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Worldwide Report

TELECOMMUNICATIONS POLICY, RESEARCH AND DEVELOPMENT

(FOUO 6/81)

FBIS FOREIGN BROADCAST INFORMATION SERVICE

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COMORO ISLANDS

BRIEFS

KUWAITI TELECOMMUNICATIONS AID--A Kuwaiti mission, visiting from 28 February to 7 March, negotiated and signed an agreement to loan the Comoros one million Kuwaiti dinars to help finance an inter- and intra-link telecommunications project. The contract could go to Thomson-CSF which is already working on the first phase of work financed by the EDF and BADEA. [Paris MARCHES TROPICAUX ET MEDITERRANEENS in French 17 Apr 81 p 1143]

CSO: 5500/5007

INTERNATIONAL AFFAIRS

CONFIGURATION OF FRENCH, GERMAN DIRECT TV SATELLITES

Paris AIR & COSMOS in French 28 Mar 81 pp 42, 45

[Article by Pierre Langereux]

[Text] The configuration of the first French and German direct TV satellites to be produced in cooperation by the French-German Eurosatellite concern is now definitely fixed. It has been decided that the two preoperational satellites TDF 1 (French) and TV-SAT (German) will be identical, except for their antennas which must obviously be adapted to the geographic configuration of each country and conform to international regulations (IUT). This French-German program will result in the launching of the two preoperational satellites with a 7-year life, on a geostationary orbit (19°W) in the middle and at the end of 1984. With this program, it will be possible to acquire the experience necessary to develop and market this type of satellite and to have available a heavy satellite adpated to export for direct TV missions (12-18 GHz) or mixed telecommunications and television missions. The launching of operational direct TV satellites for French and German needs could be considered about 2 years after the launching of the preoperational satellites, or toward the end of the decade (around 1987).

A Sophisticated Modular Satellite

The final configuration of the French direct TV "TDF 1" satellite was presented for the first time by Mr Jean Georgy, an Engineer with "Telediffusion de France," (TDF) at the International Teleprocessing Meeting.

A modular concept implementing five main modules was selected in order to make subsequent adaptation to other types of missions easier. These five modules are: the antennas, telecommunications, service module, solar generator, and power plant. The satellite will weigh a total of 940 Kg (without ergols), and about two tons at launch with ergols allowing a nominal life span of 7 years, and even 9 or 10 years. The payload will weigh around 530 Kg, 115 of which will be for telecommunications equipment and 415 for the antennas. The payload will be redundant: the five channels will have six TOP's [progressive wave tubes] with three being used at any one time.

The satellite will be built using the most modern technologies. The structure will consist largely of composite materials (Nida and carbon fiber sandwich) already used by Aerospatiale Company in the "Intelsat 5" satellites. The rigid solar generator

(GSR) designed by the Aerospatiale company at Cannes will have a power of 3.1 kW at end-of-life. It will be one of the most powerful solar generators ever produced. The broadcast antenna will make use of multisource illumination with 9 active and 14 passive horns to satisfy the coverage and polarization conditions. The antenna aiming device (SOFA) developped by the Aerospatiale company at Cannes will allow aiming of the antennas with $\pm$ .1°, whereas the body of the satellite will be stabilized within $\pm$ 4° only. The repeaters will use radiating collector TOP amplifiers. Thermal regulation will be obtained using caloducts. Also for the first time, the satellite will be equipped with a two-liquid power plant derived from the "Symphonie" power plants. It will thus use the same ergols for the apogee maneuver (400 N engine), and for the localization in its position (10 N engines), with a resulting saving of about 40 Kg as compared to the traditional system, which corresponds to a one and a half years additional lifespan. The concept will, however, have certain limits according to Mr Georgy:

--Technological, due to the power of the TOP's and solar generator, and the weight (capability of the launchers);

--Operational due to the fact that the satellite will not be able to operate in eclipse conditions (about one hour for two months each year), which forces moving the satellites west so that the interruption may take place at night (1 to 2 o'clock in the morning);

--Regulational, due to the limited 5-channel capability and the coverage required by the IUT (with possibility of exceptions).

CHARACTERISTICS OF THE "TDF 1" AND "TV-SAT" SATELLITES

SATELLITES	Pre-Operational		Operational	
	TDF-1	TV-SAT	TDF-1	TV-SAT
Number of active channels	3	3	5	5
Radiated power (dbW)	64	65.5	64	65.5
Broadcasting power (W)	220	250	250	250
Solar generator power (W)	3100	3100	4600	4600
Total satellite weight (T)	2	2	2.4	2.4
Launcher	Ariane 2		Ariane 3	

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FUTURE OF FRANCO-GERMAN DIRECT BROADCAST TV VIEWED

Paris PROJET in French Mar 81 pp 346-351

[Article by Jean Legres: "Direct Broadcast Satellites"]

[Excerpts] Where will the Franco-German project for building two direct broadcast satellites (radio-television) lead? Jean Legres analyzes the political problems posed in particular.

