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DRAFT PROJECT DOCUMENT

STUDY OF THE REGIONAL SPACE COMMUNICATION SERVICES INCLUDING THE FEASIBILITY OF A REGIONAL COMMUNICATIONS SATELLITE FOR COMMON-CARRIER COMMUNICATION, AND EDUCATIONAL AND INFORMATIONAL BROADCASTING

ECA PROJECT 9.556.03

ADDIS ABABA
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Study on the Region's Space Communication Services Including the Feasibility of a Regional Communications Satellite Service

Project No.).556.03

Description of the project

Introduction and justification

In 1971, Wernher Von Braun said that the day will come when space "will earn more than it is costing". That day is already very close not only for the developed but for the developing countries as well, including those in Africa.

The best and cheapest way to meet many communication needs is by satellite communication, the rapid development of which has resulted in the planning and/or establishment of domestic systems in a few developing countries such as Indonesia and India. Experimental and developmental satellites such as the American ATS-6 and the Franco-German Symphonie are helping to pave the way for economic and more socially productive multi-purpose systems.

In telephone and data communication by satellite, significant advances have been chalked up both technically and economically. Subject to topography and particularly to the limitations of existing and planned terrestrial systems of a country, satellite communication links can prove to be more economical than terrestrial links over distances of several hundred kilometres. In many situations such as thrown up by the need to inter-connect national population centres that are separated by geographical barriers such as offered by large expanses of mountain, desert or water, satellite communication may provide the only economic link.

A number of countries in the Region that, at present, do not have adequate terrestrial systems and which do not wish to accept delays associated with terrestrial systems development have turned to satellite communication to supplement their telecommunication needs. Some of these countries are Algeria, Nigeria and Zaire. They have leased or plan to lease transponders on the Intelsat system to provide domestic services. It is likely that such leased services will be used by these countries and a few more to follow, only as stop gap until full domestic systems catering for all possible needs including those of broadcasting can be procured.

It is necessary that, at the present stage, when a number of countries in the Region are beginning to contemplate integration of satellite communication techniques with their existing or planned terrestrial networks, advice be available to them on the possibilities of achieving maximum efficiency and economy from multi-national co-operation in the integration of space and terrestrial networks. Those countries that cannot bear the financial burden alone or economically justify national satellit and these constitute a preponderant majority, can benefit by participation in a joint satellite system. Such a system will be deployed on a cost sharing basis and can mak available separate spotbeam transponders to participants for national use.

The justification that can be given for the use of satellite communication system for broadcasting (educational and informational) are the advantages of relatively short installation time, full geographical coverage and possibly of relatively lower cost per student in formal educational broadcasting where relatively less qualified teachers are employed.

The educational systems of the Region generally suffer from a high pupil wastage rate and a shortage of well qualified teachers. The availability and quality of education formal and informal are frequently inadequate. The situation is particularly bad in the rural areas where eighty per cent of the population resides. Inspite of the increasing costs, the average percentage of GNP allocated to education in between 1960 and 1972 rose from 2.8 per cent to 4.7 per cent, most if not all will be unable to attain the target of full primary education for all eligibles by 1980 set by the 1961 Ministers of Education Conference in Addis Ababa. Adult education is not included in the above cost figures.

The need for a supplementary delivery system for formal, informal and adult education as well as for expanding rapidly telephone and data links calls for careful and detailed examination of the problems associated with the effective exploitation of the potential and the possible establishment of a multipurpose communications satellite system for the Region.

Objectives

Long-term objective

The project is to provide for the orderly growth of national, multinational and regional satellite communication systems for common-carrier and broadcasting communication and to encourage the development and use of such system for national development and education.

Immediate objectives

(i) To establish an expert working group as called for by ECA resolution 310(XIII) to study the organizational, economic, social, technical and financial implications of a multinational or regional multi-purpose communication satellite system for common-carrier communication and, for development and education. The study will include an analysis of the benefits of alternative terrestrial common-carrier and broadcasting systems, of video tape, cassettes and films or combinations of these various distribution methods.

(ii) To follow-up the completion of the study in accordance with ECA resolution 310(XIII), with a plenipotentiary meeting to deliberate on the report of the study and to decide on follow-up activities leading up to, if necessary, the establishment of a multi-national/Regional satellite communication system.

