The paper was published in Vol 12 No 1, August 1982 and is based on a presentation that took place at the April 1982 SCTE meeting in London at the IEE and subsequent Northern presentation at the Mercury Motor Inn, Ainley Top, Huddersfield, later in April 1982. It precedes the submission of licence applications for the first round of multi-channel franchises and is an interesting insight to thoughts at the time.

New Trends and Developments in Cable TV Programming and Services

By D. W. HEIGHTMAN, C.Eng., FIERE (Fellow)*

Introduction

In the first part of this paper it is proposed to briefly review current trends in Cable TV in the USA and consider what lessons may be learnt in the application to the UK. This is, of course, on the assumption that the UK Government will eventually get round to giving general approval of subscription TV before the existing industry gives up the ghost.

USA Growth

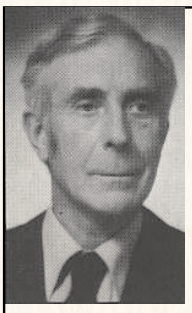
As is well known, the American industry did not begin to `take off' until additional and special pay channels became available on services which previously only relayed off-air channels to improve reception. Thus in 1968 only some 5% of homes had cable, rising to 14% by 1975 when Pay TV began.

Fig.1 shows how the situation has progressed since that time with some 25% or 20m homes now receiving cable. The contribution of Pay TV to the growth will be obvious.

Table 1 shows in broad terms financial and other statistics on the overall US Industry as at the end of 1980/1981. Assets totalling $4.46 bn. at the end of 1980 represented a $1.23 bn. increase in a year. That expenditure would have wired up the UK to some 25% saturation of 5m homes. It is likely to take us 5 years or more to reach that state - *once a* Government go ahead is given.

Channels and Programmes

We hear exaggerated numbers when people talk about the number of channels available in US Cable. Certainly, in applying for town franchises, companies vie with one another in the number game - 50 or more channels. It must not be overlooked that US channels are only 6MHz not 8MHz as in the UK and therefore 4/3 channels can be fitted in the spectrum. Table 1 also gives a realistic summary of the actual channels available - from which it will be noted that over 50% of systems still only had 6 to 12 channel capacity but the change is upward to 30+ channels.



Denis Heightman (Fellow) has been in the radio industry since 1928, having started as an engineer with Broadcast Relay Service Ltd. From 1938 to 1950 he was managing and technical director of Denco (Clacton) Ltd. and from 1950 to 1956 chief television engineer of English Electric Company, Liverpool. For the next five years he was technical director with the Radio Rentals group and from 1962 to 1965 was with the Relay Exchanges group and also managing director of Goodmans Loudspeakers Ltd., returning to Radio Rentals when the two companies merged in 1965.

With the introduction of colour television in the UK he was appointed first chairman of RCA Colour Tubes Ltd. in 1966. Until his retirement in December 1977 he was group technical director of Thorn Television Rentals and has continued to serve as a technical consultant to several companies in the Thorn group.

Mr. Heightman was president of the IERE in 1978-79 and chairman of the CTA at the same time. He was for five years chairman of the Radio Trades Examination Board and serves on technical sub-committees of the National Electronics Council.

Table 2. shows a random and fairly typical sample of West Coast, San Francisco Bay area, communities and Cable TV programming. Channels available range from 13 to 27 according to town and operating company.

There is an equally wide range of charges ($7.00 to $10.95) for the basic service, which covers off air stations, plus distant nationally available programmes received via satellite.

Payment is extra for each of the premium channels which mainly provide up-to-date films. According to geographic area those programmes come via satellite, micro-wave or video tape (bearing in mind the time change of 3 hours east to west.)

The premium channels referred to in Table 2 are as follows:

H = Home Box Office ($11.95). The first and most popular service - uninterrupted, uncut major movies.

C = Cinemax: a new supplement to H.B.O.

S = Showtime ($10.95) similar film service to H.B.O. and entertainment specials from Las Vegas etc. 24 hours.

* Consultant to Thorn-EMI Television Rentals Ltd.

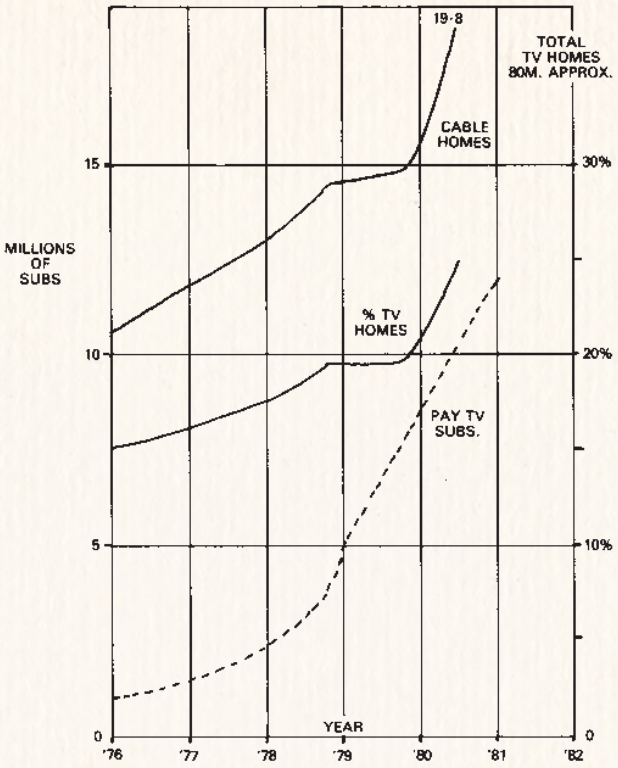


Fig. 1. USA Cable TV growth 1976-81.

