The Symphonie Project Organization

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ABSTRACT

SYMPHONIE is a Franco-German project for the planning, construction, launching, and utilization of an experimental telecommunications satellite. In this lecture, the governmental and contractor organizations are presented as well as the project experiences discussed.

1 INTRODUCTION

In Europe first considerations on European telecommunication satellite projects were made about the year 1963.

In application of the 1963 Franco-German Friendship Treaty on the cooperation between the two countries, on June 6th, 1967, the French and German Governments agreed to jointly plan, construct, launch, and utilize an experimental telecommunications satellite called SYMPHONIE.

The agreement provides the following principles for the execution of the project:

- equal participation of the two governments in planning, management, and financing of the project

- equal qualitative and quantitative participation of French and German industry in the development and construction of the satellite and the ground stations

- equal rights in the experimental utilization of the satellite

- development results at the disposal of both countries

- observation of the existing international regulations concerning the operation of the satellite and the ground stations.

Due to a subsequent agreement, the participation of Belgian industry in the development tasks amounts to about 4%.

Various organizations have been called into existence within the government authorities and by industrial companies in order to study, develop, and manufacture the various parts of the SYMPHONIE system.

We shall begin this lecture with a short description of the SYMPHONIE system and then present the project organization and our project experiences.
MAIN CHARACTERISTICS OF THE SYMPHONIE SYSTEM

The operational configuration of the geostationary SYMPHONIE satellite is shown in figure 1.

We discern

- the hexagonal main body of 170 cm maximum diameter and 50 cm height
- the integrated apogee motor held by a three-legged structure, and its fuel tank
- the attitude control nozzles and the infrared earth sensors
- 3 solar panels consisting of 4 sub-panels each
- 4 VHF antennas of the TM/TC system
- the SHF reception horn
- the SHF transmitting antenna feeders and the antenna reflectors.

The satellite is three-axes stabilized. The attitude control is semi-passive, using a flywheel the axis of which is parallel to the main axis of the satellite, and a cold gas system. The direction of the satellite is maintained with an accuracy of 0.5°.

The orbit control is effected by a hot gas system directed from the ground by TC. For TC, the NASA Tone Digital Command System is used.

The life-time of the two flight models will be 5 years.

The satellite will be positioned with an accuracy of 0.5° on its geostationary orbit at 11.5° W; this position has been chosen by mutual agreement with INTELSAT.

From this position, the antennas will cover the following areas (figure 2):

- the SHF horn will receive signals from the visible part of the earth
- the SHF antennas will transmit into two elliptical cones corresponding to the European zone and the American zone.

The satellite is equipped with two transponders receiving in the 6 GHz band and transmitting in the 4 GHz band. Each of them may be switched to either antenna.

The EIRP (equivalent isotropic radiated power) will be 29 dBW at the edge of the zones.

This EIRP permits the use of ground stations of about 16 m antenna diameter, the ground station sensitivity necessary for colour TV transmission being $G/T = 31.5 \text{ dB/}^\circ\text{K}$.

The mass of the spacecraft will be 387 kg including the apogee motor. The launcher ELDO-EUROPA II will be able to put this payload into a transfer orbit of 300 km perigee and 36,000 km apogee altitude.

Further details on the SYMPHONIE technical characteristics may be found in the publications of the IFRB (International Frequency Registration Board) (1).

Various technical difficulties had to be overcome in the development of the
following subsystems of the satellite:

- the passive type thermal control system
- the three-axes stabilization system with
  - the inertial wheel
  - the static infrared sensor
- the hot gas system
- the high-gain transponder using a 13 W travelling wave tube
- the solar generator: The difficulty lies in the soldering technology of the solar cells to be cycled between +50°C and -170°C 2000 times in 5 years.

For all of the satellite equipment, a most advanced lightweight technology had to be used in order to meet the mass restrictions.

3 PROJECT ORGANIZATION

3.1 GOVERNMENT SIDE ORGANIZATION
(Figure 3)

The principal features of the governmental organization are fixed in the 1967 agreement between the German and French Governments.

The agreement specifies two organs:

- the Directory Council
- the Executive Committee.

3.1.1 The Directory Council

The Directory council consists of 3 German and 3 French members nominated by the Governments:

- a director of the BMFT (Federal Ministry of Research and Technology) as German chairman
- a representative of the BPA (Federal Press and Information Office) assisted by an advisor representing the German radio-television organizations
- a representative of the BMP (Federal Ministry of Post)
- the general manager of the CNES (French Space Research Center) as French Chairman
- a representative of the PTT (French Post, Telegraph, and Telephone Agency)
- a representative of the ORTF (French Radio-Television Office).