Project activities

Project activities will comprise a number of studies leading to recommendations as to:

(i) the basic policies and strategies to be pursued in establishing a Regional satellite system catering for multinational needs in common-carrier and broadcasting communications; the solution of the administrative, legal and economic problems that may be encountered, and the organization of a multinational institution which will own and operate the satellite system; the financial structure of the institution and the means of financing the system;

(ii) the configuration of the transmitting and receiving equipment of the system and the specifications of the major items of equipment that may be needed, including items of equipment that can be supplied by local industry; staff training needs for equipment maintenance and operation;

(iii) the educational and informational fields to be catered for by the broadcast programmes and the supporting organizations needed to produce, research on, evaluate and monitor instructional programmes and to train staff for the purpose;

(iv) the adjustments to existing formal educational systems that may be called for in order to incorporate the use of broadcast instruction and the training of instructors and inspectors to supplement the broadcast instruction and to report on its effectiveness; and

(v) the organizational requirements and systems for effective adult education, and the training of staff for the purpose.

Organizational framework

An expert working group of seven with specialisation in each of the following fields will be established in Addis Ababa:

(i) educational and informational broadcast programme production;

(ii) economics of education;

(iii) social science with relevance to research in informational broadcast projects;

(iv) satellite communication systems - engineering;

(v) broadcasting communication - engineering

In addition the Project Manager and his deputy will be expected to have respectively;

(vi) expertise in general and educational broadcasting and familiarity with the development and cultural problems of the Region. Knowledge of English and French languages and extensive experience in teaching techniques. Some familiarity with development economics;

(vii) expertise in common-carrier, broadcasting and satellite communication systems engineering and familiarity with trade-off analyses of such systems; some economics background and extensive experience in managing and co-ordinating large-scale development projects including planning and budget preparation.

The initial stages of the project period will be taken up with the collection and analysis of data, the review of the most fundamental soft and hardware problems and the preparation of a draft model of the system. The draft model will provide the basis for the follow-on studies to be undertaken at country level in the countries participating in the project.

The co-operating agency in each country will be expected to be an inter-ministerial committee composed of representatives from ministries of Economic Planning, Communications, Information and Education. A Regional inter-ministerial committee composed of representatives of national inter-ministerial committees is envisaged to review annually at Addis Ababa the work of the working group of experts. To facilitate the work of the group, it is also envisaged that participating countries will provide at the national level, counterpart working groups composed of experts from economic, planning, education, broadcasting and communication ministries.

Work plan

	Activities	Location	Proposed duration and starting date
A.	Preliminary phase		
1.	Recruitment of experts and establishment of working group	Addis Ababa	6 months; October 1979
2.	Collection, compilation and analysis of data and establishment of list of participating countries	Addis Ababa	6 months; April 1980
3.	Assistance in establishing Working Group counterparts and inter-ministerial committees at national level	Field-Addis Ababa	6 months; October 1980
4.	Preparation of draft model of the system and plans for the experiment using non-commercial satellites	Addis Ababa	9 months; April 1981
5.	First regional inter-ministerial meeting		1 month; January 1982
B.	Experiment phase		
1.	Review of model, acquisition, installation, testing of transmitter and receiver equipment; arrangement for suitable production facilities and production of appropriate programme and implementation of experiment. Report on experiment	Field-Addis	12 months; February 1982
2.	Second Regional inter-ministerial meeting		1 month; February 1983

Activities	Location	Proposed duration and starting date
C. Final phase		
1. Preparation of final model of the system and report	Addis Ababa	8 months; March 1983
2. Plenipotentiary Conference		½ month; November 1983

Co-operation with other divisions of ECA

Social Development Division and Information Unit

Co-operation with International Organizations

Close collaboration will be established with OAU, UNESCO and ITU as called for in the Kinshasa resolution of the ECA Conference of Ministers, February/March 1977.

Initial Assumptions on the Experiment

Audience

Basic assumptions are that:

(i) the experiment will involve only six countries in the Region - three each from English and French language speaking groups. Main criteria for selection being willingness to participate fully and contribute materially;

(ii) the target audience in these countries will be mainly:

(a) first and second grades students of middle level or secondary schools

(b) University undergraduates

(c) rural adults

and that the programme fare will cover subjects as language instruction (English and French), geology, geography and ecology of Africa, environmental problems, and economic and social problems of development;

(iii) the 500 transistor receivers will be distributed as follows:

- 120 to middle level schools
- 360 to adult viewing stations
- 12 to 12 university campuses
- 8 reserved

(iv) in addition to the transistor receivers each of the six countries involved in the experiment will be having 8.0m. dia., receiving stations for other modes of communication and it should be possible to relay the experimental broadcast programmes through existing national broadcasting installations to a substantial audience beside the target audience listed in (ii) above including even those within the target audience categories without access to the transistor receiver; and

(v) two universities in each country will each offer both a selected target audience and provide leadership on the national committees to be set up to assist in the organization of each national sector of the experiment, and participate in the resulting research activities. Audience at the campuses would have access to both the direct reception and reception via the national relaying facilities.

