]

[Text] The accompanying table provides an idea of the CAD facilities in place in France in the aerospace industry. To begin with, we wish to make it clear

Company	CAD and CAM Applications	Hardware	Software	Remarks
TRT	Printed circuits, hybrids, hyperfre-quencies, integrated circuits, software.	VAX, Computervision.	CADDS 3, PLA-TINE, etc.	
TURBOMECA	Mechanical parts plans.	Computervision.	CADDS 3	Another system being ordered.

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Company	CAD and CAM Applications	Hardware	Software	Remarks
Ratier Figeac	Design of propellers and mechanical parts.	Computervision, Benson.	CADDS 3	4 consoles.
SAGEM	Electrical components (hybrids, prediffused circuits, bubble memories, etc).	Applicon, DEC, IBM.	Applicon + various others.	
SAT	Printed circuits, design drafting, simulation.	VAX, Tektronix, Calcomp, Computervision.	In-house software.	
SFENA	Drafting of cards and printed circuits,	DEC, Tektronix, SECMAI	CPS	
SFIM	Printed circuits, hybrids, prediffused circuits, mechanics.	In process of being selected.		Scheduled service date: End of 1982.
SILAT Latecoere	Drafting of 2 D, 3 D parts, wiring and electrical circuits.	Computervision, IBM/Dassault.	CADDS 4, CATIA	6 consoles. Delivery scheduled tentatively for mid-1983.
SNECMA	Drafting of mechanical parts and design.	Computervision, Dassault/IBM.	CADDS, CATIA	In process of delivery.
SOGITEC	Generation of 3 D images.	MATRA, Datavision.	EUCLID.	
TMI Forest	Electricity, hydraulics, nomenclatures, mechanics.	Computervision, Benson.	CADDS 4	8 positions.
Thomson-CSF	Printed circuits, mechanics, integrated circuits, hyperfrequencies, etc.	Applicon, Racal Redac, Computervision, IBM, Benson.	CADAM, Applicon, CADDS, SCI.	

Company	CAD and CAM Applications	Hardware	Software	Remarks
AEROSPATIALE	Design, calculations, drawings, electrical wiring, printed circuits, documentation, supervision, etc.	IBM, CDC, Computervision, DEC, Tektronics, Racal Redac, Benson, etc.	SIGMA, SYSTRID, AD 2000, CADDS 3, CADAM, UNISTRUC, ETC.	
Alkan	Structural and finite -element mesh calculations.	Prime, Tektronix, Benson.	ANSIS, NASTRAN, SUPERSAP.	Developmental work under way on application to composite material structural calculations.
AMD-BA	Design, calculations, drawings, wiring, documentation, supervision.	IBM, Computervision, etc.	CADAM, CATIA, CADDS 4	85 CATIA consoles.
Crouzet	Electronic circuits and cards.	Prime, Megatek.		
ESD	Electronics, circuits, schematics, hybrids, hyperfrequencies, prediffused circuits, software, testing, modeling, etc.	IBM, CALMA, Tektronix, DEC, Aadage/SORED	ELFINI, TRICEPS, CATIA, LOCACE, etc.	
MATRA	Mechanics, electronics.	CALMA, MATRA, Datavision.	EUCLID	
Mecachrome	Mechanical parts.	Computervision	CADDS 3	Aubigny-sur-Nere.
Messier-Hispano -Bugatti	Mechanics, kinematics, structural calculations.	VAX, Tektronix, MATRA, Datavision	FORMECA, NASTRAN, EUCLID	
Precision Mecan. Labinal	Electrical wiring and equipment.	Computervision	CADDS 4	Saint-Ouen and Toulouse.

that this table has been based on information that was kindly provided to us and lays no claim to being either precise or exhaustive. We trust therefore that any "forgotten ones" will be good enough not to take us to task on its limitations...

This having been said, we can go on to conclude from this table that some 20-odd companies already have acquired CAD facilities, ranging from the considerable ones possessed by Dassault and AEROSPATIALE [National Industrial Aerospace Company] (among the top-ranking worldwide) to the very simplest, turn-key type installations. The number of interactive consoles is close to 400, indicating that between 1,000 and 2,000 technical specialists are using them on a daily basis.

In any case, this is a fleeting glimpse at best, so great and rapid are the developments, expansions and additions of functions that are taking place. This also permits us to conclude that at the present state of the technology, the French aerospace industry represents one of the very first and foremost "offerings" to the CAD industry... which actually issued in large part from the said aerospace industry!...

The facilities currently in place are of two general types, although, it goes without saying, the boundaries between the two types are in fact very flexible and at times indistinct:

--CAD (design) for three-dimensional mechanical parts and assemblies to which scientific calculations must be applied: strength of materials, aerodynamics, kinematics;

--CAD (design) and CAD (drafting) oriented toward the drafting of mechanical parts or toward electronic circuits.

The choices available to the French aeronautics industry appear to be limited to a few systems: Software of French origin for "top-of-the-line" 3D applications and systems of foreign origin for "bottom-of-the-line" 2D and and 3D applications, which explains, among other reasons, why many of these developments have been undertaken by the users themselves in France: The case of Dassault, SNIAS [AEROSPATIALE [National Industrial Aerospace Company]], TRT [Radio and Telephone Telecommunications Company], ESD /Electronique Serge Dassault/

It will be noted that avionics is very well represented in this table, with SAGEM [Company for General Applications of Electricity and Magnetism], SFIM [Measurement Instruments Production Company], SFENA [French Air-Navigation Equipment Company], ESD, Thomson-CSF [General Wireless Company], TRT, SAT [expansion unknown], Crouzet. These are the "biggies" of that sector.

The principal suppliers of mechanical parts are going over to CAD (design), such as Messier-Hispano-Bugatti and Alkan.

The subcontractors are also beginning to equip themselves: Ratier-Figeac, Mecachrome, SILAT [expansion unknown] Latecoere, Precision Mecanique Labinal, Charles Robert. There is evidence as well of a continual flux extending toward mediumsize firms (less than 1,000 employees). Everyone, however, knows that CAD (design) is unavoidable: Many, in fact, have indicated to us their "close watch" on this situation. Nevertheless, a decision is dependent upon two major considerations: The adequation of systems and their compatibility with the CAD systems of the aircraft builders, the engine builders and the clients.

AEROSPATIALE and Dassault

Much has already been written about the worldwide aerospace industry in the field of CAD/CAM. More interesting than the description alone of these systems and configurations is an analysis of these developments in the light of the work being done in France by AEROSPATIALE and Dassault. Their efforts have in fact positioned these two French aircraft builders among the world's leaders in their field.

A first important characteristic of these developments is their originality. And this, for a good and simple reason which Mr Audy of AEROSPATIALE explains as follows: "At the time we started up, at the beginning of the 1970's, nothing was available that responded to our needs with respect to the treatment of complex shapes. We had to create our own CAD tools: SIGMA [expansion unknown] in November 1976 at Toulouse and SYSTRID [expansion unknown] at Marignane.

The Dassault company, after acquiring broad experience in batch processing and with interactive screens, began by buying Lockheed's CADAM [Computer Graphics-Augmented Design and Manufacturing] software (the only major software it has purchased abroad, Dassault points out...), to substantially enrich it (and even resell it to Lockheed), and to add to it a third dimension, around 1978, by way of the CATI [expansion unknown], which has since become the CATIA [expansion unknown], program; meanwhile, the number of program instructions has more than doubled.