The Directory Council meets alternately in France and in Germany, under French or German chairmanship.

The Directory Council fixes the general policies of the project; its decisions are made on the basis of the Executive Committee's proposals.

In particular, the Directory Council decides on

- the mission of the SYMPHONIE satellites
• the technical specifications of the project
• the selection of the main contractors
• the utilization programs
- approves the contracts
- submits the financial plans to the two governments.

3.1.2 The Executive Committee

The Executive Committee is composed of a French and a German Executive Secretary. They are charged with the technical and financial execution of the project in accordance with the lines and the decisions taken by the Directory Council, and with the overall project coordination.

The two full-time Executive Secretaries are assigned by their respective governments. The seat of the French Executive Secretary is at Brétigny, near Paris, the seat of the German Executive Secretary is at Bonn.

The Executive Committee meets every week alternately at Bonn and at Brétigny. During the meetings the decisions required to carry out the program are taken. All decisions are taken by unanimous consent. Each Executive Secretary has an advisory staff of technical, financial and legal experts. The French staff is working at Brétigny; one part of the German staff is working at Bonn, the other part at Brétigny.

3.1.3 The Project Groups

Four project groups work under the direction of the Executive Committee:

- the satellite project group seated at Brétigny, near the satellite contractor's seat. It is composed of 45 persons, with a German project manager and a French deputy project manager.

- the launcher project group seated at Brétigny, near the seat of ELDO (European Space Vehicle Launcher Development Organization). It is composed of 7 persons, with a French project manager and a German deputy project manager.

The satellite and launcher project groups are "integrated" groups consisting of approximately half French and half German personnel.

- the ground station project group consisting of a German project manager who is responsible for the ground station at Raisting, near Munich, and a French deputy project manager who is responsible for the ground station at Pleumeur-Bodou, Brétagne.

- the operational project group consisting of a French project manager at Brétigny who is responsible for the French operational network, and a German deputy project manager at Oberpfaffenhofen, near Munich, who is responsible for the German operational network.

The project groups are charged with the technical control of the contractors.
The definition of the interfaces between satellite, launcher, ground stations, and operational systems is worked out in co-operation of the respective project groups, under the control of the Executive Committee.

3.2 CONTRACTORS ORGANIZATION

3.2.1 Satellite

The development and manufacture of the satellite has been entrusted to the Franco-German industrial consortium CIFAS (Consortium Industriel Franco-Allemand pour le Satellite SYMPHONIE) consisting of 3 French and 3 German firms:

- Thomson-CSF
- Société Anonyme de Télécommunications (SAT)
- Société Nationale Aérospatiale (SNIAS)
- Messerschmitt-Bölkow-Blohm (MBB)
- Siemens
- AEG-Telefunken

This consortium has taken the legal form of an economical interest group (Groupe-ment d’Intérêt Economique), a form created in French law in order to adapt the structure of assemblies to the demands of the expanding European market. The economical interest group is characterized by being a body corporate without necessarily disposing of paid-in shares, the members of the group being liable for the obligations of the group with their general estate.

The Direction of CIFAS is the General Assembly consisting of the representatives of the consortium firms and the General Manager of SNIAS as chief manager.

The CIFAS General Assembly approves the contracts and fixes the policies of CIFAS.

The counterpart of the satellite project group is the CIFAS project group charged with the realization of the satellite.

It has its seat at Les Mureaux, near Paris. The engineers of the project group are delegated by the firms of the consortium. Corresponding organizations have been established within our satellite project group and the CIFAS project group.

The integration of the models is performed by one fixed Franco-German crew of engineers within the project group of CIFAS. It takes place alternately in France (engineering model and first flight model) and in Germany (prototype and second flight model).

3.2.2 Launcher

The launchers and launching services for the SYMPHONIE flight models are to be provided by ELDO.

3.2.3 Ground Stations

The Raisting station is built by AEG as main contractor, the most important subcontractor being the French LCT (Laboratoire Central de Télécommunications).

The Pleumeur-Bodou station is built by the French economical interest group TELSPACE as main contractor, the most important subcontractor being Siemens.

3.2.4 Operations

The operation of the satellite will be performed by two completely equipped
German and French operational networks. The German network will be established and operated by the DFVLR (German Research Agency for Aerospace Technology) / GSOC (German Space Operations Center) at Oberpfaffenhofen, near Munich. The French network will be operated by CNES.