Estimates of Target Audience

a) Middle level schools

On the assumption that there are on the average 200 middle level schools per country and that each of these schools has five grades and 60 students in each grade; the number of students in each grade per country is therefore 12,000.

For two grades, the theoretical audience in the six countries of the experiment is 144,000. Since only 120 receiving sets are available and a maximu of 60 students pe viewing set is considered advisable, the target audience will be only 10% of the number of students in the two lowest grades of the middle level schools.

Target audience ..... 14,400 (say)

b) Rural

Assuming a maximum number of viewers per set to be 60, the maximum number of audience will be 60 x 360 = 21,600. There will be a number of adolescents in the groups: this should be welcomed and programmed for.

Estimated target audience .... 20,000 (say)

c) The universities

Estimate ..... 600 (say)

Total estimated target audience ..... 35,000 (say).

In addition a number of viewers will watch through the national relay systems. In Africa (sub-Saharan) there are about 550,000 tv sets estimated to be in use: assuming that,under normal circumstances, there are as many as eight viewers per tv set, the estimated number of viewers with possible access to the experimental transmissions is about 0.5 million. Most of these though will be in the urban areas.

d) Languages

For part of the target audience in the rural areas, an attempt should be made with the full co-operation of the national broadcasting organizations to provide for some of the programme fare in the dominant local languages wherever possible.

Estimates of Operational Costs

A. Programme production costs

1. Assume (i) 4 hours of daily experimental b'casts

(ii) 75% of these are repeats and inputs from others

(iii) 5 days a week transmissions

Then the total number of hours a week of original productions is 5 hours. This will be distributed to national organizations etc.

2. Assume also duration of continuous experimental transmissions to be 24 weeks. Then number of original programme production hours is 120 hours.

3.	Taking production costs per hour to be $ US	5,000
	the total estimated production costs $ US	600,000
4.	Costs of inputs from other sources such special suitable features, news etc (say)	50,000

Total estimated production costs = $ US 650,000

B. Instructional material

It is estimated that each student should be receiving at least $ US 2.50 of instructional material that is books, pamphlets, maps and monthly bulletins. Total estimated figure ..... $ US 100,000 (say) (this figure assumes 5,000 participating audience over and above the target audience of 35,000).

C. Maintenance of receivers

a) There will be about 80 receivers in each of the six countries involved. Assuming altogether six visits to each receiver site would be required for the six months duration of the experiment, including visits for installation etc., 480 visits would be undertaken for each national system. This means roughly 3 site visits a day would be required. A lot of course depends on the geographical spread of the receiver sites and the technical skill of the teams. Making due allowance for these, it is reckoned that 4 teams made up of two technicians each, one of whom should be able to drive a vehicle, should provide adequate maintenance 1/.

There will be 480 site visits in the period. For 24 working days a month, each team doing 120 visits in the 6 months (i.e. 20 visits of 24 working days a month) will average a site visit a day.

1/ Assume the Mean Time Before Failure (MTBF) is given by M, that this is determined largely by the MTBF of the receiver and not the front end convertor, and that this (M) is about 200 hrs (for commercial sets).

If the system is built up of n identical elements,

$$\frac{1}{M_o} = \sum_{i=1}^{n} \frac{1}{M_i}$$ (where M_i is the MTBF of each element and M_o is the MTBF of the system)

Whence rate of failure/hour/set $= \frac{1}{M} = \frac{1}{200} = 0.005$

and for a group of n = 80 sets in each country, the failure rate is given by 80 x 0.005 = 0.4 set/hr. Therefore assuming 5 hours of receiver operation a day as against 4 hours of programme transmission time, for each country

Number of sets of failure each day = 5 x 0.4 = 2

And for a month of 30 transmission days = 30 x 2 = 60 failures

Assuming 24 working days a month
No. of calls or visits per day is 60/24 = 2.5 say 3 calls/day

Assuming 100 kms/day are done by each team, 2,000 kms a month will be within the reach of each team.