USA NATIONAL CABLE TV STATISTICS

Sources: NCTA, TV FACTBOOK, BROADCASTING, F.C.C.

	1979	1980	
Industry Assets	$3.23 bn.	$4.46 bn.	+1.23 bn. (+38%)
Operating Revenue	$1.79 bn.	$2.2 bn.	+0.41
Net: before Tax	0.199	0.168	
Pay TV Revenue		$575 M	(25% of total)
National monthly rate	(premium chs.)	$9.13	
	Oct '80	June '81	
Subscribers	14.7 M	19.8 M	+ 5.1 M (+35%)
(5.1 M subs = + 1.23 bn. assets = $241 per sub (£134)			
Systems Total in US		4,637 (+11%)	
Channel Capacity:	6-12 channels	57%	(−10%)
	13-29 channels	26.5%	
	30+ channels	16.5%	(+7.3%)
Systems with public access		35%	(+11%)
Systems with government access		25%	(+12%)
Systems with educational access		36%	(+8%)

CANADA

	1979	1980
Subscribers	4.1 M	
Penetration	54%	
Average cost of installation		$200 (£95)
No Pay TV yet		

TABLE 1. USA National Cable TV statistics. Sources: NCTA, TV Factbook, Broadcasting, FCC.

COMMUNITY	SYSTEM	Basic Charge	Off Air CHS.	SATELLITE		PREMIUM	
				CHS.	SOURCES	CHS.	SOURCES
SAN PABLO	CENTURY	$8.03	12	NIL	–	1	H.
BERKLEY	BAY CABLEVISION	10.00	18	3	CN. GS. WTBS	2	H.S.
EL CERRITO	TELEVENTS	9.50	19	NIL	–	1	H.
OAKLAND	TELEPROMPTER	10.95	19	3	CN. ES. GS.	3	H. S. G.
SAN LORENZO	UNITED CABLE	9.65	15	7	CN. CS. GS. C. NI. WTBS. CH.	4	H. S. R. E.
CASTRO VALLEY	C.V. CABLE	9.95	19	5	CN. ES. NI. WTBS. WGN.	1	– S.
SAN RAMON	VIACOM	6.95	19	3	CN. GS. WTBS.	3	H. S. E.
DUBLIN	VIACOM	9.00	19	3	ditto	4	W. S. C. E.
LIVERMORE	VIACOM	7.00	20	3	ditto	4	ditto
PLEASANTON	VIACOM	7.00	15	0	–	1	– S.
FREMONT	FREMONT CABLE	9.50	17	3	CN. GS. WTBS.	2	H. S.
NEWARK MILPITAS	TELEPROMPTER	8.95	20	1	GS.	1	– S
ABBREVIATIONS: *SEE TEXT.*							

TABLE 2. Typical Programming examples - USA San Francisco Bay area.

R = Rendezvous R rated adult movies.

E = Escapade ($8.95) also adult channel R movies.

G = Gala vision ($9.95) Spanish speaking network: drama and entertainment.

The figures in brackets represent the additional monthly charges for the various services.

The satellite services referred to in Table 1 are as follows:

CN = Cable News Network: 24 hours of news; establishment by Ted Turner.

C = C-Span Daytime coverage of House of representatives in Washington etc.

ES = Entertainment and Sports Network, includes European and Canadian sport.

GS = Gill sports package including local area sports.

C = Calliope childrens programming: USA network.

NI = Nickelodeon; Warner Amex daytime programming aimed at young people, followed evenings by Alpha repertory TV Service; performing and visual arts.

Although we hear a great deal about special and 2-way services, apart from a very few cases the foregoing summarises what cable offers currently in the US. In the West Coast area, Viacom last year became the first company to offer a home security system at about one half the cost of a traditional system - available to some 30,000 homes in one district.

Most of the so-called "interactive" facilities are still "in the future". This is with the notable exception of the 'Qube' interactive system run by Warner Communications, in Columbus Ohio as a large scale experiment. The system is engineered on the latest 2-way cable basis, outward 40-300MHz 30 channels return 5-30MHz. Data is picked up from each subscriber in digital form, returned to the 'exchange' either (a) by the subscriber pressing one of the 5 buttons or (b) by a self-generated signal indicating to which channel 'sub' is tuned. The service requires a rather large and secure box within each home, in addition to the wire-connected programme selector unit for subscriber use. Externally also additional digital units, injecting into the main co-axial line amplifiers are mounted on poles etc. The service also gives central indications of the location of any failure on the system. The total cost is probably twice that of simple co-axial systems.

In addition to basic cable service, there is first a premium service, paid by monthly subscription, and then a third level of pay-per-programme. For the latter the price varies from say $2.50 upwards centrally recorded/billed. Some channels also provide a data service similar to Teletext. Such services can also be seen on several other town systems, often used for small 'ads' - local advertising.

From Table 1. it will be seen that there is an increasing number of systems offering public, government and educational services. The percentages in brackets represent the increase over the previous year.

Technical Features and Standards

The co-axial multi-channel VHF system in various forms is universal in the USA, i.e. there is virtually no HF multi-pair. Thus a great deal of standardisation and cost reduction can take place.

Some of the older systems of, say, 10 years of age use rather inferior cables and amplifiers than are now generally being installed. These older systems are, in many cases, being progressively re-cabled to modern standards.