3.3 WORKING METHODS

3.3.1 Technical Questions

For technical questions, the Executive Committee and their staffs will rely upon the experts of the project groups and functional support from the national organizations CNES, DFVLR, GfW (German Space Research Agency), CNET (French Telecommunications Research Center), FTZ (German Central Telecommunications Office).

3.3.2 Financial Questions

The financial execution of the project is essentially the task of the Executive Committee. The contractors' accounts, after examination by the project groups, are approved by the Executive Secretaries. On instruction of the Executive Secretaries, the payment is effected by GfW and CNES who administrate the government funds granted for the execution of the project.

3.3.3 Contractual Questions

As a typical example, let us consider the development of a contract with the satellite contractor CIFAS.

After negotiation of the technical, financial, and contractual details between the representatives of the CIFAS project group on the one hand and the satellite project group, the staffs of the Executive Secretaries, and the Executive Committee on the other hand, the Executive Committee will submit the contract for approval to the Directory Council. After approval, the contract will be signed, on instruction of the Directory Council, by the national organizations GfW on the German side and CNES on the French side - as SYMPHONIE is no body corporate.

On the contractor's side, the CIFAS project manager will submit the contract to the General Assembly for approval and signature.

3.3.4 Personnel Questions

The personnel of the Executive Secretaries' staffs and of the project groups is employed and socially cared for by the national organizations CNES, DFVLR, GfW, and the telecommunications organizations. They work in the project by delegation from the national organizations and on instruction of the Executive Secretaries.

3.3.5 Information System

Besides the periodic reports to which the contractors are obliged by contract a system of information at various levels similar to the NASA Management Information and Control System is used for provision of the necessary informations. All information, letters, contracts, etc. are issued in French as well as in German.

4 DEVELOPMENT AND STATE OF THE PROJECT

At the end of 1968, CIFAS was chosen
contractor for the development and manufacture of the satellite. The project definition phase lasted until the end of 1969. According to the terms of phased-project-planning, the development phase followed in 1970. In 1971, the fabrication phase began with the manufacturing of the various technical mockups. By now, the inner compatibility of the satellite system has been confirmed by successful tests of the technical mockups. The integration of the satellite prototype has begun this year. The ground stations and operational system will be completed within the next months. We expect that SYMPHONIE will achieve operational status in 1974.

5 SYMPHONIE PROJECT EXPERIENCES

The SYMPHONIE project is executed according to the principle of equal project responsibility of both parties. The two parties have equal duties and enjoy equal rights. There is no partition of work packages between the two parties.

The Executive Committee is the completely integrated organ for the management of the whole project. The effectiveness of the project work largely depends on the mutual understanding of the Executive Secretaries. Understanding lacking the project work will be blocked whereas with good collaboration the necessity of exchanging views and coming to decision by mutual accord will be very fruitful and advance the project in the best possible way.

A good collaboration between the French and the German side is of particular importance for the daily work of the project groups.

We should note that the collaboration in the SYMPHONIE project is remarkably good at all levels. Language difficulties can be neglected. Our common French and German efforts taken for progressing an advanced and promising project have formed the basis for the steady development of excellent human relations and communication.

On the contractor's side, the organization of the satellite contractor as a consortium of French and German firms in an economical interest group has stood the test. After initial difficulties, the cooperation has developed notably well.

The satellite development was based on a fixed price contract; only the costs of the CIFAS project group are paid cost plus fee up to a maximum amount. Awards are provided for the perfect functioning of the satellite in the orbit, penalties shall be imposed for late deliveries of the flight models.

The development risk was covered by a single fixed amount to be held in the responsibility of CIFAS in order to finance modifications as may be necessary on the system level.

Summing up, I would state that we have made a lot of experiences in European collaboration, on the government side as well as on the industrial side. And I dare say, we are successfully solving our challenging task.

REFERENCES

(1) Special Section No. SAT/6/790 annexed to IFRB Circular No. 790, 30 January 1968
Special Section No. SAT/19/970 annexed to IFRB Circular No. 970, 3 August 1971
Special Section No. SAT/20/984 annexed to IFRB Circular No. 984, 9 November 1971
Special Section No. SAT/23/1022 annexed to IFRB Circular No. 1022, 8 August 1972

ILLUSTRATIONS

Figure 1. Configuration of the SYMPHONIE satellite.

Figure 2. SYMPHONIE coverage zones.

Figure 3. Organization of SYMPHONIE.

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