panaftel

the Pan-African telecommunication network

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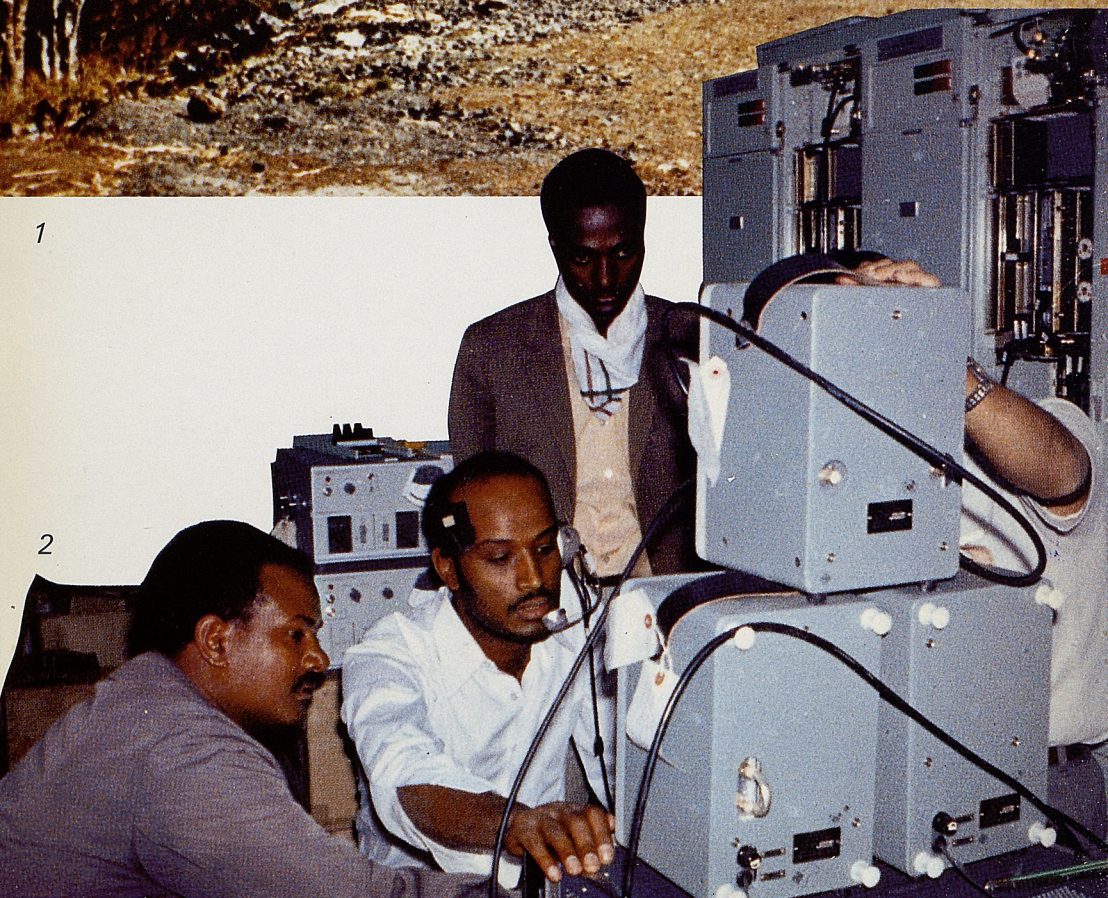

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Other information publications on the ITU:

Book — From semaphore to satellite, 1793-1965 (1965)
Booklet No. 1 — 1865-1965, a hundred years of international co-operation (1967)
Booklet No. 2 — ITU and space radiocommunication (1968)
Booklet No. 3 — Eighth Report by the International Telecommunication Union on telecommunication and the peaceful uses of outer space (1969)
Booklet No. 4 — Symposium "Space and Radiocommunication", Paris, 1969 (1969
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Published by the International Telecommunication Union, Geneva, 1979

PREFACE

What was still a project ten years ago has now become a reality. PANAFTEL, the Panafrican telecommunication network, is gradually taking shape and starting to play the role for which it was intended.

On the basis of the ITU's planning and engineering work, the African governments have launched this undertaking, so essential to the social and economic development of the continent.

In this way, a chain of cooperation has been created between the national authorities of the African countries, on the one hand, and the ITU, UNDP, and such African organizations as OAU, ADB, ECA, PATU, on the other.

This joint action will clearly be strengthened in the coming years: the Decade of Transport and Communications in Africa, proclaimed by the United Nations General Assembly for the period 1978–1987, will give a powerful impetus to the building of the infrastructures necessary for all development.

The Decade is focussed on the development of infrastructures–including those of telecommunications and the related human resources–which Africa must have if it is to play its part in the modern world.

PANAFTEL encompasses all the latest techniques–cable, satellite, and radio relay systems–but the choice of means depend on the needs of the countries themselves and the particular conditions of each specific situation.

To provide a country with powerful international telecommunication facilities would be pointless unless it possessed at the same time an adequate national communications infrastructure to allow the possibility of heavy international traffic. Hence the fundamental importance of the rapid development of national networks, so that every citizen, wherever he may be, may have a fair share in the benefits of technological progress.

That is why we can answer to those who ask when the Panafrican network will be completed by saying that PANAFTEL will never come to an end, because it must progress and develop in step with the economic, social and cultural advancement of Africa as a whole.

PANAFTEL is, therefore, a constantly evolving network; its steady growth is itself a guarantee that it will be built on sound technical foundations consistent with the real needs of the African countries, which are themselves in the full spate of evolution.

M. MILI
Secretary-General

1. PANAFTEL–the Panafrican telecommunication network: improving links between the countries of Africa

At its thirty second session on 9 March 1978, the United Nations General Assembly passed a resolution[1] proclaiming the years 1978 to 1987 the "Transport and Communications Decade in Africa". The proclamation of the Decade was intended to focus the attention of the world on the need for rapid development of transport and communications in Africa. In its capacity as United Nations agency responsible for telecommunications, the ITU has been engaged for many years in activities aimed at encouraging and speeding up the development of telecommunications services in Africa as in the rest of the world. In response to this action on the part of the United Nations, the ITU has made a special study of the assistance required during the Decade to help in the establishment of the basic infrastructure for telecommunications and thus, to enhance the national and regional self-reliance of African nations.

The undertaking of this particular study, the essence of which will be discussed later in this account, is one more important step in the ITU's involvement in the development of telecommunications in Africa, and the publication of this brochure offers an opportunity to review what has already been achieved, as well as to relate it to the vast effort which is still required.

2. Why PANAFTEL?

There are several ways of expressing the availability of telecommunications to the people of a country, perhaps the most widely used basis for comparison being the number of telephones per 100 population.

World telephones statistics show that at the beginning of 1978, African countries members of the Organization of African Unity (OAU) had by far the world's lowest density of 0.4 telephones per 100 population–an unbelievably low figure, even compared to the South American and Asian figures (of 4.9 per 100, and 5.3 per 100 respectively), let alone Europe (20.5 per 100), and North America, with the astonishing figure of 73.6 per 100. Perhaps a more immediately obvious way of presenting this depressing picture is to observe that, of 49 African countries, the entire network of 10 countries is below 5 000 telephones, more than half the countries have less than 20000 telephones, and in only 7 countries does the total exceed even 100000 telephones. As a measure of comparison, Geneva–which is the seat of ITU Headquarters–has over 300000 telephones for a population of 330000!

These figures above do not–as we shall see later–fully bring out one of the most serious problems of the African Continent, which is the virtual isolation of the rural population outside the capital, or major cities, but they do illuminate sharply the relative poverty of Africa in telecommunications links compared with the rest of the world.

3. What is PANAFTEL?

The pressing necessity for the rapid, but co-ordinated, development of African telecommunications is abundantly obvious from the statistics given above, and this need began to be stressed by a number of Governments as long ago as 1960. The desire to have a Panafrican telecommunications network was first formulated at the

[1] *No. GA 32/160*

meeting of the ITU Regional Plan Commission for Africa held in Dakar in 1962 and this is perhaps the date when PANAFTEL–as the Panafrican telecommunications network came to be called–may be said to have been conceived. This was followed in 1965 by an understanding reached between the United Nations Economic Commission for Africa (ECA) and the ITU to co-ordinate their respective efforts to accelerate the development of telecommunications in Africa. A joint ITU/ECA expert mission was established at ECA headquarters which carried out preliminary studies on the most economic ways of linking African countries, and from 1968 the African Development Bank (ADB) participated directly in the work of the mission. It had originally been thought that a number of high frequency (HF) radio circuits crossing the African continent might be the most appropriate solution, but experience in the operation of such a link between Addis Ababa (Ethiopia), and Abidjan (Ivory Coast) soon showed that the inherently low capacity of HF systems could not meet the long term need for circuits between African countries, and a much more extensive system was called for.

Consequently, the ECA, at its eighth session in 1967, adopted a resolution asking the ECA Secretariat and the ITU to develop a project for a thorough and systematic survey of the technical and financial requirements of a network capable of meeting the full needs of the African continent, as revealed by the outcome of the earlier studies.