A second essential characteristic of these developments is the envelopmental attack on the most complex of programs: Three-dimensional forms, aerodynamic calculations, design and manufacture, creating CAD/CAM.

In the latter regard, CAD/CAM received its first major impetus from the aircraft manufacturers, at the level of their model shops. "This was our first objective," Pierre Bohn told us in this respect. "The creation of wind-tunnel models in a matter of weeks, indeed of days, where theretofore months had been requires, resulted in spectacular gains in the optimization of new programs. Similarly, CAD/CAM makes substantial gains possible with respect to the creation of tooling, which is derived by a simple mathematical operation from the shapes of the plane's parts."

In AEROSPATIALE's case, the advent of CAD/CAM into its operations appears to have been linked to the calculations of the complex formes associated with aerodynamic calculations, in its Helicopters as well as its Planes Divisions. But also in its case, the creation of models was rapidly taken over by CAD/CAM. Thus, the first modern (interactive) three-dimensional systems were born toward the end of 1976.

Integrated manufacturing by way of CAD/CAM has become an important industrial reality in the realms of machining; pipe and tube bending; cutting, punching and stamping of sheet metal (as with AEROSPATIALE's "Panoplies" software used with a "Trumatic" machine). But it is unquestionably in the model shop that the most integrated and advanced examples of CAD/CAM are found.

CAD/CAM is progressing both in the direction of robotics (as evidenced by the tests now being carried out at Seclin), and in that of the direct creation of manufactured-product lines. As regards the latter, AEROSPATIALE is developing "morphodimensional codes" that should be applicable to the production of stock parts for the ATR 42 line by describing the entire chain of creation through the finished part. "We expect thus to achieve a standardization of work methods," indicates Mr Audy.

Consoles by the Hundreds

All CAD programs have been enlarged. A convenient benchmark is the number of consoles in service: Dassault has in service today 85 CATIA consoles, without counting the Computervision consoles used for electrical wirings and some mechanical equipment applications. At AEROSPATIALE, the Studies Bureau of its Planes Division already has 80 Computervision consoles, 10 SIGMA consoles, 10 consoles for the AD2000 (drafting of parts with VAX or CDC computers), plus several others for UNISTRUC [expansion unknown], and... plans for 20 additional consoles per year from 1982 through 1985! Adding to these the NC [numerically controlled] preparation consoles at Toulouse, Nantes, St-Nazaire and Meaulte, and still a few others, the current total comes to some 150 consoles... without counting the facilities of the Helicopters Division and those of the Ballistics and the Tactical Missiles Divisions.

This proliferation of consoles (and of associated computers) is dependent, of course, upon telecommunications networks on a European scale. Both Dassault and AEROSPATIALE make use of design and production units widely distributed throughout the territory, from Seclin to Marignane and from Saint-Nazaire to Annecy... But European cooperation requires a communications network that extends even beyond these limits. "MBB [Messerschmitt-Boelkow-Blohm] communicates with our data banks from Germany," says Mr Audy, "which gives rise to two problems. The first is secrecy: We have instituted very strict procedures for accessing the system. To date, no one has been able to break in on it... The second major problem is that of inadequation of the common-user communications networks. A plan described in CAD represents from 200,000 to 300,000 bytes, which take 15 minutes of line at 9,600 bauds to transmit! We therefore use MIC [microwave integrated circuit]-type links and are counting very heavily on telecommunications satellites. From a more general standpoint, we might say that CAD increases all telecommunications needs by one order of magnitude," Mr Audy adds.

The creation of data banks is seen by both aircraft builders as an essential aspect of CAD. In Mr Bohn's view, "This creation is the starting point for the safeguarding of the company's know-how, one of the features of CATIA which is soon to be marketed. The history of the creation of a part by the operator will be preserved. In time," Mr Bohn says, "it will thus be possible to better understand the creative processes and to take advantage of the best among them..."

Quantifying the Benefits

It is not very easy to quantify the benefits of CAD; AEROSPATIALE has nevertheless calculated some orders of magnitude in the case of mechanical parts.

With respect to design and drafting times, gains of from 50 percent for simple parts to 90 percent for complex parts are representative.

As regards NC preparation cycles, the gains are very substantial, being of the order of 80 percent...

Another measure of gains is provided in terms of the time required to complete a finished plan: At AEROSPATIALE, it was currently 5 weeks; today, with CAD, the objective is 24 hours...

There is still another area in which gains are significant: CAD is in a general way extraordinarily positive in its approach to everything that is evolutive.

3D Requirements

Apart from the aircraft manufacturers, French industry as a whole is gearing up, as in the case of Messier-Hispano-Bugatti, to deal with the complex problems of strengths of materials, volumes and kinematics.

Messier-Hispano-Bugatti's initial work in the domain of CAD began more than 10 years ago.

The axes along which the company's efforts have been deployed since the start of the 1970's are the following:

--Aid to the resolution of graphics problems in two essential aspects: Problems of kinematics and of displacement of volumes in space; and automation of the process of actualizing the design drawings of assemblies and of parts.

--Aid to the resolution of problems of calculation: Optimization of operational performance characteristics and of weights, particularly of landing gear; studies of possible reductions, in a future phase, of certain qualification tests.

--Aid to testing: Exploitation and rapid adaptation of test programs and their results.

--Technical management: Exploitation of technical data banks and automation of repetitive tasks (standardization, planning), through the use of facilities already in place for the resolution of the foregoing problems.

From a software standpoint, Messier-Hispano-Bugatti has developed softwares that are specific to its graphics and calculations needs, as well as used existing softwares in the calculations domain (for example, NASTRAN [expansion unknown] software).

The company has also equipped itself with independent data processing facilities dedicated entirely to its technical needs. (The powerful data processing facilities needed for production management are, owing to their nature, entirely separate.)

These facilities consist essentially of a computer suited to the resolution of scientific problems, graphics and alphanumeric displays, graphics-output peripherals, test-data-acquisition and -processing minicomputers, etc (VAX computer, Tektronix consoles...).

Concurrently, Messier-Hispano-Bugatti is equipping itself with new and powerful softwares, noteworthy among which are "EUCLID," which the company deems to be well suited to the resolution of the complex problems of 3-dimensional shapes, and a software that could be an interesting supplement in the domain of calculations.

On the whole, the French aerospace industry has taken a very advanced position in the field of CAD, particularly in top-or-the-line sectors, with its CATIA (derived from Lockheed's CADAM, which was revised and expanded by Dassault and is now being marketed by Dassault Systemes and IBM), SIGMA and SYSTRID (developed by AEROSPATIALE, SYSTRID being marketed by the Batelle Institute and SIGMA by CDC/Control Data Corp./, and EUCLID, which was developed by the AEC [Atomic Energy Commission] and picked up by MATRA [Mechanics, Aviation and Traction Company] through MATRA Datavision. French CAD ranks now among the world's leaders in the realm of 3D, a considerable asset to the national economy and national industry as a whole, and of course to the European aeronautics industry...

As evidence of French leadership we need only cite the worldwide acclaim of Professor Bezier's "polynomials" and the choice (reciprocal) of CATIA by IBM, this choice having been based on the competitive merits of two American systems, one Japanese and the CATIA system. And CATIA has now been bought by Boeing, Rockwell, Grumman, MBB, Dornier, SNECMA [National Aircraft Engine Study and Manufacturing Company], WMI [expansion unknown], Kajima, with its acquisition by others pending. Still in the aeronautics sector, EUCLID made its successful breakthrough at Messier-Hispano-Bugatti, MATRA, Normalair Garrett, MBB, Aermacchi, ESA [European Space Agency], FN [expansion unknown] Herstal, Dowty, etc.