The use of satellites to broadcast television programs is already relatively old, since it dates back to the early sixties.

The initial concept, in the United States, was to combine satellite and cable facilities to operate special pay-television networks.

However, these systems are still relatively difficult to launch, even if their operating costs have diminished significantly. Technical experts have long sought to build systems that would make it possible to do without ground relays.

Direct broadcast satellites are operational today and projects are being studied; the most advanced is the Franco-German satellite.

The Franco-German Project

On the basis of an agreement concluded in April 1980, France and the FRG decided to jointly produce two 3-channel satellites, one for each country. Their launching, using the Ariane rocket, could take place in late 1983 or early 1984. The life of the first satellites would be 7 years. It is hoped that greater longevity (9 years) and a larger capacity (5 channels) will eventually be possible.

Each of these satellites will serve the ellipses respectively assigned to each country by the Geneva Conference. France, due to its favorable geographic position, has an ellipse covering a very vast area that includes, in addition to national territory, the north of Italy and Spain, the Benelux countries, Switzerland, a part of Great Britain and the FRG, or about 100 million potential television viewers.

This project will be relatively expensive: in the case of France alone and for a 15-year period, it will entail a total investment of more than 2 billion francs. The annual operating cost of the system, which will be managed by the French

Broadcasting System [TDF],* is also estimated at 35 million francs. Finally, to receive the signals, individuals will have to equip their sets with a special antenna whose approximate cost should be between 2,000 and 3,000 francs. In the case of a group antenna serving an entire building, the cost per household would be between 200 and 300 francs.

Other countries are also thinking of using direct broadcast satellites at a later date. Such is the case of Luxembourg in particular. The Luxembourg Television Company has been studying a 3-channel satellite that could be launched by 1985 and whose total cost would amount to $200 million. The Scandinavian countries, Japan and the United States also have projects that could be completed between 1986 and 1990. Thus in the large family of communications satellites which are today used mainly to transmit telephone messages and computer data, direct broadcast satellites would occupy a growing position by providing users with a wide range of radio and television programs.

In brief, this is the state of the art of this new communications technology. This is also the stage of consideration at which those who are to reveal these projects to the public, whether they are members of a government or journalists, too often become bogged down.

A Long List of Questions

But looking further into the matter, it becomes apparent that direct broadcast satellites constitute a complex venture whose consequences may turn out to be important, even though they are partly unpredictable. In this connection, many questions should be asked: for the time being, they may go unanswered, since communications law and sociology have lagged behind technological innovation.

The first question concerns the inescapable character of this technology. Since France has limited resources and must determine its industrial policy through difficult negotiations, did it have to get involved in a rather costly venture whose immediate goal is to duplicate a television system that already operates perfectly? The project's defenders justify this by pointing to certain inadequacies of the latter system, which does not make it possible to provide television service to the entire population, due to the existence of shadow regions. If we want to serve, using conventional means, the 400,000 to 500,000 French people who are still deprived of one channel or another, considerable investments are required over a 10- to 15-year period. Since we cannot think of depriving some of our fellow citizens of the public television service, increasing the number of repeater stations would appear to be a solution that is both inevitable and very expensive. The satellite will enable the French Broadcasting System's executives to get around this dilemma, since it will immediately cover all national territory while assuring each viewer of optimum reception.

It is obvious, however, that the French Government had other considerations in making this choice. The Ministry of Industry in fact became convinced that the direct

*Public establishment in charge of networks providing microwave broadcasting of the three television channels and of Radio France.

broadcast satellite is, as they say in the jargon of specialists, "a good spot." In the next 20 years, many countries plan to have national television programs for educational purposes: scholastic broadcasts, cultural, social and economic reports, etc. The cost of broadcasting such programs via microwaves, using a complete network of ground transmitters, would be prohibitive for very large countries with limited financial resources, such as India, China, Brazil and Nigeria. The satellite could be a practical and economic method for them as well as for certain parts of Europe, such as Scandinavia. According to experts, there is a large potential market and the French and Germans have a chance to snatch it away from American and Japanese competition. To obtain credibility among their future customers, however, they must first try out these satellites in their own countries, thus the decisions made this year by Paris and Bonn.

If industrial policy goals were absolutely decisive in the case of France's decision, other reasons also persuaded the FRG to get involved: there is the possibility of that country covering, due to the position of its eliipse, part of central Europe and the GDR in particular.