As part of the process, and with UNDP financial backing, the ITU carried out detailed preinvestment surveys of 18 international switching centres and some 20 000 route km of broadband transmission system. It is sometimes stated that these 18 exchanges and 20 000 route km of transmission system constitute PANAFTEL but this is a false concept. These alone do not form a telecommunications network, either in terms of geographical coverage, or in terms of providing all the elements–telephone instruments, tele-printers, distribution cables, data modems, exchanges and transmission routes–which go to make up a complete functional network. It is this total network which will permit a person (or, in this computer age, a machine) in one African country to communicate with a person or a machine in another African country without the need to go through another continent, which constitutes the Pan-African telecommunications network PANAFTEL.

4. What are the particular concerns of PANAFTEL?

The mistake should not be made of paying attention only to common carrier telecommunication services, that is to say telephone, telegraph and telex: other related telecommunication requirements must be taken into account. These requirements cover, for example, the needs of broadcasting and television, civil aviation, meteorology, maritime communications and the press. The PANAFTEL network will (with only few exceptions in the case of television), be capable of carrying the information which all of these services need to transmit from one point in Africa to another, in addition to its role as the common carrier network for the African continent.

In talking of the broadcasting and television services, it is perhaps worth emphasizing the distinction between the exchange of sound or vision programmes, and the broadcast of these programmes for reception by the listener and viewer. This latter function of broadcasting–be it sound or vision–is normally controlled by an administration other than that which is responsible for common carrier telecommunications, and the coverage provided to the listener or viewer will depend upon the number and siting of the broadcast transmitters. The existence of a PANAFTEL network does not therefore automatically imply that it will be possible to receive any and every broadcast programme put out by an African broadcasting station at any point on the continent.

On the other hand, the PANAFTEL network will give to the broadcasting organizations of African countries the facility to exchange programmes among themselves and thus reach a much wider audience.

5. How has PANAFTEL been implemented?

Preliminary studies, financed by the United Nations Development Programme (UNDP) were commenced in 1968 in the countries of Northern and Eastern Africa by a team of experts recruited by ITU. The studies were continued in 1969 by a second group of experts, who reviewed the requirements of countries in Central and Western Africa. Together, the studies covered well over 80% of both the area and population of Africa, and identified–on the basis of traffic forecasts derived from studies of population distribution and the growth of foreign trade and national income–the routes which would constitute the most economic plan for the Panafrican telecommunication network, including both terrestrial and satellite links.

These preliminary studies were then followed by very detailed pre-investment surveys, again financed by UNDP, to establish–in detail–the precise requirements of an integrated, high quality, and economically justifiable network which, in conjunction with the existing development plans of the administrations, would meet the basic needs of the African continent. The UNDP-financed studies were carried out by telecommunications consultant firms appointed and directly supervised by ITU, and involved some 20000 km of transmission routes and 18 international switching centres. In addition to establishing the technical parameters of the system, they included revenue and viability calculations. Other aspects necessary for the establishment of the network such as common regional signalling systems and recommended tariff rates were simultaneously examined by the ITU by means of a series of conferences and seminars.

The achievement of these ambitious but indispensable plans, and certain additional requirements which have emerged during their implementation so far, are discussed in the following paragraphs, but it can certainly be said that these cautious but carefully planned initial steps have provided a sound basis for African telecommunications development.

6. Making PANAFTEL work

6.1 Organization

The genesis of PANAFTEL has been briefly summarized in the preceding paragraphs. But plans and studies alone do not constitute a network, and it is important to remember that the individual countries are themselves responsible for implementing their respective sections of the PANAFTEL network.

The overall co-ordination of the network, and particularly, of its financing, is carried out by a Co-ordinating Committee established in 1973 and responsible to the Heads of State and Governments of African countries. The Co-ordinating Committee is composed of the Secretary General of OAU, the Executive Secretary of ECA, the President of the ADB and the Secretary General of ITU. Through this Committee, ITU is responsible for the technical co-ordination of the network, a task of particular difficulty when projects in adjacent countries are separately funded.

The work of the Committee has been facilitated by the decision of African countries, at the second conference of African Telecommunications Administrations in 1975, to establish a Pan-African Telecommunications Union (PATU), the Secretary General of which now also participates in the work of the Co-ordinating Committee. It may indeed be said that PANAFTEL was the catalyst in the establishment of PATU.

The UNDP continues to support the development of PANAFTEL and is financing a project executed by the ITU to maintain a team of ITU experts in Africa to assist in resolving the problems of planning, implementation, operation and maintenance.

6.2 Planning

The expansion of telecommunication systems in Africa has been far from uniform, both in acceptable quality of service and systems compatibility. In particular, in many–perhaps most–countries, telecommunications enjoy rather less priority in economic development plans than other areas of national need, even in comparison with other public utilities such as water, electricity, or transport.

In many African countries, the telecommunication administrations lack the necessary machinery for the preparation of a fundamental plan. From this would be derived various subsidiary plans, all which are necessary for the harmonious development of the network. For example, it is immensely complicated to make fundamental changes in the numbering scheme for an automatic telephone network. Thus, a plan must be devised which will not need to undergo radical change for possibly fifty years. At the other end of the scale, secondary batteries operating in severe climatic conditions may last only two or three years. It is thus unnecessary for a battery to be so big that it can carry the load which is expected to exist after ten years system growth. Consequently, equipment plans cover much shorter periods of time than numbering plans.

All of these plans lead ultimately to an investment plan and a manpower plan which will describe the resources, both material and human, required to meet the telecommunications demands. When it is remembered that many sections of the PANAFTEL network took 15 years of development planning by African Telecommunications Administrations from their conception to putting them into service, it will be evident that improved planning services are crucial to the success of the network. Within the context of the (UN) Transport and Communications Decade, a major effort will be made to assist African telecommunications administrations to build up their planning divisions and achieve the necessary balance and cohesion in their development plans.

6.3 Implementation

Very considerable progress has been made in the implementation of the PANAFTEL network. The interested reader will find details of what has been done in the table attached to this account. The following summary will, however, bring out the highlights of the achievements:

- 18 international automatic telephone exchanges are in service, 8 more are under construction or contract, to be in service in 1979 or 1980. 12 countries have not yet obtained financing and four have no plans for such exchanges.

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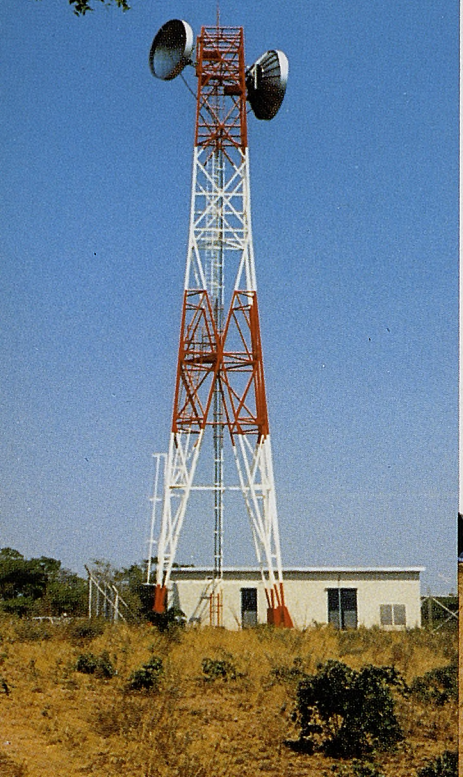

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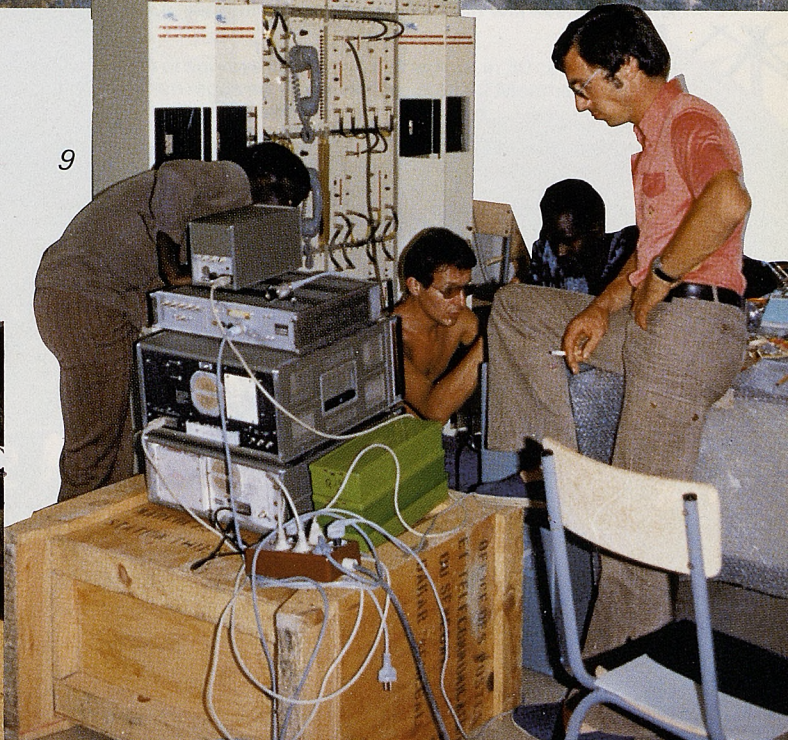