AEROSPATIALE has marketed its developments directly or through other companies: CMN [expansion unknown], Volkswagen, NLR [expansion unknown], BMW [Bavarian Motor Works], NERPIC [expansion unknown], CISI [International Data Processing Services Company] ... .

French success in this 3D domain of CAD is apparently owing to two factors:

--The first is that the French aerospace industry depends for its survival--in the face of American mass production--on the imperative need to reduce its nonrecurrent, hence developmental, costs as well as its production cycles, while at the same time clinging to demand through pronounced customizing of its products. The result can only be the most advanced of data processing facilities;

--The second is undoubtedly the allure for the French mind in virtualization of conceived objects. There can be no question that the abstract approach made possible by CAD finds in the French intellect a very favorable terrain, whereas the Anglo-Saxon mind is more generally known for its pragmatism and its empiricism.

CAD/CAM in Subcontracting

Paris AIR ET COSMOS in French 24 Apr 82 pp 27, 36

[Article by Nicole Beauclair: "Being a Subcontractor in CAD"]

[Text] "How," you will ask, "can a company be a CAM subcontractor without actually performing a machining operation on any material?" Actually, the term "services" is perhaps better suited to types of tasks consisting of designing, drafting and procuring for clients a magnetic or perforated tape that is virtually usable in the numerical control of a machine tool.

The SIG [Graphics Data Processing Company] was established in France in November 1980. This French subsidiary of the Belgian holding company COFIXEL [expansion unknown] (61 percent Electrobel and 28 percent Joint Navigation Group) specializes in subcontracting, service bureau activities, continuous training and consultation services to enterprises.

For these purposes, SIG started out with a Computervision CAD system. Several factors influenced the choice of system. Daniel Picard, general manager of SIG, explains this choice, In the first place, it was a matter of having equipment identical to that in use at Electrobel, for obvious reasons of system compatibility in the event a work overload, a system failure, ... were to compel SIG to have its subcontract work done by its opposite number CGS [expansion unknown]. The second factor governing the choice was that Computervision systems are well established in France: According to Daniel Picard, more than 100 systems are installed within our national territory, which makes for a substantial potential clientele and which therefore alone justifies the choice of a Computervision system. As a services company, and although it was using a system like that of its sister company, the management of SIG quickly found it necessary to ensure the continuity, the security and the performance of its work orders. Thus, a second Computervision system, in every respect identical to the first, was purchased and installed in October 1981. SIG's Computervision equipment now consists of two systems with peripherals as follows: 5 graphics display screens and alphanumeric consoles, 1 high-speed printer, 2 Benson tracers, 1 tape perforator, 1 digitizer table and one 300-Mbyte disk drive. The basic softwares for these two systems are CADDS [Computer-Aided Design and Drafting System] 3's. It is recalled that the CADDS 3 is of the branched type and that by the insertion of specific applicational software the system can be adapted to the resolution of mechanical, schematic, tubing, electronic, NC, and other types of problems. SIG is currently carrying out certain tests on CADDS 4 software, and in this regard it should be noted that although CV [Computervision] software compatibility is not total, it would appear to be effective in the direction from CADDS 3 to CADDS 4 (upstream compatibility).

SIG's CV systems are able to handle mechanical, electronic, NC and other types of assignments. It also appears that, the electronics market being as vast as it is, SIG decided to have a system specifically designed for this sector of its activities. Choice of its third system was arrived at by way of a different approach. It was not necessary to seek a system compatible with the system of its sister company, but rather one compatible with the largest number of systems in use in this domain. Furthermore, to effectively actualize a CAM operation, it was necessary to have a high-resolution image tracer that would mesh neatly between CAD and CAM to form an integrated whole. As a result, a British system was chosen. Besides, Daniel Picard explains, it was clear to us, after considerable study, that the QUEST [expansion unknown] combined system offered the best quality/price ratio. QUEST, which has been established in France only 8 months, has nevertheless already sold 4 systems, and this bears out the fact that the system is highly compatible with other systems; otherwise, how could SIG justify an investment in a system that could not be made to duplicate the equipment of its clients?

The configuration of the combined digitalization and image tracing equipment--the Q Plot 80--procured by SIG is as follows: FRED 4 digitalization table, SAM dialogue console, Tektronix display screen, Data General computer, 20-Mbyte disk drive, tape unit, paper-tape perforator and reader, EMMA 80 image tracer, roll-paper tracer. The Q Plot 80 works with a Quad digitalization software (known also by the name of Q-Draft). A Gerber emulator renders the image tracer compatible with the system of the same name; in the near future, SECMAI [Company for the Study and Design of Industrial Machines and Equipment] will also be.

SIG thus has at its disposal an appreciable number of machine hours that can be made available on a subcontract basis or a service basis; that is, a client (who may himself be a subcontractor, but at the same time also an aircraft manufacturer, engine builder, equipment maker...) can come to SIG and work on a cooperative basis. This may be necessary as an initial contact with CAD, or in case of an overload on the client's own system, or merely in case of a malfunction in the client's system. SIG has its own staff of 27 persons (taken all together). Its CAD operators highly trained professionals: Experienced design draftsmen with graduate technical certification and superior technical certification, under the supervision of engineers. It is a structure that appears made to order to respond to the problem of CAD/CAM on a subcontract basis.

Still a Long Road To Travel

We have intentionally chosen an enterprise that is in the CAD/CAM vanguard, but not unique to it, to concretize the adventure of being a CAD/CAM-oriented subcontractor. In the vanguard certainly, because MECACHROME [expansion unknown], with a plant installed at Aubigny-sur-Nere (Cher) and a staff of around 400 persons, is often cited as an example because of its dynamism and its inclination toward investing in new technologies. We recall briefly that MECACHROME comprises three plants: SILMECA [expansion unknown] at Amboise (around 115 persons), PRECIMECO [expansion unknown] at Colombes (45 persons), and Aubigny-sur-Nere (MECACHROME), the first two being subsidiaries of the third, whose head office is in Paris. Only the Aubigny plant is CAD/CAM-equipped. As we have mentioned heretofore, an enterprise cannot consider going into CAD/CAM until it equips itself with NC machine tools. This was the case of MECACHROME, which began in the 1970's to equip itself with this type of machines: NC lathes (2 axes), then progressively 3-axis then 4-axis machines, to arrive at a total today of around 70 NC machines, with an average rate of investment of one NC machine per month! Although oriented toward, among other things, aeronautical and space subcontracting (including armaments), the specialty of the Aubigny plant is the machining of mechanical components (SILMECA is more oriented toward the machining of aeronautical panels). Why did MECACHROME decide in favor of CAD/CAM?

"Our principal concern," we were told by Jean-Yves Poncet, head of the group's purchasing activities, "is, on the one hand, to remain a partner of our clients and, on the other and from a technological standpoint, to be able to input rapidly to the brains of our MOCN's [NC machine tools] the necessary numeric commands." The choice of CAD/CAM system was made on the basis of a factor of scale: Acquisition of a system whose characteristics would provide the best possible match with the systems in use by the major client companies. The solution was self-evident: At the time of the decision, most client companies had CV equipment in place; and so it was that MECACHROME received its CV system in October 1980. It includes a graphics display screen, a console and alphanumeric keyboard; a hard-copy output (direct photocopy of the graphics being displayed on the screen), and a perforator output, all working in accordance with updated CADDS 3 software. Before being equipped with CAD/CAM, MECACHROME had an automatic programming aid system: The MDSI [expansion unknown] company's Compact 1. This system was then replaced by a Compact 2, which provides the system with a broader range of interactivity.