Once the project was definite, French public authorities began to be concerned with the content of the programs which the satellite will send over its three channels. It has already been decided that two of the channels will rebroadcast TF 1 and Antenne 2, which will make it possible to eliminate the notorious shadow regions. On the other hand, FR 3 cannot use the satellite because of the regional nature of some of its broadcasts. A use for the third channel must still be found. The government has not yet made its decision; it still has time, since the system will not go into operation before 1984 at the earliest, but the choice will be extremely delicate. France does not have the same political motivations as the FRG, which is concerned with its influence in Eastern Europe, and the need for a fourth channel is hardly felt in our country. However, for the satellite to be a success capable of being exported, it must not just revolve in the sky; it must also be favorably received by the French public. Since rebroadcasting the first two channels will not be enough to encourage users to purchase a rather expensive antenna, a sufficiently attractive, additional television programming schedule should be devised so that households will quickly install it. TDF currently estimates that 5.2 million households could be receiving the satellite's broadcasts by 1990 and 11.1 million households by 1995. Those are ambitious goals, even considering the development of cable networks, which will rebroadcast these programs via satellite relays.

The easy solution would be to design a "general public" network on the basis of films, series, variety and game shows, with financing provided by advertising. In this hypothetical situation, success would be almost certain, but at the cost of fearful effects on the other media, whose current balance is delicate. The three broadcasting companies would be forced to lower their standards to withstand competition and to retain their audience; the written press in turn would lose vital advertising revenues.

Public authorities must also consider the European aspect of this future network. It would be received by all our neighbors and language will not represent an obstacle to its distribution, of course, since it is technically possible to have two sound tracks with the same picture: French-German or French-English, for example. We might wonder how other European countries would react to this cultural intrusion.

International broadcasting also raises many complex legal problems concerning royalties, advertising ethics and film legislation. It is true that France will in turn be bombarded with foreign programs, those from the FRG initially and then later from Luxembourg television. It will therefore be necessary to quickly establ h European regulation of television to prevent pirating, embezzlement and plugging of products. Unfortunately, no serious negotiations in this connection have yet begun in Brussels, even though time is pressing.

This list of questions shows that, in the present situation, we should be equally wary of the euphoria of technical experts and of the apocalyptic fears of certain politicians and sociologists who readily predict that within 5 years clouds of satellites will bombard the screens of French television viewers with Russian, Chinese and American programs! It is much more realistic to note that the direct broadcast satellite is a bold and expensive gamble by France and the FRG in an effort to assure the future of their space industries. There is no certainty, however, that developing countries will agree to purchase this type of satellite or that European television viewers, who already have an abundance of programs, are waiting to quickly install equipment to pick up the satellites. The results of this vast operation cannot be assessed for 20 years and its success is by no means certain.

What Kind of Public Television?

On the other hand, it is not pointless to begin now to consider in detail this matter, which includes and epitomizes all the problems and contradictions of the world of communications.

First of all, the gap between technologies and products is growing. The kinds of communications equipment, the fruit of an inventive and dynamic technology, are on the rise. Satellites, optical fibers and video recorders will be combined to form diversified television systems. However, we are not witnessing a parallel advancement in programs, which are still appealing to the same markets and to the same mentalities. The proliferaton of audiovisual media may lead to more repetition than creativity. This observation puts into proper perspective the current quiet but intense debate as to who will be in charge of managing the new television network broadcast by satellite. Whether this system is assigned to a private company such as RTL [expansion unknown] or to a public agency such as SOFIRAD [expansion unknown], the difference may well be hardly noticeable to television viewers. However, it should not be impossible to reconcile the requirements of its establishment, public service needs and the desires of users.

It also appears that France can no longer entirely regulate its television operations in a strictly national framework. It is also not one of the least paradoxes of the present situation to note that the United States, where a broadcasting monopoly has never existed, is shielded against outside interference as a result of its geographic size, whereas European countries are too small to escape such interference. Thus to give one of many examples, French regulation of movies will be seriously threatened. Limiting the number of films broadcast over the three French channels will no longer make a lot of sense when viewers will be able to watch films broadcast by German and Luxembourg television in a French-language version.

The impending use of direct broadcast satellites makes it essential to establish regulations for a European public television service.

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INTERNATIONAL AFFAIRS

BRIEFS

STATCOM INTERNATIONAL CREATED--On 25 March, 1981, the French company Matra and the British Aerospace Dynamics Group announced the creation of a common subsidiary, Statcom International, to market national or regional telecommunications satellites derived from the OTS, ECS, and Telecom 1 satellites. Satcom International, a company registered in France and Great Britain, will tender its first offer to the Overseas Telecommunications Commission for the Australian telecommunications satellites project "Australisat" whose cost has been estimated at 1 billion francs. Matra and BADG have been working together for the last 15 years and have participated in 32 satellite programs, 15 of them as prime contractor, primarily within the scope of the european industrial consortium MESH which produced the ESA telecommunications satellites OTS, ECS, and MARECS. [Text] [Paris AIR & COSMOS in French 28 Mar 81 p 45] 6445

CSO: 5500/2179

FRANCE

TELEDETECTION SATELLITES ENTERING MARKET

Paris AIR & COSMOS in French 21 Mar 81 pp 45-46

[Article by Pierre Langereux]

[Text] The SEP [European Propellant Company], a specialist in liquid-fueled propulsion (Ariane rocket) and solid-fueled propulsion (MSBS and SSBS ballistic missiles), has for several years also exploited its expertise in other space technology sectors (satellite launching, space imaging) and industries (solar energy, machine tools, composite materials, etc.).