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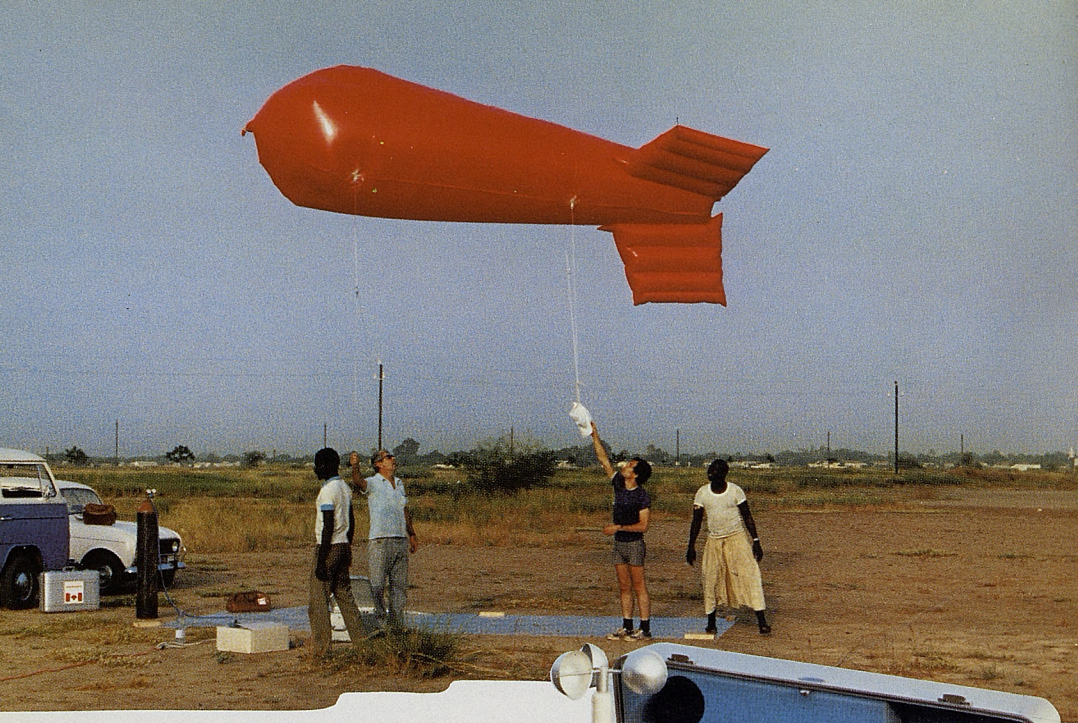

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- 30 countries already had international semi- or fully-automatic telex exchanges in operation before 1978. Five countries brought them into service in 1978 and five more will be in operation in 1979, some replacing small, or semi-automatic exchanges. Six countries have no plans to instal such exchanges.
- 42 satellite earth stations for international service are in operation, under construction, or under study in 36 African countries. In addition, five countries in Africa are already installing or operating domestic satellite communication systems.
- 1978 saw the completion of an extensive internal microwave system within Liberia which ultimately will connect with Sierra Leone, Guinea and the Ivory Coast.
- The extension to Abidjan of the Casablanca to Dakar submarine cable (2,540 km long) with a capacity of 640 telephone channels was inaugurated in April 1978. The cable is being further extended to Lagos, Nigeria.
- The West African inland route linking Senegal, Mali, Upper Volta, Niger and Benin is under construction and should be operational by the end of 1980 or early in 1981.
- The Zambian section from Lusaka to the Tanzanian border of the north-south route in Eastern Africa was completed in 1978.
  The Ethiopian portion of this link is being completed during 1979, while the section through Kenya and Tanzania is expected to be operational in 1980.
- A contract has been placed by Sudan for what is probably one of the longest microwave hops in the world (320 km) from Sudan to Saudi Arabia, to be operational in 1980.
- The microwave link from Brazzaville to Ouesso in the Congo is being completed in 1979.
- On 17 May 1979 (the anniversary of the founding of the ITU) Gabon inaugurated an important trunk route from Brazzaville to Franceville, which will eventually link with Congo.
- Since 1973, additional studies or surveys have been carried out in 30 countries, and requests from 12 more have been received. Thus, no less than 42 Member countries of OAU are receiving or have received assistance of this kind.
- A routing and switching plan for the Eastern and Southern African sub-region was prepared by the PANAFTEL team and adopted by the Administrations in 1977; a similar plan for the Central African sub-region was presented to administrations in September 1978. A plan for the Western Africa sub-region was presented–in draft form–to the administrations concerned in 1979. ITU experts are now concentrating on the elaboration of a regional switching and routing plan, based on those of the three sub-regions. In drawing up these plans, telecommunications traffic forecasts were also up-dated.

For the implementation of the PANAFTEL network, international financing has been obtained from a wide range of bi-lateral aid sources including, Canada, France, Japan, Netherlands, Norway, Sweden and the United Kingdom, and also multi-national sources, including the African Development Bank, the International Bank for Reconstruction and Development, the UNDP and the Arab Fund. More recently, negotiation with the Arab Bank for Economic Development in Africa has led to the assignment of funds for pre-investment studies for extensions to the network. When completed, these studies are expected to lead to further investments.

Against this very encouraging picture, the fact must be underlined that 34 surveyed PANAFTEL routes are not yet under implementation, seven of which are particularly important from an overall viewpoint. It must also be stressed that it will be very difficult to find the necessary sources of financing for their construction. Equally, no funds have yet been found to carry out 20 additional surveys of routes in 21 countries.

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The facilities described above result from more than a decade of sustained activity by African administrations and international agencies, and form part of the PANAFTEL which–although conceived some fifteen years ago–is constantly evolving as new needs arise, and new portions of the network are completed. PANAFTEL routings were planned to pass through the main population centres in each country so that international routes which ultimately cross the border to an adjacent country would carry traffic to important centres in the national network.

Much work has still to be done to rationalize the tariff structure for calls within the PANAFTEL network. A review of present tariffs shows that the high rates existing in some countries not only restrict the number of telephone subscribers but also the use of telecommunications services. The economic feasibility of the network assumed that current tariff recommendations of CCITT[2] for international calls would be utilized, and it is essential to encourage the use of these tariffs in the network now being constructed. It is, moreover, necessary to establish accepted international accounting procedures for the settlement of accounts between administrations, since the cost of providing the service does not necessarily fall equally on each administration involved.

6.4 Operation and maintenance

The highest degree of service availability can only be achieved by efficient operation, and continuous and meticulous maintenance, of the equipment available. African countries are experiencing rapid and important changes from old to new technologies, and–at the same time–must frequently cope with the special problems of equipment of varying ages produced by different manufacturers; this has to be done with very limited resources both human and material. In spite of these fundamental difficulties, the very substantial investments committed to telecommunications by the governments concerned have to be justified by the maximum possible utilization time of the equipment.

Among the steps required to improve service availability in each country during the coming decade are:

- the setting up of an operations and maintenance unit fully responsible for the entire network;

[2] *International Telephone and Telegraph Consultative Committee.*

- the establishment of objectives defining the quality of service to be maintained–standardized as far as possible on an inter country basis;
- the introduction of maintenance plans and procedures for both the national and international network;
- the development of staff through continuous training or retaining of all available human resources;
- the provision of adequate material supplies, in terms of spare parts, tools, test equipment, supporting hardware and technical documentation.

6.5 Vocational training

In previous paragraphs, mention has been made of staff development especially in connection with operation and maintenance of national and international networks. This is a matter of such vital importance to PANAFTEL that it deserves special attention.