There is now virtual standardisation on cables used. In many cases the outer conductor, of aluminium alloy tube, is exposed i.e. not PVC coated. On trunk lines cable diameters of the order of 1" are often used. These are 'air-filled'.

Most new systems are being installed with 2 cables for outward and return signal paths. The dual-purpose amplifier housings for these cables have plug-in amplifier modules and currently systems are being installed without the return path amplifiers in position. Thus conversion to 2-way could be made at a later date at some further expenditure but avoiding additional cable erection costs.

The continuous VHF spectrum from 50-250+MHz is used for outgoing signals and 5-30MHz for return signals (when or if required). Into this spectrum provision is made for 30 NTSC TV channels (6MHz wide) and a few companies go up to 36 channels. Qube are talking of going to 50 channels by extending above 250MHz.

Amplifiers for use with these systems are of modern solid state design, using push-pull circuits to avoid cross modulation problems.

Cables, amplifiers and other equipment are all carried on public utility poles, e.g. power and telephone. A galvanised steel stranded wire stretched between poles normally carries the cable and other equipment—this is called the "strand".

In some cases cable is run underground and with the use of modern cable laying machines and cables, costs are being reduced so that underground is not so much more expensive than overhead. The local situation very much decides the approach taken e.g. with soft road edges or behind homes in soft ground, cable laying underground is relatively cheap. With underground systems compact metal kiosks are used for amplifiers etc. at ground level, similar to UK practice.

Security aspects, i.e. the exclusion of subscribers only paying for basic cable service from receiving the Pay channel(s) is most frequently taken care of by the switched convertor used to transfer signals from the cable to the TV receiver. The TV receiver is left tuned to one VHF channel and channel selection is made on the convertor to the set, not remotely controlled. An alternative system is the use of simple traps which attenuate the vision carriers of the Pay channel(s) so as to spoil reception. These traps are mounted outside the home out of reach and are shorted out for Pay subscribers. Of the more sophisticated systems, the square wave sync. suppression 'scrambling' is most frequently used.

Several set makers now make 'cable ready' receivers.

Satellite ground station antenna dishes are firmly concrete block mounted on open ground unobstructed by objects such as trees, traffic, wire fences etc. The angle of reception - towards the equator, is quite acute, say 30° in most latitudes. The US satellites operate in the 4GHz region. A typical 5-metre diameter dish antenna costs about $12,000 and the complete installation, with frequency conversion (mounted at rear of antenna) to normal TV frequencies, taken by co-axial cable to the headend site about $20,000.

For good reception of normal off-air signals efforts are made to have aerials on hill tops with high masts and in open interference-free areas. Micro-wave links are very frequently used to couple these signals to distribution equipment in towns.

The FCC regulate Technical Standards and obligatory performance tests to which systems must comply. This performance is subject to annual FCC inspection. Special regulations apply to operation on channels outside normal off-air frequencies i.e. to avoid cable radiation interfering with other services. The regulations are too lengthy for me to make other than this brief reference.

What can UK learn from USA experience?

Given the same minimal degree of Government regulation to enable free enterprise to function, as in the US, there is little doubt that cable TV could be equally successful in the UK. The other requirement is an adequate supply and spread in character of programme material at competitive rates. It is evident that sufficient volume could be found if the scale of operation was large enough.

The Government and the Industry

Unfortunately, many of us have grown old waiting for various UK Governments and civil servants to make up their minds on policy. Currently we are running 5 to 7 years behind the USA in the development of a large scale national network, the only bright lights on the horizon are (a) the limited pilot subscription TV experiments permitted by the Home Office and (b) the recent favourable report from the Government's Information Technology Advisory Panel, which said there were powerful industrial and economic arguments for encouraging the installation of cable systems in Britain. Still not taking the advice of the panel, Mr. Whitelaw has delayed decisions for at least another 6 months whilst Lord Hunt examines the proposals - yet again! We live in hope!

Future Growth in the UK

As an exercise in predicting the rate of growth we might expect in Britain if the pattern was similar to that in the USA - except for a 7-8 year delay - I have produced the graphs in Fig. 2.

Since the larger US market has some total 80 million TV homes the figures have been scaled down to the smaller British market of 20 million+. The US annual growth rate curve in percentage terms has been applied to the UK position to reach 25% (5 million homes) in 6-7 years.

The British situation is complicated by the need for large scale and radical updating of existing systems, particularly HF, which have inadequate channel capacity. This updating would go on simultaneously with new installations during the first 4/5 years before the growth rate increased to some 500,000 homes/year. Prediction beyond that period is somewhat uncertain but at a guess, penetration might eventually reach 50% or 10m homes in a further 5-7 years with a connection rate peaking 1 million per year.

Engineering Standards

Assuming an eventual Government go-ahead, we shall be faced with decisions in respect of what basic cabling systems should be used. Obviously a move towards some standardisation is highly desirable in reducing variation in large scale production of systems hardware.

One simple course would be to adopt the latest USA co-axial cable tree network VHF system where techniques are fully established and costs largely known. 30 channel (UK 8MHz) capacity should serve adequately.