Thus, in particular, SEP has established its name in the domain of space teledetection and earth observation.

SEP has already sold, throughout the world, 14 "Vizir" systems for producing meteorology or teledetection satellite images. It has just been chosen by the CNES [National Center for Space Studies] as prime contractor for the earth-imaging segment of the SPOT [Earth Observation Probe System]. It is also sharing in the building of the SPOT satellite and in the study of the future French military reconnaissance satellite SAMROS [expansion unknown].

From the 'Vizir'...

Heir to the space optics and airborne teledetection activities of the LRBA [Ballistic and Aerodynamic Research Laboratory], SEP developed an expertise in the fields of laser beam modulation and "magnetic-bushing" suspensions, enabling it, in early 1973, to develop the "Vizir" image visualizer.

This achievement, the only one of its kind in the world at this time, was originally brought out in response to the needs of our national meteorological services for equipment capable of producing fast and sharply defined earth images taken by the new geostationary meteorological satellites--the American GEOS, followed by the European Meteosat satellites--data from which is received at the Lannion (Brittainy) CMS [Space Technology Center].

The Vizir then embarked on a dual career, one in meteorology and the other in its new application, which was space teledetection. It was equally successful in both, having sold half its production to meteorological services and the other half to teledetection services, in France and abroad.

The Vizir system, associated with a minicalculator and a satellite signals receiving system, brought forth the STARIS [expansion unknown] space meteorological data receiving and processing station, the first of which was installed at the Lannion CMS in 1974.

Other stations were then built together with Dornier (Germany and with the INPE (Brazil) [(Brazilian) National Space Research Institute] for the reception and processing of images from the GEOS and Meteosat geostationary meteorological satellites.

For the last 5 years, SEP has also been working together with the EURATOM [European Atomic Energy Commission] and the IFP [French Petroleum Institute], this time on the application of the Vizir to the processing of earth images taken by teledetection satellites. This work has enabled SEP to broaden its expertise in the new and important field of space teledetection. Specifically, SEP has just completed the installation, at the EURATOM center in Ispra (Italy), of a Vizir associated with a minicalculator and with interactive image-exploitation consoles, to obtain high-definition color images directly.

...To the 'SPOT' System

But above all, SEP has just succeeded in culminating its efforts with the obtention of the prime contract for the earth-imaging segment of the SPOT system, which has just been awarded to it by the CNES after 2 years of industrial competition against Thomson-CSF and Matra.

SEP has prime responsibility for the building the SRIS [Space Image Receiving Station] and the CRIS [Space Image Rectification Center], which provide the interface between the SPOT satellite and the future SPOT-Image Company for the distribution of data to the users.

The SPOT system's French station will thus be able to receive images from the new American "Landsat D" teledetection satellites. The SPOT station is in fact equipped for the new receiving standards of the future French or American teledetection satellites using Band X (8 GHz) instead of Band S (2 GHz) with high bit rates: 48 Mbits/sec for SPOT and 85 Mbits/sec for Landsat D, in place of the 15-Mbits/sec rate used with current satellites.

A market study made in 1979 at the request of the CNES found interest in a teledetection station capable of receiving both very-high-resolution (10 m) panchromatic images from the French SPOT satellite--which will have no competitors at the time --and the multispectral images from the American Landsat D satellite. Inasmuch as the Landsat D satellite will be launched between the end of 1982 and the beginning of 1983, that is, before the SPOT 1 satellite (May 1984), the modular design of the station will permit users to equip it first to receive Landsat D, while preparing to also receive SPOT later. Users will also be able to install further variants to their French equipment if desired.

This station also includes an interactive processing system downstream enabling highly precise geometric corrections of the preprocessed images, by means of charted "bench marks" (distinctly visible landmarks). There are also absolutely essential softwares for the analysis and manipulation of mono and multispectral images (classification). The system is thus the basic module of a modern center for the exploitation of space images.

This SPOT station is therefore, in fact, the prototype of the French teledetection station for export. Furthermore, SEP has obtained a 2.5-million-franc contract from the COFACE [French Foreign Trade Insurance Company] for a market study, and aid from the DREE [Foreign Economic Relations Directorate] for a sustained marketing effort for the French export station.

SEP thus possesses the complete system for receiving and preprocessing teledetection images (SRIS station and CRIS center), as well as the key component of the imaging system (Vizir visualizer).

These credentials qualify SEP to meet foreign competition in today's world market for space teledetection image reception and processing stations.