Let us indulge momentarily in a glimpse of Utopia and see the relationship as it should be between the giver and the receiver of orders, both being equipped with CAD/CAM systems. The subcontractor should receive from his order-giving client not plans, any longer, but rather a magnetic tape containing all the characteristics of the part to be fabricated (geometry, dimensions, etc). This tape would be introduced into the order-receiver's CAD/CAM system, to produce, in the form of magnetic or perforated tapes, a programming of tools for each required machining operation; these tapes would then be directly usable on the subcontractor's NC machine tools. And even these perforated tapes would not exist if the subcontractor's shop were equipped with DNC [Direct Numerical Control], in which case the instructions would be transmitted via a central computer to the NC units of the machines.

MECACHROME is not presently equipped for DNC, which explains the need for transmitting instructions via a machine tape. On the other hand, there has not yet been a case of an order-giver's providing MECACHROME with tapes. Thus, this is how Claude Pardessus, head of MECACHROME's Programming Service, and his staff operate: All the data of a plan that has been provided are introduced manually into the CV system, making use of the bill of fare provided with the graphics console, so that all the information is inserted into one central-data base. Based on the geometric description of the part to be machined, a machining program is extracted, thanks to the system's use of APT [Automatic Programming Tool] language to denominate the various entities that make up the part, which in turn serves to generate in real time and interactively the run of the tool. All tool runs can thus be visualized on the screen and in all the desired planes (X, Y, Z). For a given machining run, however, the perforated tape that is produced from it cannot (at MECACHROME) be fed directly into the machine NC's. The data it contains must be converted to render them compatible with the languages of the different NC's in use in the shop. This is where the Compact 2, thanks to the computer with which it works (a Digital Equipment PDP 11-34) comes into play: The tape obtained from the CV system is processed by the PDP which transforms it via the Compact 2 into a machine tape (The Compact 2 places at the disposal of the user a substantial library of softwares that are machine translators). Of course, many gaps remain to be bridged to render the system fully automatic, and this is why an interface between the CV system and the computer with which the Compact 2 system operates is being developed jointly by CV and Digital. This interface, which should be operative within some 15 days, will eliminate the need to produce a tape that must be reintroduced into the computer for processing. The processing of a design into a machine tape will then be... direct.

The CAD/CAM system acquired by MECACHROME, which permits, besides the processing of clients' plans, the design, for example, of machining montages, does not however exploit all the possibilities opened up by this new technology. For, is not the fact that the order-giver is continuing to furnish plans actually owing to an incompatibility between systems, to a desire to guard against access to data banks through procedures whose security still leaves much to be desired?

Would it not then be desirable, from the standpoint of being able to work with several order-givers, that the subcontractor equip himself in accordance with his own needs and develop or have developed for him the necessary interfaces to render his system compatible with those of his different clients? This would mean as many interfaces as there are order-givers, but a hedge against restricting the subcontractor's field of action.

Use in Electronics Industry

Paris AIR ET COSMOS in French 24 Apr 82 pp 37-38

[Article by Gerard Collin: "Electronics, CAD/CAM's Privileged Terrain"]

[Text] The electronics industry is, historically speaking, the first to have taken advantage of the possibilities of CAD. This undoubtedly is in a way related to the fact that electronics and electricity require essentially planar descriptions of equipment, concretized by drawings, and finally electronic cards plugged into a general interconnection card (matrix card).

True, the interconnections criss-cross each other, but this results at most in interconnection layers (multilayer circuits), which are, after all, nothing more than interconnected stacks of plane circuits.

Electronics is thus a bidimensional form of CAD, or at most a "2-and-1/2 D" form of it; hence, the required calculating and graphics processing powers are more limited than in the case of mechanical parts which, moreover, are at times mobile.

Furthermore, the electronics industry and data processing have always made good bedfellows... .

And a final argument: Electronics makes use of elementary component cells (transistors, resistors, etc) belonging to a limited number of families. Components may even be reiterative on the same card; a borderline case is that of prediffused circuits, which are somewhat like micrometric checkerboards on which the operator must apply connections between squares... . At this game, the computer is lord and master and provides the designer with priceless assistance.

But CAD brings to the electronics industry--avionics, insofar as it directly concerns us herein--its full potential as regards end-product quality (for example, mask tracings far more precise than any obtainable through manual drafting methods) and universalization through virtualization of the circuit being processed. Thus it is that, in the view of Mr Bodin, of the SFENA [French Air-Navigation Equipment Company], CAD must be introduced into the company's operations in accordance with an overall policy: CAD is unquestionably a powerful circuit-design tool, but it is above all "a synchronization and organization" of the entire chain comprised of design, development, production, customizing, and post-sale support.

CAD and CAM are thus so integrated and closely tied to the other aspects of the industrial cycle that they are subsumed into a more embracing "computer-aided engineering" concept: design, transcription of the electrical schematic, simulations, testability, testing, drafting of cards and circuits, automatic sorting and routing, documentation, drilling, creation of masks, NC removal of material, depositing, management of production and versions, laser-based adjustments, characterization of components, arrangement of input components, reliability management and post-sale service!

Computer modeling in space is beginning, as we were able to note at TRT [Radio and Telephone Telecommunications Company], SFIM [Measurement Instruments Production Company], ESD [expansion unknown] and Thomson-CSF [General Radio Company]. All the foregoing can of course be applied to software in a practically identical manner.

The facilities being offered to the avionics industry are foreign--Computervision, Applicon, Calma, Kongsberg, Ferranti, Racal Redac, Quest, Scientific Calculation, Gerber--with some few French such as SECMAI [expansion unknown] and now SORED [expansion unknown].

This market being in its phase of rapid expansion, any attempt to cite all potential suppliers is at best illusory...

The avionics industry remains open, however, to systems adaptations, indeed to the creation of original systems. Its own developments in this respect stem from the fact that "turn-key" systems are not very, indeed not at all, open to the changes sought by its clientele. Hence the call for original systems. The most typical example in France is undoubtedly that of the LOCACE [expansion unknown] system developed by ESD and SORED [French Air Navigation Equipment Co.] TRT has also developed an original system for the design of hybrid circuits. SFENA sought out a little-known system, that of BNR [Bell Northern Research (Canada)], and adapted it with the assistance of the German firm CADE [expansion unknown].

Software CAD

Another important characteristic of the world of avionics is that it has for a very long time practiced CAD/CAM. CAD has in fact been used for the tracing of masks, particularly on film-stripping tables (examples: ESD, TRT), the stamping of cards, removal of material, guidance of components-implantation machines, of connection-wrapping machines, testing machines, laser alignment machines, etc. But the CAD/CAM label is still likely to be misleading. We cite the case of SFENA: "There unquestionably exists currently a gap between CAD and CAM that is not bridged by the CAD/CAM label. CAD/CAM is frequently taken to mean a simple connecting up of the data generated by design systems to NC machines. This link is of course necessary, but it is not enough. The "universal joint," or procedures, that must be inserted between the design and the fabrication stages is a domain in which data processing aids have yet to be developed.

"These computer-aided procedures, which could be defined as the set of softwares that enable the preparer to choose the best solution, to write its procedures and, more generally, to document the methods used in the fabrication and control phases."

Worthy of note is the importance accorded to software. Our interlocutors (particularly SFENA, TRT, ESD) stress the need to treat software in a manner similar to that used for hardware, to structure the software, establish an accurate and up-to-date documentation, etc.)

