# TELEMATIC NETWORKS FOR OPEN & DISTANCE LEARNING IN THE TERTIARY SECTOR
# Final Report
# Volume 2

*Final Version*

**RATIONALE AND WORK PROGRAMME**

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# Executive Summary

This is Volume 2 of our Final Report of the DELTA "CCAM" Study Contract "Telematic Networks in Open and Distance Learning in the Tertiary Sector". In contractual terms, it forms Deliverable 3 of the Study. The summary that follows covers *both* volumes of the Final Report.

*Organisation of the Study*

The study was carried out by the project office of the European Association of Distance Teaching Universities (EADTU) under the direction of the general project manager Nicholas Fox. The work was primarily undertaken by two member institutions of EADTU:

1 The UK Open University (UKOU) led the survey, scenario and policy aspects.

2 The National Distance Education Centre (NDEC) in Eire undertook the cost analyses.

During the course of the study there was regular consultation with the EADTU Board and with the Media Methods and Technology Working Group of EADTU.

The Report is relevant to so-called "traditional" universities wishing to use telematic networks for teaching as well as to "distance teaching universities". (It should be noted that EADTU contains many traditional universities within its organisation as well as open universities and several dual-mode organisations.)

*Deliverables*

The project had three Deliverables, produced as a two-volume Final Report:

Volume 1 "Scenarios, costs and survey" covers Deliverables 1 and 2

Volume 2 "Rationale and work programme" covers Deliverable 3.

*Work plan*

The work plan had six components. In the list below we describe them and give volume and chapter references:

a The specification of hypothetical but potentially realisable scenarios relating to the use of telematic networks in tertiary education (by campus-based or distance universities). [Volume 1 Chapter 2]

b A postal survey of 760 degree-awarding university-level teaching institutions, primarily in the member states of the European Community (but also some in other parts of Europe), and a subsequent telephone survey of selected institutions. The objective of the two surveys was to identify the potential demand for telematic networks in tertiary education. [Volume 1 Chapter 3]

c An economic analysis of the comparative cost of using each of four media within the context of the scenarios (see (a) above), relative to the cost of providing the same programmes through a more conventional mode of teaching. In addition, an estimate was derived of the cost of equipping learning resource centres (Euro Study Centres), based on specifications prepared by EADTU. [Volume 1 Chapter 2]

d An analysis of trends in the use of telematic networks in education and training, drawing on a range of sources and in particular on results from the JANUS project. [Volume 2 Chapter 5]

e The formulation of policy recommendations for the development of European telematic networks to meet tertiary level education and training needs. [Volume 2 Chapters 6 and 7]

f The formulation of proposals for future work both short-term and longer-term. [Volume 2 Chapters 8 and 9]

*Conclusions*

The conclusions are in three parts:

1 General conclusions

2 Conclusions on particular media

3 Infrastructural conclusions.

*General conclusions*

1 Our survey work shows interest, but non-specific interest, in the potential of telematic networks

2 Standardisation is required in order to avoid the problems, and associated cost increases, of having to buy different products to fulfil similar requirements. For example:

- having to buy an extra or more complex satellite receiver because education and training channels are on different satellites [as were EUROSTEP and EuroPACE]
- having to buy a different type of microcomputer from that used for administrative tasks [for example if teaching needed a PC but administration was done via dumb terminals on Unix].

3 Media/technologies should be used *extensively*, if users wish to gain economic benefits from them:

- both for large numbers of students
- and for a large number of study hours.

4 Where telematic networks can be developed on existing infrastructure, the fixed costs can be reduced. For example:

- using mainframe computing power in the evening to support student access [at times when administrative use and staff access is light]
- using a satellite for which many users already have receivers or could be "easily" persuaded to buy them [such as Astra]
- use of existing computer networks cost-justified for other purposes such as research [such as the national academic networks].

5 Even now, little is known about *true* costs in *actual* situations.

*Conclusions on particular media*

Some of our main conclusions are given below. It should be stressed that our conclusions are mostly phrased in terms of *overall* system costs including student costs. The issues of who actually incurs the costs and who notices them raise complex organisational and political questions.