Several builders--Canada's MDA [expansion unknown] and three American companies: General Electric, Ford aerospace and TRW Systems--are in fact already in place in the market, and others are preparing to enter it, notably, Japan's NEC [Nippon Electric Company] and Mitsubishi.

A Fast Growing Market

This desire to export is going to demand a substantial financial effort by SEP and its industrial partners, as the viability of France's operation in this field will require the design of other stations, according to a recent statement by SEP President Pierre Soufflet.

But the outlook appears promising. According to the market studies made in 1978-1979 by the American company Metrics and the Swiss company Eurosat SA, the teledetection market is in the full process of expansion: The world market during the 1980's is estimated at $1.6 billion (around 8 billion francs) with an annual growth rate of 15-20 percent--which recalls that of space telecommunications! It also appears that most of the expected growth is in the area of digital processing of images (hardware and software), the market among the more developed countries being the largest in volume, but that of the developing countries expected to grow rapidly.

A more recent SEP study finds that the market appears to be opening up faster than forecast, as countries recognize that teledetection is an instrument for economic development (harvest forecasts, detection of geological and mining resources, etc.), as has been shown by the examples of Brazil and Bangladesh, to which SEP has just sold Landsat D-SPOT teledetection centers.

The market for space teledetection centers and stations should therefore be revised upwards, to around 1 billion francs (1980 prices).

Under these conditions, SEP's objective is to attain a gross revenue of the order of 100 million francs beginning in 1985 in this market, which is estimated to be around 25-30 stations throughout the world.

'Vizir' Visualizers Sold by SEP
(a/o March 1981)

Organization	Location	Country	Equipment	For Satellite	Start of Service
Equipment in service:					
CEMS	Lannion	France	1 Vizir black	GEOS	1974
CEMS	Lannion	France	1 Vizir black	Meteosat	1975
IFP	Rueil-Malmaison	France	1 Vizir black	Landsat	1975
EURATOM	Ispra	Italy	1 Vizir black	Landsat	1977
EURATOM	Ispra	Italy	1 Vizir color	Landsat	1979
ESA/ESOC	Darmstadt	FRG	1 Vizir black	Meteosat	1976
Rovsing	Darmstadt	FRG	1 Vizir black	Meteosat	1977
Meteorology		FRG	1 Vizir blac	Meteosat	1978
ISRO	Ahmedabad	India	1 Vizir black	Landsat + Meteosat	1976
INPE	Cachoera-Paulista	Brazil	1 Vizir black	GEOS	1978
Ecoles Mines	Sophia-Antipolis	France	1 Vizir black	Landsat	1978
Equipment to be delivered:					
CNES	Toulouse	France	1 Vizir black	SPOT + Landsat D	1983
CNES	Toulouse	France	1 Vizir color	SPOT + Landsat D	1983
SPARRSO	Dacca	Bangladesh	1 Vizir black	Landsat D + SPOT	1983

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FRANCE

'VIZIR' LASER IMAGE VISUALIZERS' OPERATION DESCRIBED

Paris AIR & COSMOS in French 21 Mar 81 pp 46, 49

[Article by Pierre Langereux]

[Text] The SEP's [European Propellant Company] "Vizir" laser image visualizers make it possible to reproduce, in real time and with a very high degree of sharpness, the images photographed by earth-observation satellites. Vizirs are currently in use in France and abroad to reproduce images taken by polar (Tiros N) and geostationary (SMS/GEOS, GMS and Meteosat) meteorological satellites, as well as for the reproduction of images taken by teledetection satellites (Landsat and, shortly, SPOT).

SEP has developed this equipment in two versions: the conventional Vizir for the reproduction of images in black and white, and the Vizircolor for the reproduction of images in color. The Vizircolor is a worldwide exclusivity of SEP.

The Vizir reconstitutes images in large format (480 x 480 mm), and of exceptional geometric quality (38,000 points and 38,000 lines) and optical quality (64 density levels on film or 32 levels per color), thus enabling high-definition interpretations and highly accurate reproductions. The image can even be enhanced according to the user's needs (sectorialization, enlargement, increase of contrast, coloring treatments, etc.) through its minicalculator (with a 16 or 64 K word memory), which pilots the visualizer's electrical-optical operational sequence. The calculator also enables the combining of several images on a single film (up to four 240 x 240-mm images in four wavelengths), the superposing of geographical contours or latitude/longitude grids, or the applying of specialized digital treatments.

The operating principle of the Vizir is relatively simple. The image is reconstituted line by line by means of a laser beam, whose spot sweeps a sensitive film mounted on a drum that rotates at high speed. But the exceptional characteristics of the Vizir are essentially owing to two features developed by SEP: the film drum is mounted on a suspension consisting of active magnetic "bushings" (five axes) which eliminate all vibration even at high speeds (20 rps); and the luminous intensity of the laser beam that strikes the film is modulated by a photometric control loop, enabling the processing of up to 300,000 points per second.