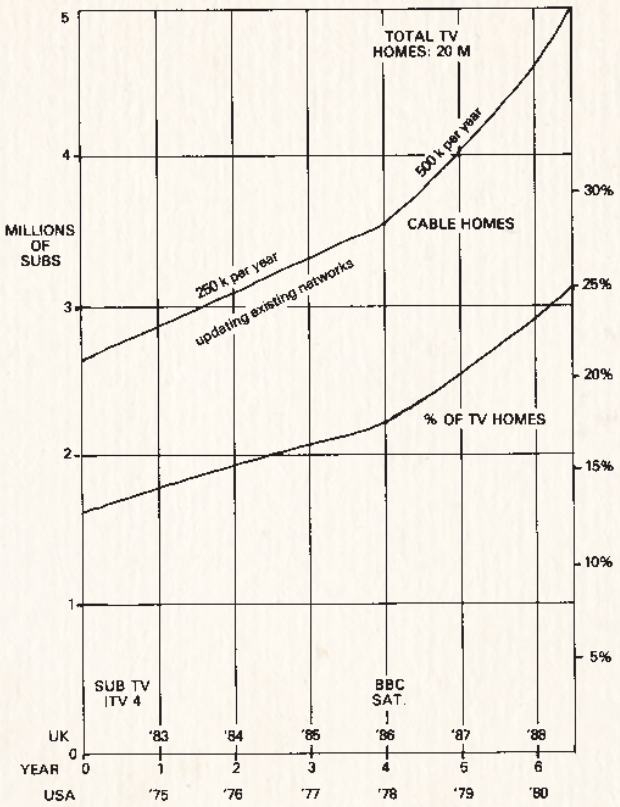


Fig. 2. A forecast for UK growth on USA Pattern scaled for market size.

We shall, no doubt, find it logical to build into any engineering standards adopted a requirement that systems are suitable or can be readily adapted for 2-way communication from subscribers to central points up to video bandwidth. Thus new and special services can be introduced as experience is gained and the economic position permits—as is the case in the USA.

Two $64,000 questions arise

(a) The future systems engineering proposals from the large HF wire pair companies e.g. Rediffusion.

(b) The implication of optical fibre technology in this overall picture.

In respect of (a) I am not aware of the forward thinking by Rediffusion in this connection but maybe we shall shortly learn more about their policy.

Whilst there are obvious applications for (b) fibre optics in wide band trunk links for Cable TV, the question of direct distribution by glass fibre to individual homes opens up major questions of which system to use and overall cost. I deal with some aspects of fibre optics application to cable later, but firm indications of cost are not yet available.

Capital Investment

(a) Assuming the national use of a co-axial network as a basis for comparison.

(b) Taking the growth curve of Fig. 2. for the UK.

(c) Allowing at 1981 cost £150 per subscriber for new installations and £100 for updating an existing subscriber, plus inflation 10% p.a. the cost after 7 years to a 5m total becomes £800 million approximately.

This compares with a USA cost for 5.1m subscribers of $1.23 or £683m. This calculation assumes that the existing approximate 2.5m subscribers would be updated in the first 4 years at the same time as new installations were proceeding at a moderate 250,000 per year. Subsequently the concentration would be on new installations at a 500,000 (increasing) rate per year.

These estimates take no account of capital cost for central equipment e.g. programme origination, head-ends and the like, nor scramble or descramble equipment.

Subscription TV Direct or via Satellite

As will have been already appreciated, the financial success of Cable TV in the USA has been very largely dependent on the additional revenue provided over the basic service by the Pay (We call it *subscription* advisedly!) premium channels. In the USA much of the transmission over the longer distances involved is by communication satellite (4GHz) not generally receivable by ordinary home viewers, direct to the local cable services. Apart from a few experimental cases there is no large scale direct broadcast satellite transmission as is now planned for the UK in 1986. This will therefore be a new factor in the UK case, where it is anticipated that many homes will rely on cable to provide the DBS reception. The main reason is likely to be cost of the home dish installation compared to cable but also some homes will be unsuitably located for installation of dish aerials to receive at low angles of elevation.

Additionally in the UK case, we may well use communication satellites to provide a wider range of international programmes for cable.

Whether receiving by satellite or more conventional means, cable companies need to provide security on those distribution channels calling for additional subscription (against interception by unauthorised people). There has been far from general agreement in the USA on common systems and standards of equipment to be used for this purpose and costs are higher than is desirable. This is an area worth detailed examination in the UK before major decisions are taken. I believe the BBC have yet to decide on what form of encryption (scrambling) they will use for the DBS channel.

It is acknowledged that the problem does not arise in a centrally switched distribution system as each subscriber has his own wire (or fibre) and scrambling is not required. Virtually every company that has looked at the question concluded that the most cost effective compromise for collecting payment for premium channels was on a monthly subscription basis rather than a pay-per-programme arrangement. With future develop- ment of 2-way services as per Qube, the point may be worth re-examination for special channels on a non-urgent basis.

For monitoring purposes, to measure viewing audiences it is also very desirable to have central indication of programme popularity - again a 2-way possibility.

Services other than Entertainment

In reviewing what is available in the USA, I have already touched on some outgoing services which will undoubtedly be made available as cable grows in the UK. These would include the following:

(a) Full time channel of News, Time, Weather and General Information

(b) Sports channel with local variations

(c) Children's channel including some educational items

(d) Parliamentary channel including relaying from Westminster etc.

(e) Local authority and local community channel

(f) Educational channel: providing a variety of courses, subjects and levels

(g) Datatext channel - like Teletext - but additional information including 'Cable What's On' - items for deaf people, local advertising etc.

Other services, mostly requiring engineering and commercial development would require a 2-way capability. These include:

(a) home security

(b) voting on various matters from preferences on programmes to government policy (local or central)

(c) armchair shopping

(d) video communication

(e) various interactive games etc. etc.

So long as the basic capability is built into the system, many of these services would be progressively introduced over the years as appropriate.

Optical Fibres—What Contribution?