- *Satellite TV* in most cases is less cost-effective than postal delivery of videos; but can become cost-effective as the number of students grows large. In addition, given the under-developed character of postal services in some parts of Europe, and the complexity of working with several national systems, satellite TV offers a single integrated solution to the requirement of Europe-wide delivery of video. The apparent cost-effectiveness of this increases if use is made of domestic satellite TV receivers and overnight transmission time.
- *Computer conferencing* has limited economies of scale because of the need for tutor/student ratios similar to conventional tutorials. It is therefore less cost-effective than commonly believed for large numbers of students. However, if students have home or workplace access to the appropriate hardware, software and telecommunications, it can provide an effective method of extending access and support even for small study programmes.
- Video conferencing used for video lectures can be cost-effective at relatively low hours usage per year. At present, however, the initial capital outlays required are substantial. A potentially significant factor affecting costs is the decreasing requirement for bandwidth, opening the way to the use of ISDN in video conferencing and substantially reduced charges. If network bandwidth is apparently free (as on many academic networks) this has a substantial effect on apparent costs.

*Infrastructural conclusions*

The cost analyses are restricted to a small number of specific scenarios – however, these have been chosen to be typical of operational use in North America and operational, pilot and planned use in Europe. They strongly suggest that the common assumption of the universal cost-effectiveness of telematic networks is unsupported, and that the use of these technologies needs to be carefully focussed if resources are to be deployed effectively.

They also suggest that factors tending towards cost-effectiveness include scale of use, both in number of students and number of study hours, and use of existing equipment and services on a marginal cost basis. But one cannot have marginal costs if there is no basic tier of service on which to add marginal costs.

They also bring out that there are many limitations of the analytic method, including the fact that it is in practice impossible to substitute one medium for another (is live television the same as video?) and that there are many factors which are either hard to cost or where users (such as students) make economically unjustified decisions (such as over phone bills, TV costs or car use).

And of course it is well known that there are few reliable studies of the cost of telematic networks in operational use.

This suggests that:

a A number of pilot trials are set up to get better information on the cost factors in the context of educational practice.

b A European Telematics for Education Infrastructure is set up so that real-world trials can be undertaken without getting bogged down in heavy start-up costs and complexity.

*Recommendations*

In order (a) to make best use of existing infrastructures (run by PTTs, etc) which fulfil part but not all of the operational requirements for telematic trials and (b) to avoid setting up a new large infrastructure – plus organisation to run it – which may not (yet) be justifiable, we propose that a small infrastructure organisation is set up as a "telematic network broker". This would operate rather like a package holiday company. It would purchase telematic services from PTTs, academic networks, and others, and supply them on an agreed basis to universities who wish to use telematic services for the provision of programmes for credit.

A subsidy for this broker should be available from the EC on the usual matched-funding basis.

The broker would be overseen by a board which would include a substantial representation of those universities making use of its services.

This scheme would give hard information about the demand for such networks. It would also give universities the experience of using telematic networks with the ease of use and low tariffs which market forces would *in the long term* produce if only the market were kick-started.

The broker would provide telematic services for a number of pilot projects but would not be restricted to these. The pilot projects should include the following six applications:

- Video lectures (satellite and ISDN) such as for post-graduate courses for credit.
- Voice mail and audio conferencing such as for language teaching.
- LAN linking by ISDN such as for support of tutoring in Euro Study Centres.
- Two-way video conferencing such as for a "virtual summer school".
- Integration of CD-ROM with networks such as a multi-media courses database allowing on-line registration for courses.
- User-friendly computer conferencing for home-based users such as with windows-based conferencing software over higher-speed links.

These six applications should provide a good range of trials to satisfy universities both in the distance education area and the area of traditional universities considering distance education methods. They also contain relevant trials for our

partners in the other sectoral studies. We believe that the Infrastructure can be set up to service all three sectors studied.

# Contents

# Volume 2
# Rationale and Work Programme

## 1 Introduction

### 1.1 Scope of the study

This is a short section to remind readers of the context.

The overall objective of the EADTU CCAM study is:

- To investigate the feasibility of implementing a European telematic infrastructure for distance education linking service providers (distance teaching universities and "traditional" universities) and end-users, in the different European countries.

There are three subsidiary objectives:

1 Production of realistic and acceptable technical specifications for the network.

2 Identification of potential actors willing to commit themselves to the creation of the network.

3 Commitment of sufficient actors to an Action Plan for implementation of the network.

The EADTU CCAM study is one of a group of four studies, two on other sectors of education and training and one (managed by IDATE) on common aspects and technical specifications for the infrastructures. It is likely that one overall infrastructure may emerge rather than three separate ones, but that issue is outside the scope of our study.

### 1.2 Structure of this report

This volume comprises Deliverable 3 of the study.

It provides a rationale and then a proposal for a strategic European plan for implementation of an infrastructure supporting scenarios which the previous work in the study has judged to be economically viable, taking into account the views of the institutions interviewed.