The Vizircolor includes the same components as the conventional Vizir, and in particular, its continuous-wave (He-Ne) red-source laser, to which are added two other (Argon) green-source and blue-source lasers, with their corresponding optical channels and modulators. This equipment thus enables the obtention of color composition directly on the film, in a single reconstitution, by the simultaneous application of the three laser beams in combination.

The data recorded on magnetic tape are line-multiplexed and converted into analogue signals to to command the laser beam modulators. Each of these beams is split by a lamina: part of the luminous energy is directed to the photometric control cell of the laser beam concerned, while the other part (reflected) is focused and mixed with the other laser beams. A single spot is thus formed, which sweeps the color film consisting of three layers sensitive to the different wavelengths of the lasers.

Vizir and Vizircolor Performance Characteristics

	Vizir Monochrome	Vizircolor
Optical density	Adjustable from 0.1 to 2	Adjustable from 0.3 to 2.8
Optical density level	64 levels of gray	31 levels per color
Spot minimum diameter	12.5 microns	25 microns
Accuracy of inscription	1/5 pixel	1/2 pixel
Geometric accuracy	± 5 microns	± 10 microns
Image format; standard	1 image 405 x 405 mm or 4 images 202 x 202 mm	
Image format; optional	1 image 480 x 480 mm or 4 images 240 x 240 mm	
Image production rate	30 Landsat 1/1,000,000 scenes per hour black and white or color	

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CSO: 5500/2162

FRANCE

OPERATION OF 'SPOT' TELEDETECTION SYSTEM DETAILED

Paris AIR & COSMOS in French 21 Mar 81 pp 50-52

[Article by Pierre Langereux]

[Text] On April 21 1980, the CNES [National Center for Space Studies] awarded to the SEP [European Propellant Company] the prime contract for the "SPOT" [Earth Observation Probe System] teledetection system's earth-to-image" segment. These image reception and preprocessing facilities are scheduled to be put in service at Toulouse in early 1983. They will enable the reception in France, first, of images from the new American teledetection satellite "Landsat D," which is to be launched between the end of 1982 and the beginning of 1983, and then images from the first French teledetection satellite SPOT 1, which is to be placed in orbit in April 1984.

The SPOT system will consist of three main elements: the space segment, which will take the images; the earth segment, which will provide the image-acquisition and satellite control functions; and the SPOT-Image Company, which will distribute the data to French and foreign users (see AIR & COSMOS no. 850).

Initially, the space segment will consist of the first SPOT 1 satellite, the building of which was decided in 1977 and contracted for with the Matra Company [Engins Matra S.A.] by the CNES. The satellite, gravitating in a polar orbit at an altitude of 832 km, will be equipped with two identical (HRV) optical instruments operating in the visual and near-infrared range (0.5 to 0.9 microns, but with a degree of resolution of earth details (10 m) never before attained in a civilian observation satellite. SPOT will thus make possible a considerable expansion of the field of civilian applications for space teledetection: geological and mining prospection, land management, urbanization, surveillance of pollution, etc. But above all, according to the CNES, the SPOT system will be especially suited to applications of the conventional and thematic cartography type, as well as photo interpretation, owing to its unique stereoscopic capabilities.

Earth-to-Image Segment

The system's earth segment, which provides the interface between the satellite and its users, will consist essentially of two main elements: the SCCM [Control and Mission Center Segment], installed at Toulouse and consisting of the mission center, the system's operational brain center, and a satellite control station (telemetering, tracking and remote control); and the SSI [Earth-to-Image Segment], which in turn consists of two distinct elements:

--the SRIS [Space-Image Receiving Station], which receives the images from the SPOT and /or Landsat D satellites. This station, installed at Aussaguel, near Toulouse, will receive and record on magnetic tape the images transmitted by the satellite in digital form on Band X; and

--the CRIS [Space-Image Rectification Center] at Toulouse, which will receive the raw data recorded by the SRIS and will file them (on high-density magnetic tapes (HDDT)), visualize them rapidly (on 70 mm film), and preprocess them in accordance with different levels of radiometric and geometric quality (processing levels 0 to 3). The CRIS will also issue the preprocessed data on data mediums and in formats directly exploitable by the users (computer-compatible magnetic tapes or disks (CCT)) and photographic film (216 or 241 mm). These standardized data will be compatible with the products currently being provided by the American center for the processing of Landsat data in the United States (EROS Data Center).