I referred earlier to the uncertainty, mainly in respect of cost but also in respect of engineering and production readiness for applications to large scale distribution networks of optical fibres. The advantages of optical fibres over conventional `wire' systems are well known i.e.

(1) lower attenuation of a few dB per km

(2) higher information-bandwidth capacity

(3) smaller size and lower weight

(4) avoidance of electrical radiation problems

Against these advantages must be set the following disadvantages:

(1) the problem of making loss-free glass joints in the practical field case

(2) the losses which occur and problems of making tap-offs, particularly if a tree distribution network is attempted

(3) losses occurring at bends - which can be made minimal in practice

Because of these problems it is concluded that an optical fibre analogue of a co-axial cable tree network is not a practical or economic proposition. A switched-star network appears to be a better solution i.e. using one (or two) optical fibres per subscriber. Such a network would have a minimum of joints and no tap-offs. Amplifiers would not normally be used in town distribution i.e. up to 3 or even 5km. Techniques for handling bunches of fibres and cables in and out of ducts along streets, homes, etc need developing.

With a switched network a wide band TV capability is not required i.e. only one or two TV channels are needed at any one time but a return communication capability is required to operate the centralised switching. However, 'scrambling' for security is not required - a saving with switched systems.

In order to avoid the added cost of analogue to digital processing and the reverse, LED devices can be used for signal launching with intensity modulation. These devices are not only cheaper but more reliable than lasers.

Large scale experiments with networks on these lines have been and are being satisfactorily carried out in various parts of the world, but initial cost indications are higher than co-axial networks. I am attempting to obtain better forecasts for large scale production as it is vital to obtain such information before the country is committed to billions of L's expenditure in a 'national' network.

As I said earlier if distribution over fibres is not economic there is no doubt that the application, as per British Telecom to wideband trunks is and we may see a combination of fibre trunks/links and ordinary co-axial cable for distribution making up future networks.

TV Receivers for Cable

Several set manufacturers in the USA make receivers which are known as 'cable ready'. In general these receivers have additional interband VHF channel coverage and extended coverage to some 250MHz. The adjacent channel rejection performance is adequate and cross modulation effects in tuners are minimal. Direct signal pickup into antenna inputs is minimised by good screening and matching. Because of the small demand in the UK very little attempt has so far been made to make suitable receivers but some steps in the right direction have come about with the introduction of surface wave IF filters. Cable operators of co-axial systems in the UK have overcome the inadequate coverage of receivers by using convertors; a rather expensive alternative. The channel spacing on cable has also been set higher to avoid adjacent channel operation interference - which means fewer channels than possible with good receivers.

Most convertors include a descrambling section for the Subscription TV channel(s). However, if receivers covered the cable channels the descrambling arrangement could be a more compact wall-mounted affair only available to Subscription channel subscribers.

An advantage of receivers with full channel coverage is that the very desirable remote control circuits can be built in, whereas the cable convertor box has to be wire-connected and also needs a mains supply cable. With the increased popularity of cable in Europe, we shall probably see an increase in supply of suitable receivers.

Of course, in the event of using a switched network receivers will only need one input channel.

Discussion

Mr. D. W. Heightman: Perhaps I could ask Mr. Fabich a question to start the discussion. This relates to *why* you were putting in optical fibre links in place of the microwave. Was this because of reliability, or because of the cost?

Mr. W. Fabich: That is a question which is actually decided by our PIT. Normally the frequencies in densely populated areas are occupied by other services and they tend to run out of frequencies. So the first ones they push out of the air are those who are not strong enough to say: "We have to stay in." The PTT decided that they would have a temporary solution for six to seven *years* with microwave and that after that they would make cable systems.

Now, we are not opposing that, because we will take out one microwave and then the next one, and we shall start gaining experience with optical fibres in trunk connections. However, when starting cable TV it is obvious that microwave is the quickest solution, because when you think how long it takes to lay a cable of eight or ten kilometres, with microwave it only takes four weeks. It is not only a question of economics with us, but a question of becoming acquainted with new technologies. I am sure that microwave with a trunk of 10 to 12 kilometres is cheaper than an optical fibre connection.

Mr. S. Kharbanda /Labgear Ltd.): I noticed on of the diagrams that Mr. Fabich displayed that elements of the system showed a two-way capability. My first question is this: Is the two-way capability being used at the moment and, if so, for what purpose?

Mr. Fabich: We have a double cable system, with two cables transporting nine TV channels. It is a VHF system, with a return path possibility. We have plugged in all our amplifiers to the return module. So we have a return channel from 5 to 25MHz. It goes from the headends to the conversion stations. At the present time there are 60 conversion stations in Vienna, and when we finalise our system in 1985/86 there will be 150. At the moment there is neither supervision nor anything else, but our idea is that in the future there might be local events taken up by TV cameras, brought back to the centre and then distributed via the main TV network. Financially it is good, because people are already temporarily renting these free frequency bandwidths for data transmission and TV transmission. We rent it to anybody who would like it, but it is only in that part of the network that it is two-way.

Mr. Kharbanda: Secondly, is there any form of pay television mooted for your country. I believe that there is no pay television at the moment. Do you know whether you will have pay television in Austria within the next five years?

Mr. Fabich: In the next five years, yes: in the next three years, no. In Austria the law is that broadcasting is only allowed to be done by the State-controlled broadcasting company, ORF, which has the monopoly. So at the moment you start with local programmes and community programmes. In fact even the city of Vienna is not allowed to make its own programmes, and that is the law. It really depends on the political scene and what will happen in the next elections in 1983. In our country and maybe in your country, too, cable TV is a very political item. Both the ruling Socialist Party and the Conservative Opposition Party are in favour of local programmes if they can gain anything from that move, but it will take another three years at least.