It identifies some of the potential actors willing to commit themselves to the creation of the infrastructure. No doubt further actors will emerge during the period when the trials are formulated.

### 1.3 Acknowledgements

To our co-workers on Volume 1 (Adrian Rawlings, Robin Mason, Seamus Fox, Valerie Hogg) without whom we would have no data on which to base our plans!

To colleagues in our own and other institutions who have listened patiently at various seminars and workshops to the ideas developing over the last few months.

# 2 Review of position

Volume 1 of our Report contains a comprehensive review of five emerging scenarios for open and distance learning using telematic networks, intertwined with a thorough economic analysis of the main scenarios. It also contained the results of a survey of organisations interested in distance education.

In the three sections below we review the conclusions that were reached. To help the analysis in Chapter 3 we underline the parts of the conclusions that are particularly relevant.

## 2.1 General conclusions

Volume 1 comes to the following general conclusions:

1 Our survey work shows interest, but non-specific interest, in the potential of telematic networks

2 Standardisation is required in order to avoid the problems, and associated cost increases, of having to buy different products to fulfil similar requirements. For example:

- having to buy an extra or more complex satellite receiver because education and training channels are on different satellites [as were EUROSTEP and EuroPACE]
- having to buy a different type of microcomputer from that used for administrative tasks [for example if teaching needed a PC but administration was done via dumb terminals on Unix].

3 Media/technologies should be used *extensively*, if users wish to gain economic benefits from them:

- both for large numbers of students
- and for a large number of study hours.

4 Where telematic networks can be developed on existing infrastructure, the fixed costs can be reduced. For example:

- using mainframe computing power in the evening to support student access [at times when administrative use and staff access is light]
- using a satellite for which many users already have receivers or could be "easily" persuaded to buy them [such as Astra]
- use of existing computer networks cost-justified for other purposes such as research [such as the national academic networks].

5 Even now, little is known about *true* costs in *actual* situations.

## 2.2 Conclusions on cost-effectiveness of telematics

- **There is no general cost-justification of telematic networks based on our scenarios**. The general cost-effectiveness of telematic networks is unsupported by our scenario calculations.
  (Yes, this conclusion is contrary to much received wisdom!)

- **Our scenarios are valid and relevant**. The scenarios were based on existing practice or small extensions of that; and we assume that existing practice tends to focus on the areas where there is some belief in cost-effectiveness. This was confirmed in the survey – no significant alternatives were mentioned by mainstream providers. Thus we believe that our scenarios cover most of the practical possibilities.
- **Nevertheless** there are many specific areas where telematic networks make good sense from a perspective encompassing economic, organisational and educational factors.
- **Furthermore**, cost-effectiveness increases when careful use is made of existing infrastructure and careful "in-fill" developments.
- **But** really confident predictions can be made only when large-scale carefully-evaluated pilots in major existing actors have been carried out.

### 2.3 Specific media

We can also learn more about the general situation by looking at the conclusions on specific media.

- *Satellite TV* in most cases is less cost-effective than postal delivery of videos; but can become cost-effective as the number of students grows large. In addition, given the under-developed character of postal services in some parts of Europe, and the complexity of working with several national systems, satellite TV offers a single integrated solution to the requirement of Europe-wide delivery of video. The apparent cost-effectiveness of this increases if use is made of domestic satellite TV receivers and overnight transmission time.
- *Computer conferencing* has limited economies of scale because of the need for tutor/student ratios similar to conventional tutorials. It is therefore less cost-effective than commonly believed for large numbers of students. However, if students have home or workplace access to the appropriate hardware, software and telecommunications, it can provide an effective method of extending access and support even for small study programmes.
- Video conferencing used for video lectures can be cost-effective at relatively low hours usage per year. At present, however, the initial capital outlays required are substantial. A potentially significant factor affecting costs is the decreasing requirement for bandwidth, opening the way to the use of ISDN in video conferencing and substantially reduced charges. If network bandwidth is apparently free (as on many academic networks) this has a substantial effect on apparent costs.

## 3 Implications

Let us now reflect on the implications of the statements in Chapter 2.

Marginal cost and scale issues

If you look at the statements that we have underlined (with single underline), they point to two factors:

- large scale of use, both large student numbers and large number of study hours
- use of existing equipment and services (or such as can be cost-justified outside the educational parameters) on a marginal-cost basis.

A fundamental problem with a marginal-cost approach is that there has to be a basic service on which to build the marginal one. To give two concrete examples:

1 If there is no satellite TV channel on which one can buy cheap night-time transmission then there is no point writing reports extolling the virtues of cheap night-time transmission!