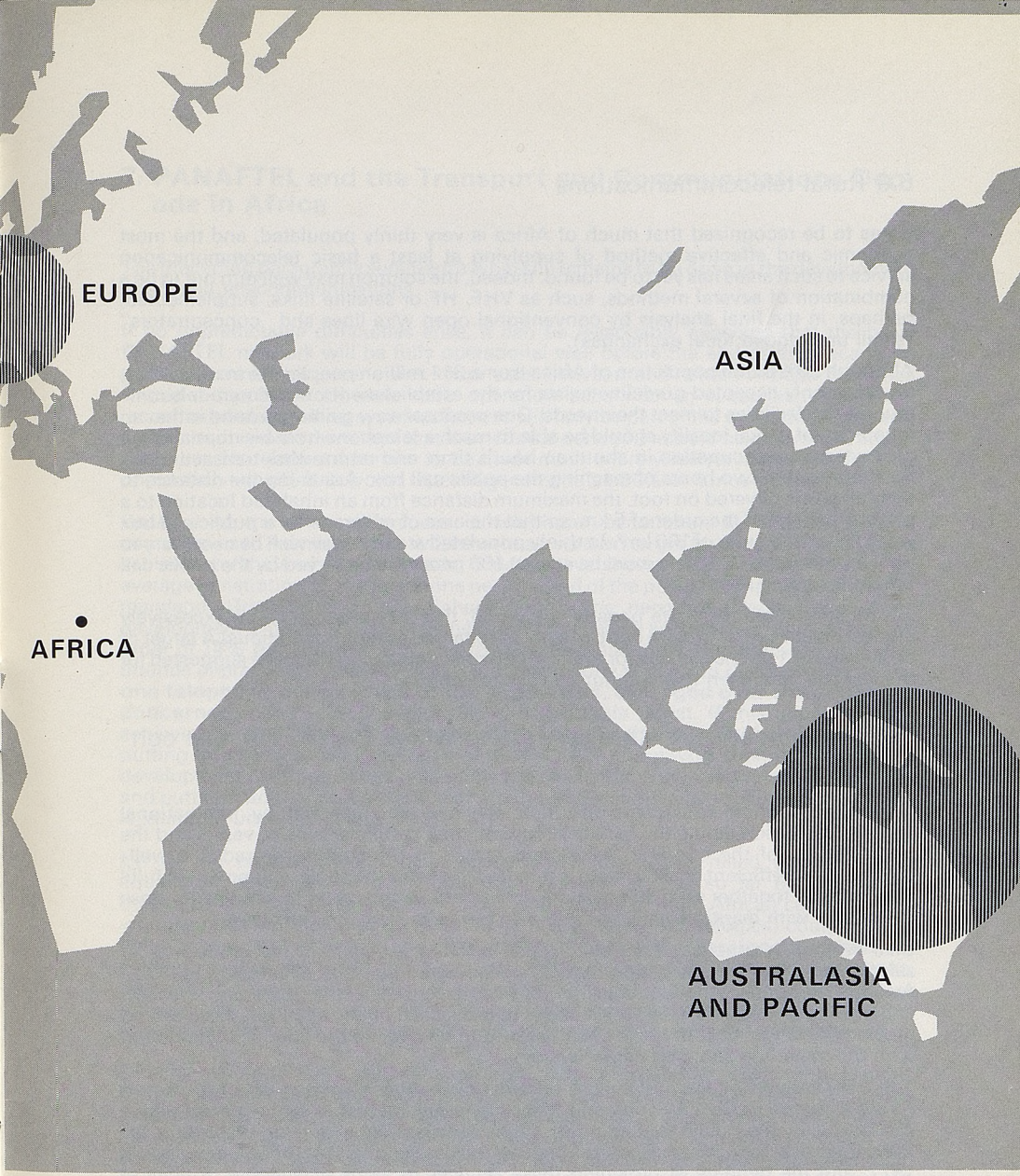
Meetings of training specialists in Africa have resulted in a classification of technical telecommunications staff into the following four basic groups, which–with minor variations between countries–apply throughout the continent:

– Engineer	(high level)
– Assistant Engineer	(high to medium level)
– Technician	(skilled)
– Craftsmen	(semi-skilled)

It is not at present possible to predict with any accuracy the total demand for these categories of technical staff over the whole continent, but some illustrative figures are available. In 13 East and Southern African countries, the demand for student-weeks of training at the medium level will not begin to level out until about 1983/84 at a figure of the order of 45000 student-weeks per year! In ten West African countries there will be–over the next decade–an approximate additional requirement for 600 assistant engineers, corresponding to some 48000 student-weeks of training!

To meet these requirements it is to be expected that–in the long run–universities, polytechnics or technical institutes in the countries concerned will increasingly provide the top group of engineers. Similarly, each country must provide its own courses catering for its basic training requirements in the lowest group of semi-skilled craftsmen. Wherever feasible, the countries should also provide medium level training facilities, covering the third group and part of the second group requirements; where this is not possible, the countries concerned should continue to send their trainees to multi-national training centres offering the training required, a number of which have already been set up on a sub-regional basis by ITU with UNDP assistance. If the overall training plan (which has only been outlined in this summary) is fully implemented, self-sufficiency in human resources, except perhaps for the highest level training requirements, can be achieved within the continent by the end of the Decade.

Telephone density in various continental areas in relation to population



The size of the circle is proportional to the number of telephones expressed as a percentage of the population of the continental area concerned.

(Source: A.T. & T. — The World's Telephone 1978)

6.6 Rural telecommunications

It has to be recognized that much of Africa is very thinly populated, and the most economic and effective method of supplying at least a basic telecommunication service to such areas has yet to be found. Indeed, the solution may well turn out to be a combination of several methods, such as VHF, HF or satellite links, supplemented, perhaps, in the final analysis by conventional open wire lines and "concentrators" (small unattended local exchanges).

Although 80% of the population of Africa–some 311 million people–live in rural areas, no commonly accepted guideline exists for the establishment of minimum telecommunication facilities to meet their needs. One proposal now gaining ground is that an inhabitant of a rural locality should be able to reach a telephone from his normal place of residence or occupation in about an hour's time, and return–after transacting his business–within two hours of reaching the public call box. Assuming the distance to this call box is covered on foot, the maximum distance from an inhabited location to a call box may be of the order of 5 km, so that the area of coverage for a public call box would be of the order of 100 km^2. In thinly populated areas, it may well be necessary to add the condition that there must be at least 100 people to be served by the public call box in the given area.

For those in more fortunate parts of the world, this may seem to be an excessively modest objective: in Africa, it can certainly be regarded as highly ambitious! A target of an average of 1 public call box for every 10 000 rural population has been suggested for the Decade, and even this will not be easy to achieve.

6.7 Requirements of other services to which PANAFTEL can contribute

On-board Maritime radiocommunication services are governed by international agreements which define the facilities required for a particular type of vessel and the qualifications of the operator. As a complement to the ship borne radio, a well-equipped and efficient coast-station is required to enable the ships' equipment to fulfil its purposes, together with an on-shore network to permit communications to those concerned with maritime activities and also between ports on the coast.

Civil aviation requirements are even more exacting. Apart from the ground-to-air safety aspects of air navigation, which are normally handled directly by the Civil Aviation authorities, the requirements for fixed links between airports are extensive and the authorities concerned are anxious to use leased public circuits if these can be provided reliably: most of these circuits can–and should–be provided in conjunction with the main line common carrier systems.

The transmission of meteorological information between various weather centres (closely related to Civil Aviation and Maritime requirements) is again, a need which can be met by the public telecommunications services. Detailed requirements for the meteorological services have been submitted to sub-regional PANAFTEL meetings in 1977, and the benefits of providing these services in terms of warning of adverse weather conditions or impending natural disasters cannot be over-estimated.

Finally, the recent establishment of the Panafrican News Agency will certainly give rise to an increased demand for–initially–telegraph-type service, and later, for voice and facsimile transmission. The Kampala meeting of African Ministers of Information in 1977 recommended the maximum possible use of the PANAFTEL network for the distribution of information in Africa.

7. PANAFTEL and the Transport and Communications Decade in Africa

The preceding paragraphs summarize what still remains to be done in the development of African telecommunications.

If no unpredictable difficulties arise, it can be reasonably expected that the basic PANAFTEL network will be fully operational well before the end of the Decade. In practical terms, this means that most calls between and within African countries should be possible by automatic operation subscriber-to-subscriber, using the recommended signalling systems. But this will only be part of the story: once the basic links exist, it is even more vital that the national networks should be developed, and in particular, for telephone service to be made much more widely available to the rural population–which, it is worth repeating–constitutes 80% of Africa's people.

Because of the wide differences in telephone penetration in different African countries, each Administration will have to set its own target for the penetration to be achieved by the end of the Decade. Studies have shown that, in order to reach an average penetration of one telephone per hundred of the population in the countries of mainland Africa south of the Sahara (where the need for telecommunications development is greatest), it will be necessary to achieve an annual growth rate of the order of **14% per annum.** Such a growth rate–while quite ambitious–is within the bounds of practical possibility, and it is consequently suggested that a penetration of **one telephone per hundred of the population, averaged over the countries concerned,** constitutes a reasonable and realizable target. If this target is to be achieved, great efforts will be necessary to improve the leadtime from planning to putting into service. Many sections of the PANAFTEL network took fifteen years of development planning between the time they were first conceived to implementation and putting into service. By the end of the Decade, it should be possible to reduce this leadtime to under five years.

Up to the present time, African telecommunications has relied exclusively on equipment developed in other countries. No attempt has so far been made to determine whether the technology in use is appropriate under African conditions, or whether other technologies (or modifications to existing technologies) could provide benefits by way of economy, reliability, or ease of operation. There is consequently an evident need to set up in the larger and more advanced African administrations, research and development centres to examine the compatibility of new techniques with existing systems, and to determine which of the available technologies are most appropriate for Africa. Such research would, of course, benefit the entire continent.

Directly related to these studies is the possibility of expanding telecommunications manufacturing plants in the continent. While the electronic and communications industries in general have inherently complex technologies which must be backed by elaborate and well financed research and development groups, there is no doubt that some peripheral equipment and some basic plant can be manufactured or assembled in Africa, which will improve the present very low industrialization of the Continent, and increase employment opportunities. It should certainly be possible for African countries to be self-reliant by the end of the Decade in such items as external plant (e.g. poles, cable ducts, insulators), internal and external structures (towers, air conditioning ducts, earthing accessories, etc.), cables (open wire, underground cables, power cables, open and insulated) and a variety of engineering tools needed in telecommunications installation and maintenance. During the Decade, it should also

be possible to assemble domestic radio and television receivers, and subscribers' apparatus, such as telephone instruments, switchboards, and private exchanges, aiming for full manufacturing capability by the end of the Decade or shortly after.