Mr. Kharbanda: My last question is a technical one. Could you tell me, please. whether in Austria the West German FTZ regulations concerning radiation leakage are mandatory? Do you have to have equipment which meets the West German FTZ regulations, as far as radiation leakage is concerned?

Mr. Fabich: Are you referring to cable or to amplifiers?

Mr. Kharbanda: To the complete network.

Mr. Fabich: We have radiation regulations which are quite similar to the German ones. We have never succeeded in measuring these leakages, but in principle we do have similar regulations.

Mr. R. J. Seacombe *(Visionhire Cable):* Mr. Fabich, can you give us a little more insight into how you intend to use glass fibre links? Will these links be owned by Telekabel, or will they belong to the PTT? Also, what system of transmission will be used? Will you use one fibre per programme with digital transmission, or will it be an analogue system?

Mr. Fabich: In answer to your first question, our system technically is licensed by the PTT and, therefore, the PTT controls what we do. At the moment they are getting terribly nervous as to what we are going to do in taking out just one glass fibre. As the technical manager I feel that if we put the glass fibre either into the trunk or into the subscriber's premises it must be a digital transmission. Commercially speaking we have no reason for putting the optical fibre into the trunk, into the subscriber loop or outlet. Why do I say that? My personal feeling is that when you put in glass fibre it will be an integrated system of digital speech, digital TV, digital data, digital text, and so on, and then all the PTTs in the world will not allow private companies to operate, such as TV distribution, and they will try to regain the territory they have lost. Perhaps that is only in Austria. They have opened up once to private operators for cable TV. There will be optical fibre systems, and you have heard of the German system with two fibres from the last exchange. Our sister company
Germany is working on that, but we regard that purely as the TV business. We are very happy to have our TV distribution with the three-stage co-axial network and we hope that we will go on for another 30 years.

Even if you asked for my technical advice, I could not recommend even to put one metre of glass fibre into the ground today, because if I have to use it commercially for 30 years I do not know which type of glass and which type of amplifier, etc. However, we are a small country and we have not got the problem of a national electronics industry which should export and which should be in the forefront with regard to development; we can just look at what happens around us.

Mr. M. A. E. Butler (Philips Video): Mr. Fabich, since you are allowed to distribute German programmes, what is the position about distributing programmes from OTS, if this satellite company gets going?

Mr. Fabich: We acknowledge that the OTS satellite is not a direct broadcasting satellite, but a communications satellite. So we think that only the PTT are allowed to receive those programmes. We said to the PTT, "Buy a reception station and give us as cable TV operators in Austria, and specifically in Vienna, the decoded programmes." The PTT agreed to do that, except for one point. By Austrian law the cable distributors are only allowed to distribute programmes which are already broadcast. Now, as we have agreed, the OTS is not broadcasting, because it is a communications satellite. We hope that in three or four months there will be a transmitter in Malta. That means that the OTS programmes go to Malta and are transmitted by a terrestrial TV transmitter. So it is then broadcasting and it does not matter for our laws where it is broadcasting! So we are a very happy country. *(Laughter)*

Mr. Butler: Mr. Heightman, if the proposals in relation to cable are ultimately for a national type of system, obviously it will be quite a different situation to what we have at the moment, where each cable company has been able to put in its own system and have whatever type of receiver it likes at the end of the line. There is obviously an interface problem at both ends of the system, particularly if it is two-way. What do you think the problem is going to be in terms of getting some sort of standardisation for this?

Mr. Heightman: Not knowing the views of the companies directly involved, it is a little difficult to answer the question. I was surprised to find fairly heavy support for the co-axial system in the Information Technology Advisory Panel's report. I also noted that they wanted to appoint a technical committee, and certainly that committee is going to take some very short cuts if they are going to obtain suitable answers in a short time.

Otherwise I see it running as it has for many years; in other words, every town has its own system and it is the interface that becomes important. Of course, those towns that look into the future sufficiently will be putting in maximum channel capacity up to 30 channels as soon as they can. The exact means of doing it is not vital, provided that receivers normally bought or hired off-the-shelf can be readily connected.

I think that one has to take that view and, taking my growth curve in the UK, with the best will in the world I would guess that in the first five years we shall not only be putting in new installations in the order of perhaps 200,000 a year, but we shall have to update a similar number, and it is quite evident that that is going to take us at least five years to do.

So the overall answer is probably the usual English one of compromise, with the ultimate hope that standardisation will come along, because that is vital from a manufacturing point of view. If we are ever going to get large scale manufacture in the UK of cable and equipment, then we must have some sort of standardisation.

The only other point is the relevance of optical fibres. In the trunk side and the links, that is all right, but the distribution aspect is a bit trickier. I am already reacting against digital in favour of analogue for cost reasons. It can be shown that over short distances of three to five kilometres the intensity modulation of LEDs is a much more economic proposition than high power lasers with their attendant unreliability. So I still see that as a question to which the ITAP technical committee will have to find some answers in the context of final decisions on a system for the UK.

Mr. D. Howe (Philips): I wonder whether either of the speakers would like to comment on the development of the cable system in Japan and do they have any experience of that?

Mr. Fabich: I am sorry, I cannot. I just do not know what they are doing.