This approach tends of course to channel the processes along defined lines. But it is generally conceded that this approach pays off. According to Mr Croiron, a TRT technical director, this approach consists of putting the software as well as the hardware "into a constrictive mold that compels the machine to simplify the task of the designer. It is a method that generously rewards those who use it."

The Advance Continues

The electronics industry anticipates further major advances in CAD, namely with respect to automatic routing, enabling the CAD process to proceed directly from the electrical and electronic descriptive schematic (as sketched manually by the design engineer) to the design draft of the card and interconnections via an interactive graphics console. All the companies contacted in this regard confirmed they are in the process of acquiring such systems or developing their own.

CALMA's [expansion unknown] "STICKS" [expansion unknown] system appears to be the first to have arrived on the market enabling the use of a symbolic design procedure without an integrated circuit grid. ESD's "LOCACE" appears to be a new milestone in the design of printed circuits. A great deal of progress still lies ahead... .

SAGEM: Bubble Memories, Microelectronics, Prediffused Circuits

SAGEM [Company for General Applications of Electricity and Magnetism] has entered the field of the CAD of electronic circuits as applied to the design of bubble memories, microelectronics and, more recently, the production of prediffused circuits (AIR ET COSMOS, No 901). The facilities in place include an array of hardware and software covering: The transcription of the electrical schematic, simulation, the design of the circuit, testing, characterization of components, and fabrication.

These facilities are based on a DEC PDP 11 computer and an Applicon conversational console.

TRT: Printed Circuits, Hybrid Circuits, Integrated Circuits; Software

The introduction of CAD into TRT's operations has taken place in a progressive manner, beginning in 1968. At that time, it was more of a scientific calculation facility. Today, its CAD/CAM covers four major domains; Printed circuits, hybrid circuits (including the hyperfrequencies), integrated circuits and software.

--Printed circuits: The initial motivation in this domain was provided by a search for improved quality of the final tracing of the mask; the result was the acquisition of a Computervision CAD facility along about 1975, one of the first in France. From then on, manufacturing was added to the system: drilling, photography, crimping, implantation, serigraphy, tracing tables, cutting, ... with generation of machining tapes in APT [Automatic Programming Tool] language.

--Hybrid circuits: TRT has developed an original tool oriented on a VAX computer, that generates a magnetic tape which is then processed by a Computervision facility. Alignment by means of laser is done automatically in a dynamic mode. The design and drafting of hyperfrequency circuits are processed by a Computervision.

Integrated circuits (including prediffused circuits): These are processed by Megatek consoles associated with a VAX computer, followed by logic and electric simulation, truth table, automatic testing.

--Software: TRT has developed a methodology that formalizes the development of software, under the name of "PLATINE." This methodology is considered by TRT to be one of the most advanced in France.

Crouzet: 4-Year Plan

Crouzet's Aerospace Division undertook a study in 1978 with a view to installing a well-coordinated CAD system. Three domains of activity were accorded an ascending order of priority: Software, mechanics, electronics. A 4-year developmental plan was drawn up to define the stages of implementation. The year 1980 saw the putting in place of processing facilities and of softwares that were the first links in the electronics CAD chain, as follows:

--A PRIME 750 computer with Megatek consoles;

--A software for conceptual schematics;

--A software for the design of printed circuits compatible with the foregoing (positioning of components, management of interconnections, sorting and routing);

--Interfaces for the generation of numeric commands for the following machines: fabrication of the negative, drilling of the printed circuits, insertion of the components, testing of the unencapsulated printed circuits.

During 1981, the CAD program was enlarged to include simulation of the operation of logic cards and testability of electronic cards. The outlook is toward the CAD of hybrid circuits and toward wiring (wrapping).

Thomson-CSF: Multiple Applications

The leading French professional electronics company is equipped with an impressive array of CAD and CAD/CAM facilities, adapted to the needs of the group's various activities. One finds there, for example, CADAM systems in its RCM [Radar, Self-Guided and Electronic Countermeasures Systems] Division, Computervision systems (Brest, Gagnes, Guynemer...), SCI [expansion unknown] systems (Bagneux, TVT [expansion unknown], Guynemer, Toulouse...), Applicon (DFH [expansion unknown], RCM...), Racal Redac (RCM, Sartrouville...), not to mention the facilities specific to Thomson-CSF/EFCIS [Research and Manufacture of Special-Purpose Integrated Circuits].

These facilities cover, first of all, the drafting of printed-circuit cards. This is the case, for example, at the Sartrouville production center, which uses Racal Redac facilities and PDP 11 and VAX computers. The conceptual drawing (generally, manually sketched) is treated by information processing facilities, the long term objective being to information-process the entire chain beginning with the conceptual schematic and ending with a checked "good-by-test-run" card. The center is contemplating the addition of 3-dimensional CAD for the design of shelves and drawers that would shorten equipment development processes. Under this heading, Sartrouville is currently testing EUCLID.

It is also to be noted that, in the domain of mechanical parts design, the RCM Division has equipped itself with CADAM [Computer Graphics-Augmented Design and Manufacturing] software processed through an IBM 4341 computer and 3251 interactive consoles, with Benson tracing table. The use of 3 D facilities does not appear to be imminent, since part shapes are relatively simple and the exceptions (antenna clearances in radomes) do not appear to justify the acquisition of decidedly more costly 3 D facilities.

Developments at ESD

Paris AIR ET COSMOS in French 24 Apr 82 p 41

[Text] The introduction of CAD at ESD [expansion unknown] had its inception in 1972 and was actually part of the start of computerization of the chain of development and production of electronic circuits and cards.

The first phases were related to the simulation of logic and analog circuits. Today, 40 engineers at ESD are dedicated to the development of CAD/CAM within its LTI [Software and Information Processing] service. This service is aiming to create a continuous data-processing flow and integration as follows:

--Conceptual level: Study of functional and general architectural specifications; simulation of the behavior of units; use of 40 terminals (APL [expansion unknown] language) distributed throughout the company, using a functions library; simulation of unit behaviors by software; all IBM-computer based;

--Logic level: Creation of electrical schematics and simulation of their operation. Utilization of ACLIN [expansion unknown] software--designed by the University of Toulouse-- for hyperfrequency circuits; ASTEC [expansion unknown] software (AEC-designed) and ESTEL [expansion unknown] (ESA- and Toulouse University-designed) softwares for analog circuits. The latter is a "simulation by propagation of event" software, which indicates that dynamic operation is analyzed by taking time into account--particularly, by the study of transitory phenomena, overlapping of fronts, etc.

At this level, data processing makes available a virtual equipment of a decidedly higher quality than that of a test mockup... . This level provides a point of departure for an analysis of testability and for the drawing up of the test program for the model.

--Physical level: The electrical schematic is made up by way of DIL [expansion unknown] components, thick-layer and thin-layer hybrids, and integrated circuits including uncommitteed logic arrays if required. The integrated circuits and uncommitted lo ic arrays are designed on CALMA [expansion unknown] graphics units in association with ESTEL software.

ESD has already produced uncommitteed logic arrays based on Ferranti, Interdesign Plessey and SPI [expansion unknown] chips. Its aim is to possess the facilities for producing the mask by CAD, then proceed to the depositing of connections. Circuits have already been produced and are in the process of being integrated into equipment. For the hyperfrequencies in particular, ESD has put in place a hyperfrequency-circuit implantation system called "TRICEPS" [expansion unknown] which enables production of a mask by cutting on a precision board 50 microns by 2 meters.