Evidently, this objective will call for a comprehensive study to determine precisely the inputs required to set up the industries, and it will make considerable demands on skilled personnel, but the economic advantages are such as to make this objective one of the most important of the Decade.

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No sector of the human community can survive and develop without communicating, in some way, with other sectors: this is true of all fields of endeavour, but particularly so in transport, which implies a relationship between points separated from one another to a greater or lesser degree. The development of "Transport and Communications" in the broadest sense in Africa will demand an efficient network of telecommunications, and only with the existence of such a network will the other sectors concerned in the Decade development programme be able to make progress. Railway, road, sea, lake and river transport will depend heavily for their success on the ability to communicate along the routes followed by these various forms of transport. There will also be a multiplier effect, for on the success of these sectors of the infrastructure will depend the marketing of agricultural produce and industrial output, the distribution of essential goods, and indeed, much of the whole range of activities of modern society in Trade, Commerce, Public Administration and Social Services.

PANAFTEL has much to offer to the success of the Decade: in return, it must be given the necessary priority by those responsible for national and multi-national planning to enable it to advance fast enough to cope with the demands which will be made upon it.

1 *Repeater Station on the Addis Ababa-Asmara Route in Ethiopia.*

2 *Ethiopia – Installation Testing.*

3 *Concrete Tower Microwave Repeater in East Africa.*

4 *Installation of Power Plant in a Remote Repeater Station in East Africa.*

5 *Zambia – Pemba Repeater on the Lusaka-Livingstone Route.*

6 *The old and the new – An open-wire line alongside a microwave repeater station – Zambia.*

7 *Installation of a buried-tank microwave repeater station in West Africa. Note the gas-turbine power plant on the left of the photograph.*

8 *A closer view of the tank which contains the radio equipment. The technique of burying the station underground reduces the temperature range to which the equipment is subjected.*

9 *Senegalese and French engineers testing microwave equipment in northern Senegal.*

10 *Propagation testing in Senegal – A balloon used to collect meteorological information.*

11 *Propagation testing in Senegal – The balloon-borne meteorological package and the ground receiver and recorder.*

12 *Parabolic antennae with radomes mounted near ground level operating in conjunction with angled reflectors at the masthead to form a periscope antenna system. (Note: a complete periscope antenna system can be seen in the background of the photo of Zamengoe Earth Station.)*

Fotos: NEC, FUJITSU, TRT, A.G.W. Timmers (UIT).

PROGRÈS DE LA MISE EN ŒUVRE DU RÉSEAU PANAFRICAIN DE TÉLÉCOMMUNICATIONS — *PROGRESS IN IMPLEMENTATION OF PAN AFRICAN TELECOMMUNICATION NETWORK* — PROGRESO REALIZADO EN LA EJECUCIÓN DE LA RED PANAFRICANA DE TELECOMUNICACIONES

SYSTÈMES DE TRANSMISSION – LISTE DES ARTÈRES — *TRANSMISSION SYSTEMS – INVENTORY OF ROUTES* — SISTEMAS DE TRANSMISIÓN – LISTA DE RUTAS

DONNÉES AU 30 JUIN 1979 – *REPORTING DATE JUNE 30, 1979* – *FECHA: 30 DE JUNIO DE 1979*

Artère / *Route* / Ruta	Bande de fréquences GHz / *Frequency Band GHz* / Banda de frecuencias GHz	Capacité des voies radioélectriques (circuits téléphoniques) / *Capacity of Radio Channels i.e. Telephone CCTS.* / Capacidad de los canales radioeléctricos (circuitos telefónicos)	Configuration des voies radioélectriques (paires ou n+1) / *Configuration of Radio Channels (twin or n+1)* / Configuración de canales radioeléctricos (gemelos o n+1)	Circuits de télévision / *TV Facility* / Servicio de TV: Oui / *Yes* / Si	Circuits de télévision / *TV Facility* / Servicio de TV: Non / *No* / No	Artère / *Route* / Ruta: km / *km* / km	Artère / *Route* / Ruta: Bonds / *Hops* / Saltos	Date de mise en service / *Date operational* / Fecha de entrada en servicio	Observations	*Remarks*	Observaciones
WEST AFRICA SUB-REGION											
BENIN (BEN)											
BEN – AAA											
Cotonou – Dan Tota	6.77	960	1+1	X		142	3	1975			
BEN – BBB											
Dan Tota – Parakou	2.101	960	1+1	X		247	5	1980/1	Projet bénéficiant de l'aide CIDA	*CIDA Assisted Project*	Proyecto con asistencia del CIDA
BEN – CCC											
Parikou – Donwari	6.77	960	1+1	X		204		1980/1	Projet bénéficiant de l'aide CIDA	*CIDA Assisted Project*	Proyecto con asistencia del CIDA
BEN – DDD											
Dan Tota – Guene	2	960	1+1	X		531		1980	Projet bénéficiant de l'aide CIDA	*CIDA Assisted Project*	Proyecto con asistencia del CIDA
BEN – NER											
Danwari / Dosso	2	960	1+1	X		246	6	1980/81	Projet bénéficiant de l'aide CIDA	*CIDA Assisted Project*	Proyecto con asistencia del CIDA
BEN – NIR											
Cotonou – Porto Novo – Lagos	4	960	1+1	X		125	3	3/1976	Projet commun Benin – Nigeria	*Joint Benin/Nigeria Project*	Proyecto mixto Benin/Nigeria
BEN – TOG											
Cotonou – Ovidah (frontier)	4	960	1+1	X		39	1	1975			
Ouidah – Lome	4	960	1+1	X		106	3	1972			
CAPE VERDE (CPV)											
Nil											
GAMBIA (GAM)											
GAM – SEN											
Banjoul – Kaolock (SEN)	7	300	1+1			93		1977			
GHANA (GHA)											
GHA – AAA											
Accra – Koforidua – Kumasi	6.175	300/960	2+1	X			5	1971			
GHA – BBB											
Kumasi – Tamale	7.575	120	1+1		X		7	1971			
GHA – CCC											
Tamale – Bolyatanga	7.575	120	1+1		X		4	1971			
GHA – DDD											
Accra – Takoradi		960	2+1	X		194	5	1981	Obtenu prêt BAD	ADB, loan obtained	Préstamo recibido del BAD
GHA – EEE											
Koforidua – Ho	7.575	120	1+1		X		2	1971			
GHA – FFF											
Kumusi – Kankan – Tukoredi	6.77	960	1+1 (n+1)	X		237	7	1981			
GHA – GGG											
Accra – Tema	7.275	300	1+1 (twin)		X	25	1	1971			
Accra – Tema	6.77	960?	1+1 (n+1)	X		25	1	1981	(Compris dans GHA-TOG)	*(Included in GHA-TOG)*	(Incluido en GHA-TOG)
GHA – IVC											
Takoradi – Aboisso	6.77?	960	1+1	X		177	4	12/1981	Obtenu prêt BAD	*ADB, loan obtained*	Préstamo recibido del BAD
GHA – TOG											
Accra – Tema – Akatsi – Kakaueli	6.77	960	1+1 (n+1)	X		181	5	1980/81	Obtenu prêt BAD	*ADB, loan obtained*	Préstamo recibido del BAD
GUINEA-BISSAU (GBS)											
NIL											
GUINEA (GUI)											
GUI – AAA											
Conakry – Mamou – Fornuh – Kankan	6.77	960	1+1 (n+1)	X		614	14	1979/80	BAD, en cours d'installation	*ADB, under installation*	BAD, en instalación
GUI – BBB											
Samatonde – Mt Douabo – Dabola – Dinguiraye	6	960	1+1	X		112	3	1979/80	BAD, en cours d'installation	*ADB, under installation*	BAD, en instalación
GUI – SIL											
Mt Kakoulima – Forecariah (frontier)	6.77	960	1+1 (n+1)	X		54	1	1980	BAD, en cours d'installation	*ADB, under installation*	BAD, en instalación
GUI – SEN											
Mamou – Mali – Tomboronkoto	6.77	960	1+1 (n+1)	X		281	6	1979	BAD, en cours d'installation	*ADB, under installation*	BAD, en instalación
IVORY COAST (IVC)											
IVC – AAA											
Abidjan – Digo – Dotenzia – Dalou – Man	4	300	1+1		X	560	6	1976			
IVC – BBB											
Abidjan – Aqbouille – Bouake – Korhogo	6.77	960	1+1			610	7	1976			
IVC – CCC											
Abidjan – Aboisso	6.77	960	1+1 (twin)	X		97	2	1981	Obtenu prêt BAD	*ADB, loan obtained*	Préstamo recibido del BAD
IVC – DDD											
Man – Touba – Sokorodougou		600	1+1				2	1976			
IVC – EEE											
Digo – Sassandra – San Pedro	2	300	1+1		X		3	1976			
IVC – FFF											
Dotenzia – Bouake		300	1+1				1	1976			
IVC – GGG											
Agboville – Abengourau		300	1+1				2	1976			
IVC – HHH											
Abengourau – Bondoukou	6.77	960	1+1	X		175	4	1981			
IVC – JJJ											
Man – Zoukougbeu – Daloa	6.77	960	1+1	X		174	3	1981			
IVC – KKK											
Zoukougbeu – San Pedro	6.77	960	1+1	X		231	4	1981			
IVC – UPV											
Korhogo – Banforo	4	960	1+1	X		110		11/75			
IVC – LIR ()											
Man – Mt Nimba	6.77	960	1+1	X		110	2	1981			
IVC – LIR (B)											
San Pedro – Tabou – Harper	2				X	130	2	1979	Système à diffusion troposphérique	*Troposcatter system*	Sistema de dispersión troposférica
IVC – SEN											
Abidjan – Dakar		480				2500		4/1978	Câble sous-marin	*Submarine Cable*	Cable submarino
IVC – GHA											
Aboisso – Takoradi		960	1+1			177	4	12/1981	Obtenu prêt BAD	*ADB, loan obtained*	Préstamo concedido del BAD
LIBERIA (LIR)											
LIR – AAA											
Gbarnga – Voinjama	0.4	24	1+1		X	167		9/1978			
LIR – BBB											
Kpein – Tchien	0.4	24	1+1		X	175		9/1978			
LIR – SIL											
Monrovia – Mano Mines (frontier)	6.77	600	1+1 (n+1)	X		122	2	8/1978			
LIR – IVC (A)											
Monrovia – Gbarnga – Mt Nimba (frontier)	6.77	600	1+1 (n+1)	X		288	7	8/1978			
LIR – IVC (B)											
Monrovia – Harper (frontier)	2					413	4	1979	Système à diffusion troposphérique	*Troposcatter system*	Sistema de dispersión troposférica
LIR – GUI											
Mt Nimba – Nzerekore						42	1	8/1978	Section pour la Guinée non installée	*Gutrea section not implemented*	La sección de Gutrea no se ha realizado
MALI (MLI)											
MLI – AAA											
Bamako – Segou – Mopti	6.77	960	1+1 (twin)	X		660		1/1979			
MLI – SEN											
Bamako – Kita – Koulinegote (frontier)	6.77	960	1+1 (twin)	X		500	9	1980/81	CIDA, en cours d'installation	*CIDA, under installation*	CIDA, en instalación
MLI – UPV											
Bamako – Sikasso – Natie (frontier)	6.77	960	1+1 (twin)	X		338	8	1980/81	CIDA, en cours d'installation	*CIDA, under installation*	CIDA, en instalación
MAURITANIA (MAU)											
MAU – AAA											
Rosso – Nouakchott – Akjoojt		360				407		11/1976	Câble coaxial	*Coaxial cable*	Cable coaxial
MAU – SEN											
Rosso – Richard Toll	6.77	120	1+1 (n+1)		X	14	1	12/1978			
NIGER (NER)											
NER – AAA											
Niamey – Dosso	6.77	600	2+1 (n+1)	X		129	3	2/1976			
NER – BBB											
Dosso – Zinder	6.77	600	1+1 (n+1)	X		600		12/1978			
NER – UPV											
Niamey – Koupela	2	960	1+1 (twin)			357	7	1980/81	CIDA, en cours d'installation	*CIDA, under installation*	CIDA, en instalación
NER – BEN											
Dosso – Donwari	2	960	1+1 (twin)			246	6	1980/81	CIDA, en cours d'installation	*CIDA, under installation*	CIDA, en instalación
NER – NIR											
Maradi – Katsina	6.77	960	1+1 (n+1)	X		84	2	1980/81	Projet commun Niger-Nigeria	*Joint Niger-Nigeria Project*	Proyecto mixto Niger/Nigeria
NIGERIA (NIR)											
NIR – AAA											
Lagos – Kaduna (A)		600				800			Câble coaxial	*Coaxial cable*	Cable coaxial
Lagos – Kaduna (B)	6.175	600/960	1+1 (n+1)	X		750		1972			
NIR – BBB											
Kaduna – Kano	6.175	600/960	1+1 (n+1)	X		235		1973			
NIR – CCC											
Kaduna – Zaria – Sokoto		240		X		450					
NIR – DDD											
Kaduna – Jos – Bauchi – Makurdi	2?	960		X		440		1973			
NIR – EEE											
Bauchi – Marduguri		120									
NIR – FFF											
Lagos – Ilaro – Abcokuta		240									
NIG – GGG											
Kano – Katsina	6.77	960	1+1 (n+1)	X		158	4	1980	En cours d'installation	*Under installation*	En instalación
NIR – HHH											
Lagos – Ijebu – Onitsha – Aba – Port Harcourt	6.175	600	1+1 (n+1)	X		598		1972			
NIR – JJJ											
Aba – Calabar – Ogoja							3				
NIR – LLL											