As regards the overall SPOT earth-to-image segment, SEP is responsible for its design, engineering and integration of component equipments. SEP is also the prime contractor for the informatics project and for the image-processing software, and of course it supplies the system's high-performance Vizir visualizers. SEP's subcontractors are: for the SRIS station, the French firms Starec and CSEE [Signals and Enterprise Company] (antenna) and Intertechnique (antenna test equipment), and the Belgian company Bell Telephone Mfg (demodulation equipment and error-signal receivers); and for the CRIS center, the French firms CIMSA [expansion unknown] (Solar 16/75 calculator), Schlumberger-Enertec (high-density recorders and high-density tape reading system) and SESA [expansion unknown] (software).

The overall market for the SPOT earth-to-image segment thus totals over 100 million francs; this includes the 85-million-franc contract awarded to SEP and a contract of around 20 million francs in which the IGN [National Geographic Institute] will share substantially as regards the design and the software for fine correction of the images.

Image-Production Operations

The SPOT system's image-production operations will be placed under the control of the Toulouse SCCM mission center. Every 26 days, the SCCM will send to the CRIS an advance schedule of the proposed medium-term satellite data acquisition programing; in return, the SCCM will be kept informed at all times as to the availability of the earth-to-image facilities and as to any and all operational irregularities discovered during processing of the data.

Exchanges between the CRIS center and the SRIS station will be limited to HDDT magnetic tapes. The CRIS will supply to the SRIS the blank tapes (type Ampex 799) in accordance with the advance satellite programing schedules. It will receive in return, morning and evening, all the HDDT tapes concerning the data recorded during the satellite passes.

Each HDDT tape will contain only the data relative to a single satellite pass. Landsat D tapes will contain the video from the "Thematic Mapper" instrument or from the multispectral scanner, whereas the SPOT tapes will record the video from the HRV instruments in both its operating modes, multispectral and panchromatic.

The contents of these HDDT tapes will be monitored by means of a fast visualization--generated on low-resolution 70-mm photographic films--to provide an estimate of quality of take, acquisition and recording.

The HDDT tapes will then be filed and a catalog of the recorded images built. This catalog and its updates will be forwarded to all interested users, so that they can thus order the shots they require at such and such a level of processing.

The image data transmitted to the CRIS will be "cut up" into geographical sections 60 km long (by 60-80 km wide depending upon the angle at which taken) in accordance with a predetermined grid system covering the terrestrial surface.

These data will be subjected to various treatments: radiometric corrections taking into account the calibrations and peculiarities of the detectors, the optics and the telemetery involved, and geometrical corrections taking into account the conditions under which the shot was taken (viewing angle, relative motion of the earth and/or of the satellite). Other corrections may then also be applied, such as atmospheric corrections, dynamic modifications, etc..

Thus, the CRIS will supply SPOT and Landsat D images at different processing levels:

--Level 0 (unnormalized): a simple uncorrected duplicate of the raw images received by the SRIS station on CCT magnetic tape with 70-mm monitor film;

--Level 1: radiometric and geographical corrections not taking into account terrestrial reference points or corrections for satellite altitude. Level 1A will provide equalization of the satellite detectors (relative calibration in each spectral band) with the possibility of interband and absolute calibrations for further processings. Level 1B will add geometrical corrections to the foregoing ones, taking into account the earth's rotation and curvature, the viewing angle, and the twisting effect produced by the rapid displacement of the satellite;

--Level 2: bidirectional corrections to readjust the images with reference to geodesic points (terrestrial reference points at known geographical coordinates), enabling the images to be superposed among themselves or over a map;

Description of SRIS Station and CRIS Center

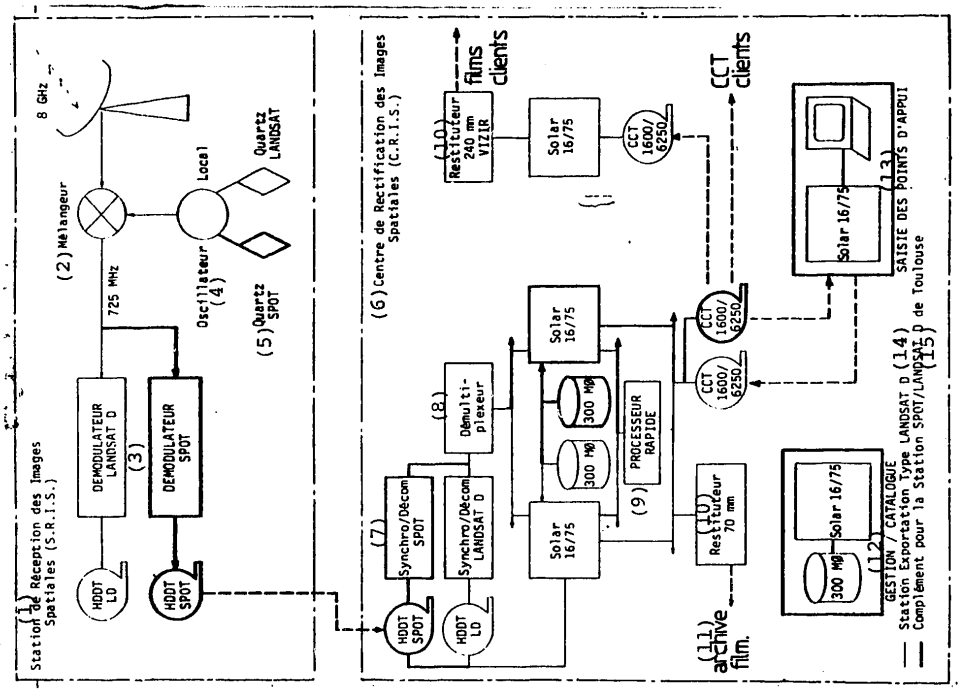
The SPOT system's earth-to-image segment, actualized by the SEP, consists essentially of two distinct operating setups: the SRIS and the CRIS, installed at Aussaguel and Toulouse respectively.