For hybrids and printed circuits, ESD, rather than acquire an existing system, preferred to undertake the development of its own system in cooperation with the French company SORED [expansion unknown]. This approach responded to its concern for better understanding the mental process of the operators and for thus achieving a better alignment with them. The result was a highly automated, interactive and performing system in dialog. This system, called "LOCACE" [expansion unknown], effects the placement and automatic sorting and routing of the components. It utilizes high-quality ADAGE [expansion unknown] interactive graphics consoles. LOCACE is for ESD the start of an information-processing chain extending to production, documentation, etc.

According to Philippe Dain, manager of SORED, this effort brings to the electronics and avionics industry a new, "leading-edge" system. "ESD," he says, "chose to develop LOCACE jointly with us in a spirit of effective cooperation and unsparingly. The experience in implantation of electronics circuits possessed by ESD's design division, particularly in the field of aeronautics, and the quality of their data-processing service associated with SORED's work have enabled ESD to take a commanding technological lead."

--Test level (ESD produces, for example, some 20,000 hybrids per year...): Testability is established starting at the high end of the circuit design process. Use of the LASAR [expansion unknown] test program quickly brings out the flaws in the testability. This program is generated automatically on the basis of the electrical schematic. Test programs are run on automatic testers, for the hybrid circuits as well as for cards.

From the software standpoint, the developments undertaken by ESD attest to the substantial effort it is deploying over the entire cycle: Design, testing, documentation, project management. In time, ESD is contemplating a "software engineering shop" that integrates all the aspects and stages of creation of software. Efforts in that direction are already underway with AEROSPATIALE [National Industrial Aerospace Company] (DSBS [expansion unknown] at Mureaux, on a bid request from Official Services.

The definition of computer-aided software is also the object of a bid request, this time from the Data Processing Agency, in response to which ESD is working jointly with AEROSPATIALE and STERIA [expansion unknown], in competition with CII-HB [expansion unknown] and CNET [National Center for Telecommunications Studies]. This study is aimed at achieving consistency of software with system specifications.

ESD has already developed methods for testing the software implanted in equipment, the objective being to not disturb the integrity of the software for the purposes of testing. The sole required intervention is the slowing of the computer. These developments have led to the the installation of "software validation bays" especially in the Mirage F1 and Mirage 2000.

Avionics Applications

Paris AIR ET COSMOS in French 24 Apr 82 p 42

[Article: "SFENA: Taking Up the Challenge of the A 310"]

[Text] SFENA [French Air-Navigation Equipment Company] is France's leading company in the domaine of avionics; it is at close grips with the problems being posed by an evolutive technology and a diversified clientele. CAD/CAM, according to Mr Bodin, manager of the Guidance and Systems Division, has for years been the object of developments based on the following considerations:

--Manipulation of large numbers: Of components, instructions, words in storage, equipment inventories (20,000 SFENA LRU's [line replacement units] throughout the world for Airbuses alone!), modifications, versions... ;

--Reduction of delays: More and more, the aircraft builders and client airlines are demanding a complete service effective on the date of delivery: Hardware, software, documentation, maintenance, training, support, and all of this at the same time that each company tends more and more to customize its plane...

The most recent example experienced by SFENA is very much a case in point: In April-May 1981, the CADV [automatic flight control] system of the airbus A 300's for Garuda had not yet been "frozen," the printed circuit cards had not yet all been drafted..., and yet the certification and delivery schedules made it possible to deliver the six planes less than 1 year later!

--Followup of the clientele and the market: The requirement is for an ongoing dynamic followup, backed by preservation of everything that has been previously been generated;

--Socio- or psycho-professional problems ensuing from invasion of the lofty tasks by unattractive routine ones for which data processing is particularly well suited.

As in the case of many other companies, the development of data processing at SFENA began in a rather spotty manner around the end of the 1960's. After the computerization of nomenclatures, there was the computerization of production management around 1973-1975 to reduce production cycles, manage version, modifications, work restarts, cost control. "That was our first coordinated and organized data processing operation." This preoccupation with integrating all data processing developments took hold then, leading to a plan for computerizing the firm's operating methods, which gradually embraced all phases of the marketing, technical and industrial cycle.

The plan embodied five major sectors of the firm's activities:

--Management of configurations;

--Drafting followed by design of electronic circuits and cards;

--Word processing;

--Scientific data processing;

--Production of software.

A concrete objective was set up on which these developmental lines would converge: the A 310.

The A 310's CADV was frozen last year... and the first plane has already flown... The first specific objective was the production of the cards and the printed circuits, calling for a CAD system with links to the production equipment: drilling, implantation of components, wiring, production of masks, testing, management of modifications and circuit reruns.

The system put in place was developed by BNR [Bell Northern Research] of Canada, and adapted to SFENA's requirements by CADE [expansion unknown] (FRG). It includes a DEC 20-4- computer and seven Tektronix 4010 interactive consoles, with a digitalization table as well.

This system, which is now being enlarged, is evolving upstream, from drafting to design. The objective is clear: "All information generated must be preserved and passed throughout the chain of production, in the normal course of things."

In this approach, the treatement of the software parallels that of the hardware.

In time, therefore, the entire chain will be covered by CAD/CAM. "The gains from the standpoint of documentation should be prodigious," says Mr Bodin. "The most spectacular gains will be made in the areas of updating and customizing."

Implications of CAD/CAM

Paris AIR ET COSMOS in French 24 Apr 82 pp 43-44

[Article: "CAD/CAM: The Art of Integrating by Virtualization"]

[Excerpts] Since its advent, the computer has been widely used in industry. Generally speaking, it was first used primarily for management and administrative tasks and for scientific calculations.

It was only gradually that the computer became integrated into industrial developmental, production and post-sale support activities. But the trend quickly took on an inexorable allure: Computerization spread progressively to the very core of every enterprise, so much so that it soon proved necessary to synchronize and to integrate all developmental activities, leading eventually to the current unique fundamental approach in which the computer assists the human being in all the latter's activities.

In the Top Ranks

This historic movement has been spearheaded by the world's aerospace industry: It might even be said that in very large measure it was the aeronautics industry that created CAD. As evidence of this, we cite the original developmental work done by Lockheed (CADAM [Computer Graphics-Augmented Design and Manufacturing]), McDonnell Douglas (through its subsidiary McAuto), Northrop (NCAD [expansion unknown]), Dassault (DRAPO [expansion unknown], CATI [expansion unknown], CATIA [expansion unknown]), AEROSPATIALE [National Industrial Aerospace Company] (SIGMA[expansion unknown], SYSTRID [expansion unknown]). Other developments originated outside this industry, such as systems for the design of electronic circuits, and such as EUCLID [expansion unknown] developed by the CNRS [National Center for Scientific Research]. But the place occupied by the aeronautics industry is and remains a considerable one.

This placement of the aeronautics industry helps to explain the highly privileged position occupied by French industry as one of the top-ranking in the field of 3-dimensional CAD.

That said, the United States is now making short work of it with five programs (designated ICAM, ECAM, STP, Tech Mod and IPAD*) supported by the three branches of the U.S. Armed Forces and NASA...

But CAD has broken through the boundaries of the aeronautics and defense sectors into those of the automobile, architecture, shipbuilding, transportation... . This explains why we are witnessing the absorption of CAD companies by major data-processing or other groups: First, IBM bought licensing rights on CADAM

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*A program for which NASA has awarded Boeing a $15-million contract.

from Lockheed, then recently those on CATIA from Dassault; Perking Elmer is also marketing CADAM; MATRA [Mechanics, Aviation and Traction Company] has absorbed Datavision; CDC [The Computer Corporation] is marketing AEROSPATIALE's SIGMA; General Electric has absorbed CALMA [expansion unknown]; and Schlumberger has absorbed Applicon, etc.