Artère / *Route* / Ruta	Bande de fréquences GHz / *Frequency Band GHz* / Banda de frecuencias GHz	Capacité des voies radioélectriques (circuits téléphoniques) / *Capacity of Radio Channels i.e. Telephone CCTS.* / Capacidad de los canales radioeléctricos (circuitos telefónicos)	Configuration des voies radioélectriques (paires ou n+1) / *Configuration of Radio Channels (twin or n+1)* / Configuración de canales radioeléctricos (gemelos o n+1)	Circuits de télévision / *TV Facility* / Servicio de TV: Oui / *Yes* / Si	Circuits de télévision / *TV Facility* / Servicio de TV: Non / *No* / No	Artère / *Route* / Ruta: km / *km* / km	Artère / *Route* / Ruta: Bonds / *Hops* / Saltos	Date de mise en service / *Date operational* / Fecha de entrada en servicio	Observations	*Remarks*	Observaciones
Iloron – New Bossa							2				
NIR – MME											
Lagos – Budagri											
NIG – CMR – CHD											
Maiduguri – Kouseri – N'Djamena						200		1979			
NIR – BEN											
Lagos – Owode – Cotonou	4	960	2+1			125	3	1976			
NIR – NER											
Katsina – Marudi	6.77	960	1+1 (n+1)	X		84	2	1981			
SENEGAL (SEN)											
SEN – AAA											
Dakar – Thies	6.77	960	2+1 (n+1)	X		54	1	3/1978			
SEN – BBB											
Thies – Richard Toll	6.77	600	1+1 (n+1)	X		258	5	10/1978			
SEN – CCC											
Richard Toll – Batam – Bakel	7.275	120	1+1 (twin)		X	414	8	12/1978			
SEN – DDD											
Thies – Mbour						60		10/1977			
SEN – EEE											
Thies – Kaolack	6.77	960	2+1 (n+1)	X		142	5	1977			
SEN – FFF											
Kaolack – Ziguinchor	7.275	300	1+1 (twin)		X		4	11/1972			
SEN – GGG											
Dakar – Goree	7.275	120	1+1 (twin)		X		1				
SEN – HHH											
Dakar – Gandoul	7.275	120	1+1 (twin)		X		1				
SEN – GAM											
Kaolack – Benjoul	7.275	300	1+1 (twin)		X	93	2	2/1977			
SEN – MLI											
Kaolack – Tumbacounda – Koulinegali	6.77	960	1+1	X		496	11	1980/81	CIDA	*CIDA*	CIDA
SEN – MAU											
Richard Toll – Rosso	6.77	120	1+1 (n+1)		X	14	1	12/1978			
SEN – MOR											
Dakar – Casablanca		640						4/1977	Câble sous-marin	*Submarine Cable*	Cable submarino
SEN – IVC											
Dakar – Abidjan		480				2500		4/1978	Câble sous-marin	*Submarine Cable*	Cable submarino
SIERRA LEONE (SIL)											
SIL – AAA											
Freetown – Bo	6.77	960	1+1 (n+1)	X		174		9/1979	En cours d'installation	*Under installation*	En instalación
SIL – BBB											
Freetown – Port Loko – Makeni – Bo	7.575	120	1+1		X	200		1965			
SIL – CCC											
Makeni – Koida	7.575	120	1+1		X	110		1965			
SIL – GUI											
Freetown – Kumbia – Forehariah	6.77	960	1+1 (n+1)			138	3	9/1979	En cours d'installation	*Under installation*	En instalación
SIL – LIR											
Bo – Bandajuma – Muno Mines	6.77	960	1+1 (twin)			112		9/1979	En cours d'installation	*Under installation*	En instalación
TOGO (TOG)											
TOG – AAA	7.575	960	1+1 (n+1)	X		8.25	1	1974			
Lome – Kakaveli	7.575	960	1+1 (n+1)	X		8.25	1	1974			
TOG – BBB											
Kakaveli – Mt Agau	7.575	96	1+1 (n+1)	X		89.3	1	1972			
TOG – CCC											
Mt Agau – Luma Kara	4	960	1+1 (n+1)	X		319	6	1972			
TOG – GHA											
Kakaveli – Accra	6.77	960	1+1 (n+1)	X		181	5	1980/81	Obtenu prêt BAD	*ADB, loan obtained*	Préstamo del BAD concedido
TOG – UPV											
Lama Kara – Daponga (frontier)	4	300/960	1+1 (n+1)	X		189	5	1976			
TOG – BEN											
Lome – Cotonou		960	1+1 (n+1)			145	4	1975			
UPPER VOLTA (UPV)											
UPV – AAA											
Bobo Dioulasso – Ougadougou – Koupela	4	960	1+1 (twin)	X		300		1974/5			
UPV – NER											
Koupela – Fada N'gourma – Niamey (PKS)	6.77	960	1+1 (twin)	X		366	8	1980/1	CIDA, en cours d'installation	*CIDA, under installation*	CIDA, en instalación
UPV – IVC											
Bobo Dioulasso – Banforo – Korhogo	4	960	1+1 (twin)	X				4/1975			
UPV – TOG											
Koupela – Daponga	4	960	1+1 (twin)	X		130	4	1975			
UPV – MLI											
Bobo Dioulasso – Sikasso	6.77	960	1+1 (twin)			180	3	1980/1	CIDA, en cours d'installation	*CIDA, under installation*	CIDA, en instalación
CENTRAL AFRICA SUBREGION											
ANGOLA (ANG)											
ANG – AAA											
Luanda – Huambo – Benguela	6	960	1+1		X			1979	En cours d'installation	*Under installation*	En instalación
BURUNDI (BDI)											
BDI – AAA											
Bujumbura – Mt Mugongo	7	120	1+1			22	1	1972			
BDI – BBB											
Mt Mugongo – Songo – Nyanza Lac	0.4	24				93	3	1972			
BDI – RWA											
Mt. Mugongo – Kigali	0.4	24				200		1972			
BDI – ZAI											
Mt. Mugongo – Bukavu	0.3	24				98	2	1979	En cours d'installation	*Under installation*	En instalación
CAMEROON (CMR)											
CMR – AAA											
Yaounde – Ebolowa		300				130	4	1978			
CMR – BBB											
Yaounde – Sangmelima		48				121	2	1978			
CMR – CCC											
Yaounde – Edea – Douala – Kribi		600				400	5	1970			
CMR – DDD											
Yaounde – Bertoua	6	600				350		1973			
CMR – EEE											
Bertoua – Kouseri	6	600				1250		1973	En service jusqu'à Maroua seulement	*In service to Maroua only*	En servicio hasta Maroua solamente
CMR – CHD											
Kouseri – N'Djamena	0.4	24				10	1	1977			
CMR – NIR											
Kouseri – Marduguri						200		1978			
CMR – GAB											
Ebolowa – Ambam – Bitam		300				123	3	1974			
CMR – EQC											
Douala – Malaho						120	1	1974			
CENTRAL AFRICAN EMPIRE (CAF)											
CAF – AAA											
Bangui – Baoro – Berberati	7	960	1+1			660	14		Installé mais non en service	*Installed but not operational*	Instalado pero aún no explotado
CAF – BBB											
Bangui – M'Baiki	7	960	1+1			90	2		En service	*In operation*	En explotación
CAF – CCC											
Baoro – Bouar	7	600	1+1			50			Installé mais non en service	*Installed but not operational*	Instalado pero aún no explotado
CAF – CMR											
Berberati – Gemboula	7	960	1+1			75	2		Installé mais non en service	*Installed but not operational*	Instalado pero aún no explotado
CHAD (CHD)											
CHD – CMR											
N'Djamena – Kousseri	0.4	24				10	1	1978			
CONGO (PRC)											
PRC – AAA											
Brazzaville – Ouesso	6	960	1+1	X		700	16	1979			
Ouesso – Inplondo	2	120				225	1	1979	Système à diffusion troposphérique	*Troposcatter system*	Sistema de dispersión troposférica
PRC – BBB											
Brazzaville – Pointe Noire		120				600			Câble coaxial	*Coaxial cable*	Cable coaxial
PRC – CCC											
Loubouma – Makabana – Mbinda		24				300		1978			
PRC – GAB											
Loubouma – Mourla	2	12/60	1+1			358		1970	Syst. à dif. troposph. en cours de rétablissem.	*Troposcatter system under restoration*	Sistema de dispersión troposférica en restaur.
PRC – ZAI											
Brazzaville – Kinshasa		120	1+1			10		1980	Contrat passé	*Under contract*	Bajo contrato
PRC – CAF											
Inpfondo – Bangui	2	120	1+1			280		*1979	* Equipement pour la PRC seulement	* *PRC equipment only*	* Sólo equipo PRC
GABON (GAB)											
GAB – AAA											
Libreville – Lambarene – Port Gentil		960	1+1 (n+1)	X		300		1973			
GAB – BBB											
Libreville – Port Gentil	2	120				160		1970	Système d'appoint à diffusion troposphérique	*Troposcatter backup system*	Sistema auxiliar de dispersión troposférica
GAB – CCC											
Libreville – Njole – Boove – Lustourville – Koulamoutoo – Moanda – Frarceville		960	1+1			620		5/1979			
GAB – DDD											
Moila – Moanda	2	120				240		1970	Système à diffusion troposphérique	*Troposcatter system*	Sistema de dispersión troposférica
GAB – EEE											
Libreville – Oyem – Bitem	VHF	36				360		1974	A adapter aux hyperfréquences	*To be upgrated to M/W*	Mejora proyectada (microondas)
GAB – PRC											