Mr. Heightman: I did refer earlier to the Hi-Ovis experiment which took place about two or three years ago. I believe that this has almost closed down, but there were about 170 homes involved, each with a separate fibre that was intensity modulated. I forget the name of the company who developed the LEDs and the system for the purpose, but it was a two-way system, with one fibre in and another one out, and it included a camera in each home.

The question seemed to be more one of proving the engineering capability than one of overall cost. The initial investigation showed the cost to be prohibitive. The only one I know of where the cost was quoted was in Manitoba, Canada, where a figure of ten times the cost of a co-axial system was quoted for direct distribution. Again, that was fairly small scale, but it was ten times too high. In the case of the Milton Keynes experiment, cost was not the vital consideration, it being carried out by British Telecom; it was a case of proving the system.

Mr. Howe: It is very interesting, I think, that the statistics which are published do not refer to the situation in Japan. I really wondered why that was, in view of the fact that the density of population obviously lends itself *very* readily to this.

Mr. Heightman: Yes. In fact we did have an executive in Japan recently and I asked him to try and find out what had happened to this Hi-Ovis experiment, but he was unable to do so. He spoke to some well-known companies and they were unable to tell him. So I am still wondering what the outcome of the experiment was, apart from the fact that there is a technical paper which says that the reliability over a two-year period was excellent, with no problems. That was a switched system, by the way, with one fibre and no joints.

Mr. A. Burke (Visionhire Cable): Mr. Heightman, have you any more information on security systems on cable in the United States? We hear that there is quite a movement towards the more sophisticated addressable systems. I wondered the extent to which companies over there are spending fairly large amounts of money to move from some of the simpler trap type security systems to the addressable variety?

Mr. Heightman: I do not have much information currently on the system to which I referred. It was a short visit and there was no-one around with the engineering capability to answer my questions, even if they had been prepared to. In terms of addressable systems, the development is going very, very slowly. One or two companies do have addressable systems, particularly related to what they call the tiering of subscription payments, i.e. the number of channels they have, at different rates of subscription. I am hoping to get a great deal more information, but at this moment I am lacking information on the system that is used.

I have mentioned in my paper that the overall question of the collection of the money, scrambling, and so on, are things which this technical committee wants to consider very carefully. Those of us who have been involved in pilot experiments have found various problems with the multitude of different systems coming out of the USA. For pilot purposes you are almost bound to go to the USA for your headend coding and decoding equipment, and this is a very big problem, because virtually every manufacturer you talk to has a different system.

Of course, the scrambling system should be fairly unbreakable, but on the other hand they have taken this rather too far in terms of reducing production quantities to very small numbers. In this connection, I think the BBC have not yet decided what they are going to do about scrambling their second satellite channel. Here again, this is a vital one for the cable industry and it needs a great deal of study.

Mr. Burke: Quite obviously the important aspect in this respect is the extent of pirating, and that is the object of the trap or decoder in the first place. On *your* visit were you able to obtain any information with regard to this?

Mr. Heightman: Yes, it is remarkably small, even with the simple systems, and it is considerably lower than one per cent. In fact I visited a fairly big company on Long Island who keep statistics. It is very difficult finding out, of course, and it is like checking the by-passing of the electricity meter when people are actually doing it, but their statistics showed something like 0.2 per cent - it was very, very low. They were using a square wave sync. suppression system.

Mr. Kharbanda: Could I ask Mr. Heightman to comment on the relative popularity of subscription television in America compared with pay television? I believe that in a number of areas the MDS system prevails with subscription television. The total numbers of people, of comm. are much less on subscription television compared with pay-TV, but in the areas where there is subscription television how does the relative popularity compare?

Mr. Heightman: This is really a question of how does the satellite experiment, if I can call it that, compare with cable? My experience is that it

is so smallscale that it is very difficult to get statistics. There are only about four or five areas where this has taken place and I think it is a bit of a dead duck, as far as I can make out. It is a different situation to what may come along when the BBC and possibly IBA have coverage of the whole of the UK on one satellite.

Mr. Fabich: In the States, when we speak of subscription TV, you must also bear in mind that it is the code from a terrestrial transmitter and it is coded by the broad-casting transmitter.

Mr. Heightman: I am sorry, I thought you were referring to the satellite. In fact that is almost negligible and it is certainly not moving in relation to cable in any area.

Mr. A Wells (Telephone Cables Ltd.): You have implied that you would like to see fibres in the star network to subscribers as opposed to cable. Provided the economics can be got right and the price of the fibres can be made more reasonable, I would like your view as to why you believe fibres offer advantages in this area?

Mr. Heightman: Well, the simple advantages are well-known. Other than the possibility of the mechanical handling aspect, there is the relative light weight, compactness and freedom from electrical radiation problems, which are increasing so far as cable is concerned. The engineering, screening, and so on, which is necessary on co-axial systems or any cable system is quite rigid if you are to comply with the regulations. In the longer term it is *very* probable that the material costs of optical compared with copper cable could be considerably less with large-scale manufacture. These are quite simple advantages and there nothing very scientific about it. Because of the difficulty in working in field conditions with fibres, one sees the need to go for a star network, rather than the impossible technical problem of a tree network, except for linking large areas - for trunk purposes, or links in place of microwave.

Mr. Wells: Do the problems of interference outweigh the advantages?

Mr. Heightman: Probably, yes.

Mr. Fabich: I always have problems increasing the bandwidth in glass fibre in comparison with co-axial cable.

Mr. Heightman: It depends to what kind of glass fibre you are referring.