Virtualization

The aeronautics industry's particular interest in CAD is explainable: Manipulation of large numbers (infinitely large or small, quantitatively), concern with the maximizing of performance, the shortening of design times and production cycles, the customizing of products, etc. The complexity of aeronautical products, the demand for high performance, and the exigencies of the clientele required more and more compellingly an industrial machinery beyond the range of unaided human capabilities. Recourse to CAD methods enabled the entrusting of conceptually trivial tasks to the computer: calculations, file management, updating of documentation, statistical followups... . But suddenly, the power of data-processing facilities was making it possible to fine-tune methods and procedures. And eventually, the computer was doing much more than merely relieving humans of trivial tasks: It was optimizing them in terms of performance and of production times. For, the computer is able to confer upon a conceptual design the state of a virtual object, enabling it to be treated as such and thus eliminating the need to resort to a physical model or to constrain the design's role. The computer thus enables the operation of the system to be simulated while it is still in the design stage, and scientific calculations to be applied to it: weight, moment of inertia, volume, aerodynamic C_x and C_z, fatigue strength, etc.

And, above all, the computer enables the integration of industrial processes, since, as soon as an object is fed conceptually into the computer, it can be simulated under operating conditions, tested, fabricated (by numerical control), and its associated documentation edited, at least partly automatically, and updated. That is, the integration process eliminates zones of physical transportation of the object: For example, CAD/CAM eliminates the carrying of drawings between the design office and the production shops, thus shortening processing times and eliminating drafting errors, as was amply demonstrated by the processing of the Mirage 2000 via CAD/CAM at Dassault. The precision of the mask tracings obtained by means of CAD is bringing a substantial improvement to the quality of electronics... .

CAD/CAM thus becomes a universality--a total approach: An object is treated as a reality, by data-processing methods, from its earliest state as a concept. A plane is already "processed data" at the time the decision is taken to create it, based on a computer-aided market study; it is processed data at the time of the definition of its mission, its shape and performance characteristics, its systems, then its production, its customization to the requirements of each client, through to its post-sale support and its maintenance... .

Paradox...

The interest of CAD/CAM lies in the wholeness of its approach to a concept as an object, and it therefore becomes all the more directly palpable the more remotely it is situated upstream or downstream from the design stage! All the users of CAD/CAM have indicated to us that the first sector to benefit from CAD/CAM is that of documentation! It is in fact from the very moment an electronic circuit is designed by CAD that it is possible to immediately print out the required test program, repair program, listing by nomenclature of the parts to be stocked, and descriptive drawings!

Another of the major benefits of CAD/CAM is the preserving of the company's past know-how: An operator can access a library containing all the studies, plans and actualizations effected by his predecessors, and even the mental processes of the designers themselves. It actually elevates archives to the level of cultural and technical capital assets. It is an evolution that could contribute substantially to the resolution of the problem of archives and of the loss of know-how with the retirement of staff--currently a particularly sensitive phenomenon with early retirements.

CAD can also in certain cases eliminate physical test programs: Testing of electronic circuits, fatigue tests... .

This ranging out of the derivable benefits from CAD makes it difficult to address its profitability if one is to take into account solely its application to the design stage itself; and even this approach to assessing its "profitability" is arguable because "likes" are no longer being compared. The computer does much more. With it, there is no longer any hesitation about turning out, say, 30 different designs for the landing gear of a modern plane, each design adhering tightly to the changes in the plane builder's plans... . It will refine the calculations--for example, the meshing of calculations by the finite-element method--with a view to reducing the design weight margins heretofore found necessary owing to the limitations of the "manual" calculating methods used.

In the realm of historical trivia, we might mention that the emblems of the airline companies on the sides of the Airbuses are CAD-drafted, to eliminate the distortions produced by perspective: A use of CAD that was hardly to be imagined at the outset, yet a very real one!

It thus appears illusory to seek to determine the profitability of CAD. Comments in this regard run along these lines: "Any other approach is out of the question"; "It is a matter of survival in the face of the competition"; "We cannot afford to be other than homogeneous with the aircraft manufacturers as regards design capabilities." The latter is also the reason why the big equipment manufacturers and, today, even the principal subcontractors cannot afford to do without CAD: The aircraft builders will not be able to understand much longer why it should take a subcontractor 1 month to redo a design drawing, when the builders can redo the design drawings of the entire plane in a matter of a few days!... Incompressibles in the PERT [Program Evaluation and Review Technique] chart, beware! CAD is lying in wait... .

It is clear that the aircraft manufacturers, and especially Dassault and AEROSPATIALE, are in the process of sweeping their subcontractors and suppliers directly into the path of CAD... But is this not ensuring their dynamism, their competitiveness, indeed their survival? At the very least, the major subcontractors see in it the condition "sine qua non" for survival of their design departments... .

One can also conclude from this that it is impossible to show that CAD, in the short term, reduces the staffing and methods employed in design departments--an argument that sometimes finds little acceptance by managements!

It is nevertheless true, on the other hand, that CAD/CAM requires less employees than would otherwise be required to keep in step "manually" with the evolution of the technological context and of the market--a fact that is summarized in frequently heard comment: "Sure, we could do it without CAD/CAM, but with an army of design draftsmen, less rapidly and less well."

9399
CSO: 3102/270

INDUSTRIAL TECHNOLOGY

SOFTWARE DEVELOPED FOR COMPUTER-AIDED DRAFTING SYSTEM

Paris AIR & COSMOS in French 22 May 82 p 21

[Article signed N.B.: "Computer-Aided Drafting Software"]

[Text] Graphael, a public company created in 1976 by research scientists at the Compiegne University, has been involved in computer-aided design since its creation. At a press conference last week, Graphael introduced its Alpha G2, a computer-aided drafting system.

The Alpha G2 system includes a Data General France computer, a Benson digitalizing table, a graphic display and an alphanumeric display from MB Electronique. The Graphael software makes it possible to realize all schematic drawings.

In the basic configuration, the computer is an MP 100 containing a 16-bit microprocessor with wired multiplication and division. It has a basic cycle of 480 nanoseconds, and a 8.33 MHz clock. The computer manages a mass memory including a fixed 12.5 megabyte disk and a removable dual-sided, dual-density 1.26 megabyte diskette. It is connected to all the peripherals and can also pilot a drafting machine.

The Benson digitalizer (size A2 or A0) is the graphic data input unit. Its active area is 600 x 423 mm (size A2) or 1200 x 870 mm (size A0). It also supports the menu field giving access to the software function controls. The resolution of the table is ± 0.02 mm. The sampling tool is a cursor with a magnifying glass plus four control keys.

The graphic screen (MB Electronique), 15 inches in diagonal (38 cm), has a resolution of 512 x 512. The alphanumeric display unit, also from MB Electronique (more precisely from its Phylec subsidiary) displays 24 lines of 80 characters; the QWERTY keyboard is detachable.

The Graphael software includes all the functions necessary to realize diagrams with the highest efficiency. The menu and all messages are in French. The operator has at his disposal all the usual features of graphic systems: drafting functions; writing functions; zoom, erase, grid and scale modification capabilities; 255 levels; 189 symbols possible with each library.

The drawing made or being made is stored at all times in the mass memory and is therefore saved in case of a power failure. The drawing can also be produced by a drafting machine.

