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# MINUTES OF A VISIT TO SACLAY

# AND VARIOUS ORGANISATIONS INTERESTED IN

# DATA TRANSMISSION

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## 1. OBJECTS OF VISIT

1.1 To discuss with the Saturne Staff the problems arising in transmission of large quantities of data.

1.2 Subsequently to extend our investigations to railway companies and contractors who are constantly faced with transmission problems involving long distances, high security and arduous environmental conditions.

1.3 To establish some basis of close contacts with Saturne people to facilitate our tasks for the gathering of information and, eventually, for the development.

The programme of visits was arranged very competently and efficiently by Mr. Segalas of Saturne, who took always an active part in the discussions. It comprised the following meeting and visits.

## 2. S.N.C.F. (Société Nationale des Chemins de Fer Français)

Mr. Laurent and an other engineer.

Two systems used for the remote control of traffic were described, both of which fulfilled similar functions but which were constructed with different elements, and both of which were constrained to work over already existing telegraph links.

2.1 a) Working only with semiconductors in the logic.

Mode of transmission of orders. Triggered 9 bit (20 ms per bit) frequently shifted, trivalent code, comprising a 5 bit address and a 4 bit order. Giving therefore a possibility of up to 16 orders in any one of 32 addressed stations. The address code is checked at the receiving station before the order is executed and further possible errors of a dangerous nature are eliminated by local interlocks made on a classical wiring system.

Signals from each distributed station back to the central station are scanned in a cyclic manner and the resultant bits fed into the common line on a carrier reserved for that station. Each bit as before is of 20 ms and thus the only limitation to the number of signals which can be transmitted is the time of the cycle.

b) With cold cathode tubes but with principles not widely differing from a).

In discussion of system a) it emerged that 11,000 semiconductor diodes had been in service since more than one year without a single failure.

3. SOCIETE D'ELECTRONIQUE MORS

Messrs Le Goff, Arnold and Genet.

Mr. Le Goff described two data transmission systems.

a) Télécommande en fréquences musicales - a relay coded, frequency multiplexed system for the remote control of railway sub-stations. 28 Sub-stations were controlled with a total of 220 orders and 375 indications over a distance of 140 km.

b) ELSIE (Equipement de liaison à sécurité intrinsèque électronique) - This equipment built under license from Sargrove Electronics Ltd., is designed for use in mines and consists of a 220 channel pure frequency multiplexed system.

The transmitting elements working in the range 70 - 130 kc/s are distributed along a coaxial cable which also supplies the operating current. The receivers are in a central position and necessitate high gain amplifiers. Analogue indications of 5 % precision can be transmitted by amplitude modulation. Cost per channel was quoted at approximately 1,000 N.F.

A visit was made to the Gare de L'Est to see equipment of type 3 a) in service. The electronics concerned with the oscillators and detectors is mounted on printed boards plugging directly into a Souriau printed circuit connector. Some three hundred cards are in use and no trouble has been encountered.

4. COMPAGNIE DE SIGNAUX ET D'ENTREPRISES ELECTRIQUES

Mr. Malissard and Mr. Reynaud.

A large and diverse range of instrumentation was shown, which although interesting and seemingly of a high quality had very little direct application to our problems.

It was interesting to note that in this firm the printed card connector was taboo.

Documentation on most of the systems mentioned above is available upon application to the authors.

5. SATURNE, SACLAY

Messrs Segalas, Rondelet.

An exchange of views took place and Mr. Segalas demonstrated the prototype model of data multiplexing which he has constructed. This apparatus is a time division system working at 2,500 bits/second with fault detection, and comprises two shift registers and synchronising equipment constructed with "Logistor" circuits of Alsthom. The equipment is centralised.

Two Alsthom engineers visited us briefly and mentioned a system which they have installed in two large factories. This system, which costs only 500 N.F./channel comprises 64 channels with echo.

We have agreed with Mr. Segalas to share the search for possible equipment in the following way :

- 1) France - SACLAY (Mr. Segalas)
- 2) Rest of Europe - CERN (G. Brianti)

In addition, Mr. Segalas will continue the study of his prototype installation for "concentrated" transmitting and receiving equipment, whether we may look more in detail distributed systems

## 6. GENERAL IMPRESSIONS AND CONCLUSIONS

The fact which emerged most strongly from the foregoing discussions was that no fully distributed system of multiplexing has been envisaged, the nearest approach being ELSIE. This is not too surprising when one consideres the problems of railway control which are in general :

- 1) The transmission of relatively few channels over rather long distance.
- 2) The need for very high reliability.
- 3) The need to work over existing telegraph systems.

What is more surprising is the manner in which transmitted information is classified. It is necessary to appreciate these differences of classification in order to understand the literature on the subject. As we understand it :

- Télécommande means transmission of an order such as "Close switch XYZ".
- Télécontrôle means transmission of a signal such as "Switch XYZ closed".

- Télésignalisation means transmission of any indication occurring not necessarily as the result of an order e.g. "Train on track AB".

Obviously Télécontrôle and Télésignalisation overlap considerably.

In all cases presented to us, sharp distinctions were drawn between Télécommande and Télésignalisation/Télécontrôle, to such a degree that different systems were used for their transmissions.

Probably the only real reason for these distinctions arises from the necessity to send relatively few orders from one central point to each of several distributed groups and to receive from each of these distributed groups rather a larger number of indications.

For most cases price/channel did not enter into the argument mainly for the reason that one was faced with putting more information down an existing telegraph line. In those cases where price was interesting (ELSIB and Alsthom system) the order was slightly higher than that which we estimate could be obtained on a large production, better suited to our needs.

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