Mr. Fabich,: We are discussing glass fibre to the subscriber. It should be a good one, but it must be low cost, because it will go to millions of homes. A co-axial cable has a bandwidth of I GHz and goes from 60 Hz right up to 800 or 900 MHz without any difficulties. You have to compare that with the optical fibre. Is it practical, not economical, to have a star-shaped network? If we agree on that, then we obviously come to the optical solution.

Mr. Heightman: Could I say that one does have to bear in mind that when the question of security crops up, again a switched network makes that *very* much more simple, because you are not involved in scrambling as you have an individual cable going to every home.

Mr. Fabich: In our system, if there is a large apartment house all the cables go down to the cellar and you have a box down there with all the outlets. For safety, for tapping reasons and for serviceability such a star point is *very* nice. Because they have that philosophy the PTT are always in favour of a star network. Then the industry started to think about loops, which everybody uses today, such as in data transmissions and in-house networks, but that is something unheard of by the PTT. For them that is impossible - every subscriber must get his copper cable from their star! It has its advantages, but it costs a lot of money and I cannot see the private investor investing in such networks. It can only be done out of the revenue of the PTT and the telephone service, because it takes 80 or 90 years to have all the homes connected.

Mr. L. T. Mudd (Rediffusion Engineering): It is probably covered in his paper, but I would like to ask what Mr. Heightman thinks of the differences that exist between the situation here and the situation in the USA, and the wisdom of trying to transport a distribution technique across the Atlantic? In the USA the VHF bands are used for terrestrial television. Here I should think there must be at least six people using them at the moment to receive 405-line transmissions. We are going to lose a little of Band I to mobile radio shortly, but what the fate of the rest of Band I is, I do not know. The takeover could extend to Band 3 and we could have the Gas Board, British Telecom, or somebody radiating like crazy in a bit of the spectrum which is a vital part of the US type of system.

Secondly, in the US they do not need safety isolation in the co-axial feed to the receiver so that they do not have a capacitor on the inner or the outer. On the Continent there is a capacitor on the inner and the outer has to be earthed, as it does in the States. As far as I know, only we and South Africa are silly enough to put a capacitor on the outer conductor. Even if that capacitor is made truly co-axial, which has advantages, you are still in trouble with immunity. At the point where your signal is lowest, that is, at the subscriber, that is the very point where you might find the Gas Board van outside radiating and it is also the very point where you have to have cheap cable, as Mr. Fabich has pointed out.

So with those differences in mind, Mr. Heightman, would you advocate copying an American VHF type system in this country for 30 channels?

Mr. Heightman: I would not call that a 64,000 dollar question, but it is at least 32,000! I would go as far as saying that if it cannot be extended upwards above the normal VHF to 300 or possibly even 400MHz, then we have got to have serious thoughts about what system we are going to use. To go into the UHF band with its attendant greater losses in cable, particularly, is practical on short distance distribution possibly, but as an overall network we are going to put up the cost of the co-axial system quite considerably if we shift up very much higher.

On the other hand, the work we have done does show that the systems themselves can be kept down to the required limits of unwanted pickup by good engineering practice. You quoted the front end of the receiver and particularly the co-axial antenna terminal and its isolation. Work has been done by various people in an effort to reduce this problem. I must admit that I am not right up-to-date on what level of protection there is, but I believe that some tests have shown that the modern is satisfactory. I do not know receiver whether anybody could help me on that point. Certainly I would say that it is something we ought to straighten out on the receiver, rather like other aspects, such as adjacent channel rejection, cross-modulation and so on, which will be necessary if we are going to get anything like 30 channels on VHF, which is the sort of number required.

Our solution in the interim is a converter, which has all the desirable characteristics, ahead of the receiver, but it still does not necessarily stop the receiver picking up some unwanted radiation if it has a bad co-axial input. I think I can summarise by saying that have to adopt pretty well a duplicate of the USA, but in UK terms with 8MHz channels, or something very different, and this is a job for the technical committee.

The President: I must now close the meeting. Time has been very much against us, but on your behalf I would like to thank our speakers for their excellent papers. Let us hope that, before long, cable television activity in this country is just as extensive as elsewhere in the world. Please join me in showing our appreciation to the speakers in the usual *way. (Applause)*

Discussion at the Northern presentation at the Mercury Motor Inn, Ainley Top, Huddersfield, on 7th April 1982, with Mr. W. Beesley in the Chair.

Mr. John Sunderland (Rediffusion Yorkshire) enquired how franchises for cable systems were awarded in Austria. Mr. Fabich replied that the local councils placed the franchise on open tender. Interested companies must be prepared to totally finance the venture and accept the councils' decision in respect of choice of programmes distributed. It is usually the case that the Company submitting the proposed lowest subscriber input charge is awarded the franchise.

Mr. D. Coomber (Gould Instruments) commented that he was of the opinion that the SCTE should be making recommendations to the Government as to the type of cable networks to be used in future national developments.

Mr. Heightman was in full agreement and made the point that Fellows and Members of the Society were currently involved with their Companies on this very matter.

Mr. R. G. Betts (Sapperstein & Assoc.) referring to Mr. Heightman's paper in respect of Interactive Channels, stated that his Company had experienced problems and loss of data due to insufficient/ineffective coax cable screening.

Mr. N. McDonald (Raydex International) taking up this point said that cables with sufficient isolation could easily be produced. providing the user was prepared to pay.

Mr. Fabich stated that in his opinion it was false economy to install inferior cable when labour constituted the greater percentage of installation costs. In Austria financiers of cable systems were happy to bury their money, i.e. copper taped cables underground, secure in the knowledge they were the best money could buy, and would not require exhuming.