Artère / *Route* / Ruta	Bande de fréquences GHz / *Frequency Band GHz* / Banda de frecuencias GHz	Capacité des voies radioélectriques (circuits téléphoniques) / *Capacity of Radio Channels i.e. Telephone CCTS.* / Capacidad de los canales radioeléctricos (circuitos telefónicos)	Configuration des voies radioélectriques (paires ou n+1) / *Configuration of Radio Channels (twin or n+1)* / Configuración de canales radioeléctricos (gemelos o n+1)	Circuits de télévision / *TV Facility* / Servicio de TV: Oui / *Yes* / Si	Circuits de télévision / *TV Facility* / Servicio de TV: Non / *No* / No	Artère / *Route* / Ruta: km / *km* / km	Artère / *Route* / Ruta: Bonds / *Hops* / Saltos	Date de mise en service / *Date operational* / Fecha de entrada en servicio	Observations	*Remarks*	Observaciones
Lambarene – Movila – Louboma	2	60				450		1970	Syst. à diff. troposph. en cours de rétablissem.	*Troposcatter system under restoration*	Sistema de dispersión troposférica en restaur.
GAB – CMR (A)											
Libreville – Douala		36				400		1973	Système à diffusion troposphérique	*Troposcatter system*	Sistema de dispersión troposférica
GAB – CMR (B)											
Bitam – Ambam (frontier)		300				47		6/1976			
RWANDA (RWA)											
RWA – UGA											
Kigali – Musaka	0.4	24	1+1			320		1972			
RWA – BDI											
Kigali – Mt. Mugongo	0.4	24	1+1			200		1972			
ZAIRE (ZAI)											
ZAI – AAA											
Kinshasa – Matadi		60/120	1+1 (twin)			250			A adapter aux hyperfréquences	*To be upgrated to M/W*	Mejora proyectada (microondas)
ZAI – BBB											
Kinshasa – Luluaburg – Kamina – Lubumbashi	7	600	1+1			2500		1975			
ZAI – PRC											
Kinshasa – Brazzaville		120				10	1		Sans contrat	*Under contract*	Bajo contrato
ZAI – BDI											
Bukavu – Mt. Mugongo	0.4	24				100		1979	Pays-Bas – en cours d'installation	*Netherlands, under installation*	Paises Bajos, en instalación
EQUATORIALE GUINEA (EQC)											
EQC – CMR											
Malabo – Douala						120	1	1974			
EAST AND SOUTHERN AFRICA SUB-REGION											
BOTSWANA (BOT)											
BOT – AAA											
Gaberone – Lobutse	2	600	1+0		X	67.5	2	1972			
BOT – BBB											
Gaberone – Francistown	2	600	1+0		X	430	9	1979/80	En cours d'installation	*Under installation*	En instalación
DJIBOUTI (JIB)											
NIL											
ETHIOPIA (ETH)											
ETH – AAA											
Addis Ababa – Dessie – Asmara	6	960	1+1	o.w		818	14	5/1973			
ETH – BBB											
Asmara – Tessenai	4	960	1+1			298	6		Contrat passé mais en suspens	*Contracted but pending*	Contrato concebido, realización pendiente
ETH – CCC											
Asmara – Massava	2	120	1+1			70	1	1968			
ETH – DDD											
Addis Ababa – Dire Dawa – Harar	4	360	1+1	o.w		483	10	9/1975			
ETH – EEE											
Harar – Jijiga	4	300	1+1			78	2	9/1975			
ETH – FFF											
Addis Ababa – Shushamane	6	960	1+1	b.w		212	4	9/1975			
ETH – GGG											
Addis Ababa – Gondar	2	960	1+1	o.w		442	8	1979	En cours d'installation	*Under installation*	En instalación
ETH – HHH											
Dessie – Assab	4	960	1+1	o.w		426	7	1979	En cours d'installation	*Under installation*	En instalación
ETH – III											
Addis Ababa – Jimma	4	960	1+1	o.w		276	5	9/1975			
ETH – JJJ											
Jimma – Argo – Gore – Mettu	4	960	1+1	o.w		280	5	1979	En cours d'installation	*Under installation*	En instalación
ETH – KKK											
Arjo – Nekempti	4	960	1+1	o.w		32.5	1	1979	En cours d'installation	*Under installation*	En instalación
ETH – KEN											
Shushamane – Moyale	4	960	1+1	b.w		456	8		En cours d'installation	*Under installation*	En instalación
KENYA (KEN)											
KEN – AAA											
Nairobi – Mombasa	4	960	1+1	b.w		450		1970			
KEN – BBB											
Nairobi – Nyeri	6	960	1+1	b.w		142	2	8/1980	En cours d'installation	*Under installation*	En instalación
KEN – CCC											
Nairobi – Kitule						350		1970	Compris dans la sect. Nairobi–Kampala	*Included in Nairobi–Kampala*	Incluido en Nairobi–Kampala
KEN – DDD											
Nairobi – Garissa	0.8	120	1+1 (twin)		X	200		1975			
KEN – UGA											
Nairobi – Eldoiet – Kampala	4	960	1+1	b.w		600		1970			
KEN – URT											
Mombasa – Dar es Salam	4	960	1+1	b.w		450		1970			
KEN – URT											
Nairobi – Arusha	6	960	1+1	o.w		238	4	8/1980	En cours d'installation	*Under installation*	En instalación
KEN – ETH											
Nyeri – Mogale	6	960	1+1	o.w		594	8	8/1980	En cours d'installation	*Under installation*	En instalación
MALAWI (MLW)											
MLW – AAA											
Lilongwe – Zomba – Blantyre	2	300	1+1		X	300		1972			
MLW – BBB											
Lilongwe – Mzuzu	2	300	1+1		X	300		1972			
MOZAMBIQUE (MOZ)											
MOZ – AAA											
Maputo – Mt. Ponduin	2	120	1+1		X	80		1963	Qualité de fonction. améliorée en 1977	*Upgrated in 1977*	Mejorado en 1977
MOZ – BBB											
Maputo – Beira – Tete – Nampula	0.8	60	1+1	nil.		2000		1963	Syst. adapté à la dif. troposphér. en 1977/78	*Troposcatter system upgrated 1977/78*	Sistema de dispersión troposf. mej. en 1977/78
SOMALIA (SOM)											
SOM – AAA											
Mogadishu – Galib – Chirimaic	7	120	1+1	nil.		360		1974	A une section à diffusion troposphér.	*Has a troposcatter section*	Tiene una sección de dispersión troposférica
SUDAN (SUD)											
SUD – AAA											
Khartoum – Atbara	4	960	2+1	b.w		288	7	10/1976			
SUD – BBB											
Atbara – Port Suilan	4	960	2+1	b.w		453	10	4/1977			
SUD – CCC											
Khartoum – Wad Medhani	7	960	2+1	b.w		160		1970			
SUD – DDD											
Wad Medhani – Sennar	7	960	1+1			100		1970			
Wad Medhani – Sennar	4	TV	1+1	b.w		100		1977			
SUD – EEE											
Sennar – Gedarif – Kassala	4	960	2+1	b.w		426	11	6/1977			
SUD – FFF											
Sennar – El Obeid	4	960	2+1	b.w		407	8	8/1977			
SWAZILAND (SWA)											
Nil											
TANZANIA (URT)											
URT – AAA											
Dar es Salam – Mtwara	2	120				450		1974	Système à diffusion troposphérique	*Troposcatter system*	Sistema de dispersión troposférica
URT – BBB											
Dar es Salam – Dodoma						427	5	8/1980	En cours d'installation	*Under installation*	En instalación
URT – CCC											
Dodoma – Arusha	6	960	1+1			379	6				
URT – DDD											
Arusha – Moshi						67	2				
URT – EEE											
Dodoma – Igogo – Tabora – Mwanza	2	960	1+1			758	16				
URT – GG											
Dodoma – Irirga – Mbega	6	960	1+1	o.w		468	7	8/1980	En cours d'installation	*Under installation*	En instalación
URT – KEN											
Dar es Salam – Mombasa	2	960	1+1			450		1970			
Arusha – Nairobi	6	960	1+1	o.w		238	4	8/1980	En cours d'installation	*Under installation*	En instalación
URT – ZAM											
Mbega – Tandumi (frontier)	6	960	1+1			83	1	1980	En cours d'installation	*Under installation*	En instalación
UGANDA (UGA)											
UGA – KEN											
Kampala – Nairobi	4	960	1+1			600		1970	CIDA, en cours d'installation	*CIDA, under installation*	CIDA, en instalación
UGA – RWA											
Kampala – Masaka		120	1+1			120					
Masaka – Kigali	0.8	24	1+1 (twin)			320					
ZAMBIA (ZAM)											
ZAM – AAA											
Lusaka – Kitwe	2			b.w		300	13	1962			
ZAM – BBB											
Kitwe – Chingola						54	2	1968			
ZAM – CCC											
Lusaka – Kusama – Ilonda – Nukonde	6	960	2+1	o.w		971	20	10/1978			
ZAM – DDD											
Lusaka – Kutete – Chiputa	6	960	1+1	X		527	13	1979	En cours d'installation	*Under installation*	En instalación
ZAM – EEE											
Lusaka – Livingstone	6	960	2+1	b.w				1974			
Lusaka – Mumbeila – Mongu								1980/81	En cours d'installation	*Under installation*	En instalación
ZAM – URT											