Using one 2-ton vehicle per team, and assuming unit cost of $ US 0.15 per ton km;

movement cost per team per month is given by

$ US 2000 x 2 x 0.15 = $ US 600

and for 4 teams for 6 months = $ US 14,400.

b) Personnel costs

Assume $ US 150 as average monthly salary per technician then for 4 teams of 2 technicians each the total cost for the 6 months period = $ US 7,200.

c) Total maintenance costs per country (a) + (b) = $ US 21,600

Grand total cost for experiment = $ US 129,600

Summary of Software Maintenance and Operational Costs

		$ US
(i)	production costs	650,000
(ii)	personnel costs for maintenance of receivers ..	129,600
(iii)	instructional material	100,000
(iv)	spares: set at 5% of investment costs of video tape m/cs, feedback stations, vehicles, power sources, and of the 500 receivers at $ US 1,000 each, i.e. 5% $ US 1,167,000	58,350
(v)	vehicles	14,400
(vi)	power sources at 20% of investment cost	12,000
(vii)	other costs covering feedback operations, training, inspection, research etc ..... provisionally estimated at 10% of annual software system costs	30,000
	Total (say)	995,000

Estimates of Software Investment Costs for the Experiment

Item	Qty.	Description	$ US
I	500	Video tape recorders for middle level adults and compuses etc (80+2)6; at $ US 500 each	250,000
II	6	Feedback stations at $ US 20,000 each one for each of 6 major centres	120,000
III	24	two ton vehicles at $ US 10,000 each	240,000
IV	480	Power sources at $ US 120 (say) each	57,600
		Total (say)	668,000

Estimates of Hardware Equipment Costs

A. Earth-space segment

		$ US x 1,000	
1.	Control station with capabilities for TV and common-carrier communication for rural communities	3,000	
6	4.5 metres dia., thin-route common-carrier communication receive stations	540	
6	8.0 metres dia. TV receive stations	850	
500	3.5 metres dia. TV transistor receiver stations for formal and adult education	500	
	Sub-total		4,890

B. Broadcast programme production

	Equipment for a studio complex comprising, among others, tape replay and replicating and, talks production facilities	110	
	Sub-total		110
	Grand total		5,000

Estimated sum required = $ US 5.0 million

PROJECT BUDGET*

	Personnel	1979		1980		1981		1982		1983		Total	
		m/m	Cost $ US	m/m	Cost $ US	m/m	Cost $ US	m/m	Cost $ US	m/m	Cost $ US	m/m	Cost $ US
1.	Experts:												
1.1	Project Manager/Co-ordinator	3	20000	12	79000	12	79000	12	79000	11	72420	50	329420
1.2	Deputy Project Manager/ "	3	20000	12	79000	12	79000	12	79000	11	72420	50	329420
1.3	Educational & Informational Broadcast programme producer	3	20000	12	79000	12	79000	12	79000	11	72420	50	329420
1.4	Educational Economist	3	20000	12	79000	12	79000	12	79000	11	72420	50	329420
1.5	Social scientist	3	20000	12	79000	12	79000	12	79000	11	72420	50	329420
1.6	Satellite communication system engineer	3	20000	12	79000	12	79000	12	79000	11	72420	50	329420
1.7	Broadcast communications engineer	3	20000	12	79000	12	79000	12	79000	11	72420	50	329420
	Sub-total	21	140000	84	553000	84	553000	84	553000	77	506940	350	2,305940
2.	Administrative support												
	Personnel		7000		30000		30000		30000		27500		125000
	Component total		147500		583000		583000		583000		534440		2,430940
3.	Equipment												
3.1	Expendable capital		4000										4000
3.2	Non-expendable capital								5,000000				5,000000
3.3	Software operations								0.995000				0,005000
	component total												5,999000
4.	Miscellaneous												
4.1	Travel	-	6750		81000		81000		81000	-	74250	-	324000
4.2	Software operational and maintenance costs										668000	-	668000
4.3	Meetings	-	-	-	-	-	-	-	30000		60000	-	90000
4.4	Reporting costs						5000		5000		10000		20000
4.5	Sundry				15000		15000		15000		15000		60000
	Component total												1,162000
	Grand total (say)												9,600000

* See note overleaf

NOTE

No dependable cost figures can, at this stage, be given for expendable and non expendable equipment: cost estimates from the working group when assembled will be more realistic. It is thought however that a main studio complex with facilities for live talks and replay of pre-recorded programme material (audio and video); main earth-space transmitter terminal and a number of space-earth receiver terminals depending on participating countries will have to be catered for. To conduct the experiment over a period of time, spares and quite a quantity of other expendable items will need to be provided. The Group will also need to estimate operational costs for items such as broadcast programmes, pre- and post-experiment research and evaluation supply services and operational staff.