The Alpha G2 system is especially efficient with respect to the following: electric diagrams (single-wire or developed); schematic diagrams (PCF [expansion unknown], PID [Proportional, Integral, Derivative], PFS [expansion unknown], etc.); layout diagrams, hydraulic and automatic-operation diagrams; flowcharts, PERT [Programme Evaluation and Review Technique] programs; printed circuits; logic diagrams.

9294
CSO: 3102/314

INDUSTRIAL TECHNOLOGY

BRIEFS

FRENCH COMPOSITE MATERIALS--The French chemical industry, it is known, is interested in the market for high-performance composite materials. Two industrial groups are about to realize their ambitions. On the one hand, Elf-Aquitaine in association with the world leading carbon fiber producer: the Japanese Toray company. A joint 65-35 percent subsidiary will be created to operate a production plant located between Pau and Orthez. Initial capacity: 300 tons per year from an imported precursor (polyacrilonitrile). The capacity will be increased later on, and the plant will then produce the precursor itself. Operation will start during 1984. On the other hand, Pechiney-Ugine-Kuhlmann in association with Hercules, a U.S. company. The scenario is the same: joint 60-40 percent subsidiary (SEFC [expansion unknown]). Initial capacity: 200 tons per year; operation to start late in 1983. Plant at Pont-de-Claix (Isere). There again, the precursor would be imported, at least initially, from Japan (Sumika-Hercules subsidiary). So, the French industry is making a start: this is an important move, if one considers the highly strategic applications for carbon fibers (aircraft, defense). Essentially, this French-Japanese alliance is turning its back to the present European leader, the English Courtaulds. [Text] [Paris AIR & COSMOS in French 22 May 82 p 21] [COPYRIGHT: A. & C. 1982] 9294

CSO: 3102/314

TRANSPORTATION

ATR 42: TWENTY-SIX SOLD, MORE ORDERS EXPECTED

Paris AIR & COSMOS in French 22 May 82 p 16

[Article signed J.M.: "New Firm Orders for ATR 42. Aerospatiale and Aeritalia Have Now Sold 26 Aircraft to 5 Airlines"]

[Text] One month ago (see AIR & COSMOS No 903), two U.S. commuter airlines exercised the options they had purchased last year on the ATR 42: Ransome Airlines (six aircraft) and Command Airways (three aircraft + two options) thus became the first two airlines to place firm orders for the French-Italian twin turboprop.

The economic interest group Commuter Aircraft announced in close succession the receipt of two new orders: one from a U.S. airline, the other from a French airline.

Wright Airlines

Wright Airlines had been one of the first U.S. companies to show interest in the ATR 42; in June 1981, it had signed an option for eight aircraft with Aerospatiale. This option agreement is now being replaced by a final agreement, this time with the economic interest group ATR [Commuter Aircraft]. Under this agreement, which was signed on 12 May, the first ATR 42 will be delivered early in 1986; these aircraft will replace eight Convair 600 now operated by Wright Airlines from Cleveland (Ohio)--where the company is headquartered--to Detroit, Dayton, Cincinnati and Columbus.

The model chosen is the ATR 42-200, which has a maximum take-off weight of 15,550 kg, enabling the aircraft to fly 49 passengers nonstop over 1,450 km, or (for instance) over 5 successive 185-km flight legs, without refueling (see AIR & COSMOS No 903). With this weight, the ATR 42 will be an economic replacement for the 40-50 seat engine aircraft of former generations.

By placing itself once again on the U.S. commuter market--the largest--the ATR 42 is undeniable making a further breakthrough.

Air Littoral

Air Littoral, headquartered in Montpellier, had also taken an option on two ATR 42 last year. There again, the option has been exercised and a firm order agreement was signed on 14 May.

Air Littoral has launched a program of expansion and modernization of its fleet which, at present, consist of Brazilian Bandeirante outfitted to carry 19 passengers; it connects with national airlines flights to serve the Montpellier-Nice, Montpellier-Bordeaux and Montpellier-Perpignan-Valencia lines. In addition, it serves a transversal Biarritz-Pau-Lyon line on which an aircraft of about 30 seats will soon be operated, pending the arrival of the ATR 42.

The first aircraft of this type will be delivered as early as October 1985, the second in the spring of 1986. Actually, Air Littoral will be the first airline in the world to operate an ATR 42. The model chosen is also the ATR 42-200, outfitted to accomodate 49 passengers.

26 Aircraft Sold...

Following these 2 new orders, the manufacturers indicate that they have sold 26 aircraft to 5 airlines. This total obviously includes Finnair, the "launching company," who earlier this year decided to acquire 5 ATR 42 outfitted to carry 46 passengers, to be delivered from late in 1985 to early in 1987. According to the Finnish press, Finnair has also taken an option on a 60-seat model (the ATR XX), which could be placed in service in 1987-88.

... And Soon 36?

The economic interest group ATR is expected to announce an order from Air Caledonia later this month. In May 1981, this company had taken four options, two of which to be exercised within a year (negotiations are under way), the other two one year later. The first two ATR 42 would be delivered in May and November 1986, the other two late in 1987 and early in 1988. ATR will then have sold a total of 30 aircraft to 6 airlines.

However, another order should also be confirmed in the near future, that of Scheduled Skyways, a U.S. airlines who, last year, had committed itself to purchsagin six aircraft. Later this month, ATR could thus be in a position to announce that it has sold a total of 36 aircraft to 7 airlines.

Let us recall (see AIR & COSMOS No 881) that, when the ATR 42 program was launched, i.e. on 7 November 1981, 33 airlines had already shown interest in the new aircraft. Fourteen of them had committed themselves to purchasing 62 aircraft (56 + 6). Of these, six were in the U.S., three in Central America, one in Australia, two in France, two in Europe. Therefore, what we are now witnessing is a clear confirmation of positions taken back in 1981.

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TRANSPORTATION

SECOND AIRBUS A.310 BEGINS TEST FLIGHTS

Paris AIR & COSMOS in French 22 May 82 p 19

[Article: "The Second A.310 Has Begun Its Test Flights. On 13 May, the Two Aircraft Totalled 81 Flight Hours"]

[Text] As expected (see flash in our last issue), the second A.310 has made its first flight in Toulouse, on Thursday 13 May 1982. The aircraft, carrying the colors of Airbus Industrie, was piloted by Gilbert Defer and Udo Guenzel. Two flight engineers were also on board: Jean-Marie Mathios and Philippe Merville.

This first flight, which took place less than six weeks after that of the first A.310 (3 April) lasted 4 h 45 min. On that day, the two aircraft totalled 81 flight hours and 22 flights; in other words, testing is ahead of schedule. The overall results are fully satisfactory and the testing team feels that performances will exceed expectations.

The maneuverability tests have shown that the use of wing fences, vortex generators or other corrective devices (who automatically generate an additional drag) will not be necessary; the A.310 will therefore have an absolutely clean wing. This is a remarkable success for the European aerodynamics engineers.

The second A.310 is also entering its test and certification stage. The third A.310 will fly early in August; it will carry the colors of Lufthansa, to which it will be delivered later on; this aircraft will therefore be equipped with two General Electric CF6-80A turbojets (as is known, the first two A.310 are equipped with Pratt and Whitney JT9D-7R4).

Airbus Industrie also confirmed that deliveries of the A.310 will start after its certification, scheduled for March 1983, and that, to-date, 180 aircraft (90 firm orders, 90 options) have been ordered by 15 airlines.

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END