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En service avant fin / In service by end of / En servicio antes del fin de 1979

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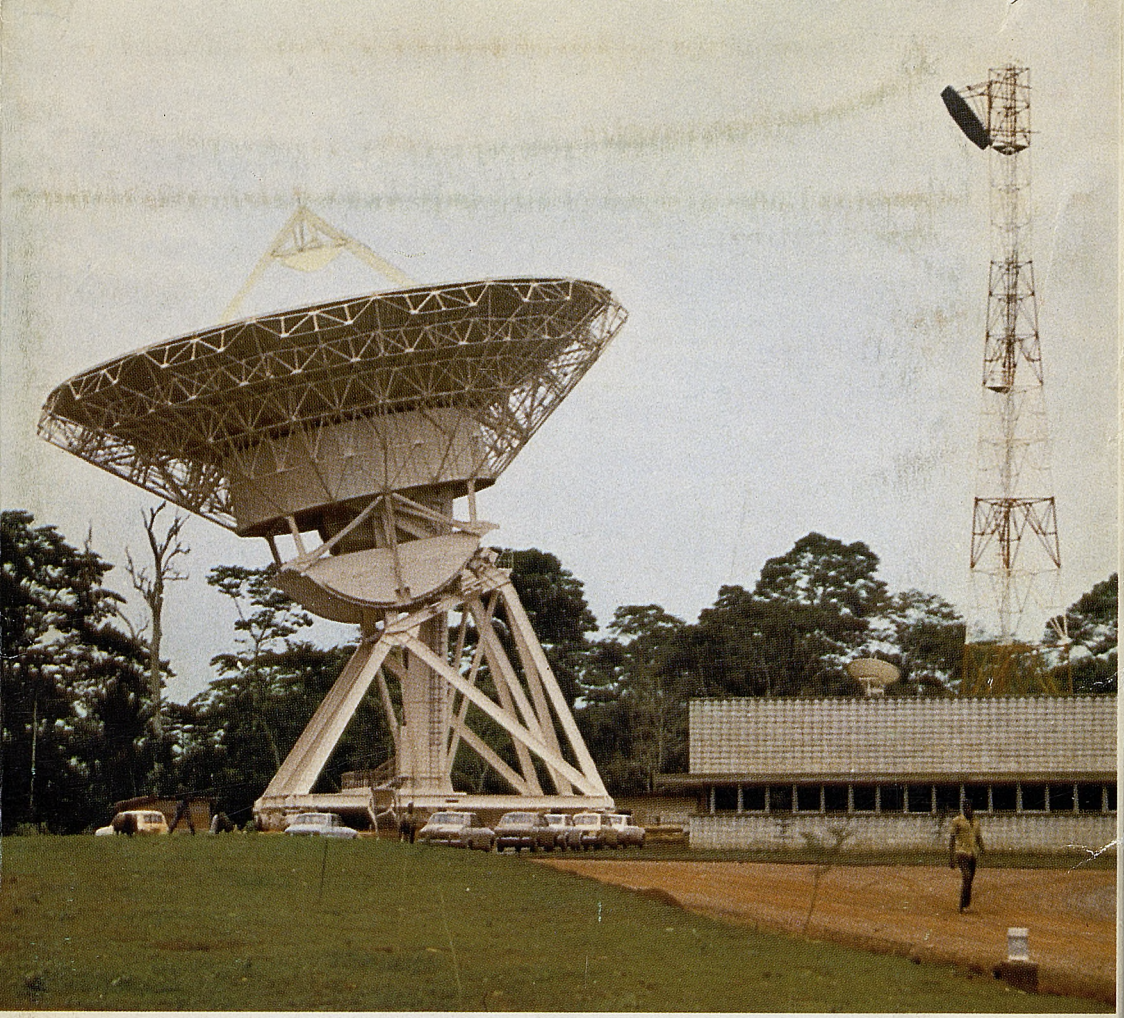

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