The SRIS is equipped with an antenna designed to receive Band X (8 GHz) satellite signals, directly or from a recording, corresponding to images taken by the two (HRV) optical instruments aboard the satellite. These data are transferred to the CRIS on HDDT tapes.

The CRIS receives and processes the data at different levels (0 to 3) as ordered by the users. The CRIS consists of four subassemblies: the "Traitimage" for the filing of the data and Level 1 preprocessing: the "Mesamers" for the preparation (acquisition of reference points) for preprocessing Levels 2 and 3; the "Prodimage" for the production of Vizir high-resolution photographic films and the duplication of CCT tapes; and the "Contrex" for the management and operation of the center and the maintaining of the data catalog. The CRIS also includes a photo laboratory for the development and duplication of films.

Key:

1. Space-Image Receiving Station (SRIS).
2. Mixer.
3. Demodulator(s).
4. Local oscillator(s).
5. Crystal(s).
6. Space-Image Rectification Center (CRIS).
7. Synchro/Decommutator
8. Demultiplexer.
9. Fast processor.
10. Restorer.
11. Film file.
12. Management/Catalog.
13. Acquisition of reference points.
14. Export type Landsat D station.
15. Toulouse SPOT/Landsat D station supplement.



--Level 3: corrections requiring a digital model of the terrain to eliminate the effects of parallax, applied to images taken from any viewing angle (orthophotographic products).

To provide the production levels desired, the CRIS center will have to operate 16 hours a day, 7 days a week, without interruption, all year round. Two shifts will alternate continuously and the architectural makeup of the center will be redundant to ensure a high degree of availability.

The CRIS filing capacity will be 800 SPOT shots a day and 80 Landsat D shots a day. The HDDT tapes containing the raw data will remain filed for 10 years.

The average production rate of preprocessed (Level 1) SPOT or Landsat D shots will be 35 shots per day; the center's maximum will be 50 shots per day. It will thus be possible to visualize and forward to clients 80 percent of all orders within 24 hours in the case of standard (Level 1) treatment, and within 1 week in the case of data subjected to special treatment (Level 2 or 3).

The CRIS's nonconfidential production--SPOT and/or Landsat D images--will be supplied integrally to the users, once a day, on CCT magnetic tapes, together with a 216-mm low-resolution monitor film and, for SPOT, also with a 241-mm, high-resolution film produced by the Vizir visualizer. Only those images ordered will be preprocessed, corrected and issued on films or tapes. The CRIS can also supply upon request raw images on CCT tapes with 70-mm monitor film.

The SCCM mission center will be the only one authorized to order work from the CRIS for the account of the SPOT-Image Company, which will provide the interface between the SPOT system and the users.

SPOT-Image

The SPOT-Image Company is scheduled to be formed between the end of 1981 and the beginning of 1982, to prepare the installation of the SPOT data marketing network. This network will serve an extremely diversified clientele. It will extend throughout France and abroad, with agents, sales offices and marketing subsidiaries established everywhere and equipped with facilities for remote accessing of the SPOT system data general catalog. Specific planning calls for the creation in the United States of a subsidiary having three main sales headquarters distributed throughout the country.

The market studies made by the CNES and the CFCE [French Foreign Trade Center], and by the American company, the Earthsat Corporation for the CNES, disclose, in fact, a substantial potential SPOT data market in the United States and in Europe (one third of the market in each region). Potential users are distributed among various economic sectors: agriculture (30 percent), cartography and thematic topography (30 percent), mining and oil prospection (20 percent) and water and forestry management (20 percent).

The SPOT-Image Company to market SPOT satellite data may take the form of a corporation (capital of at least 20 million francs) heading up the CNES, the interested industrial firms (such as SEP, Matra, AEROSPATIALE, etc.) and the principal French organizations engaged in space teledetection, such as the IGN, the IFP, the BRGM [Bureau of Geological and Mining Exploration], and the BDPA [Agricultural Production Development Bureau], members of the GDTA [Group for the Development of Aerospace Teledetection].

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