2 If there is no academic network connection to a particular university (and in southern parts of Europe many universities are still not connected in a realistic way – that is at 64 kbit/s or more – to academic networks), then there is no point recommending that university to use the academic network for video conferencing!

The problem with large scale services is that this is not the way that innovation typically happens in education. Education starts small, then scales up if the initial small scale trials are successful. But the earlier conclusions point to the fact that small scale trials will *not* be cost-effective, unless using services tariffed as if the trial was making large-scale use. (We avoid the emotive word "subsidised". There would need to be pump-priming funds to get over the hump of early small-scale use but the subsidy could taper off as the volume of use rose.)

Trials issues

The statements that we have underlined with double underline point in the following directions:

- the need for more trials on realistic networks in order to get better information on costs, bearing in mind the inevitable limitations of our predictive methodology (in particular, the fact that media are not as individually interchangeable as we have to suppose)
- the need to take notice of justification of use of telematic networks other than cost-justification (noting that humans, including students and teachers, do not always behave in strictly economic terms).

Other issues

There are some other issues that we should point out now.

- The ERASMUS scheme has been a good way of encouraging student mobility, in the interests of encouraging European integration. But ERASMUS

affects only a small percentage of students. Why not move the *courses*, not the students? Telematics could assist that process.

- Much course provision takes place on the local, regional or national scale; much less yet on the pan-European scale. It is necessary to ensure that telematics has a beneficial effect on all these levels. For example, if it only were to affect the pan-European level, it might never gain the interest of a critical mass of open and distance learning course suppliers.
- Notwithstanding the above, a pan-European market offers significant economies of scale.
- Many telematic services already exist (see Chapter 4). Many agencies offer open and distance learning. We should build on these, not ignore them.

Conclusion

Consequently we recommend a work plan to foster the use of telematics in tertiary education which has two components:

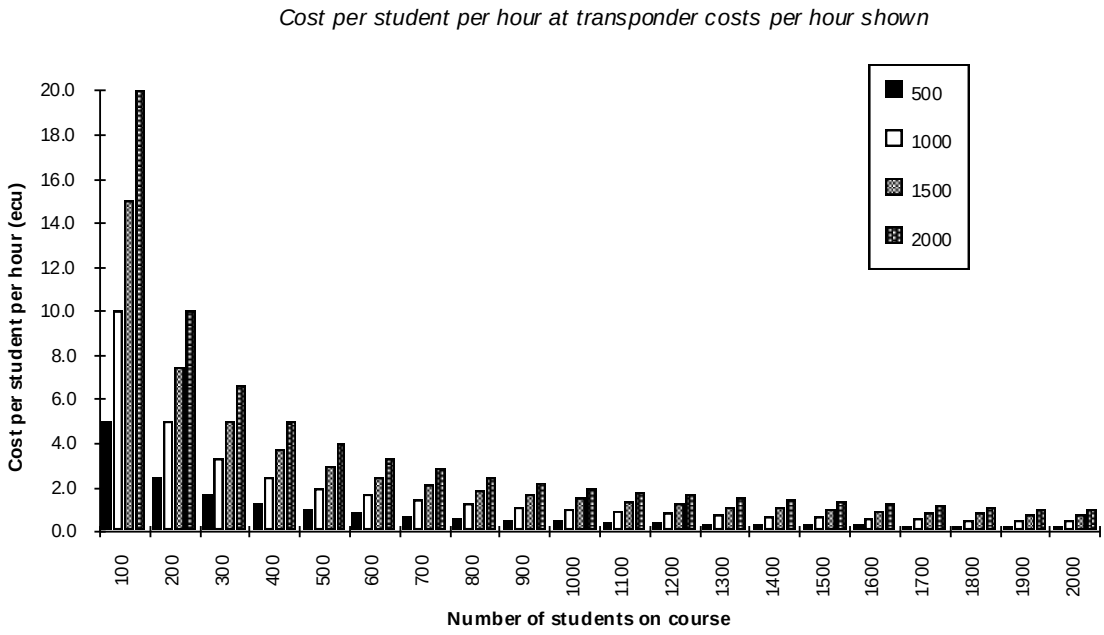
1 To set up a telematic infrastructure – the "European Telematics for Education Infrastructure" – supporting educational uses of telematics in open and distance learning at the tertiary level (including appropriate tariffing of the network). This infrastructure should make good use of existing provision.

2 To set up a series of trials on the infrastructure. These trials should build on best practice from existing suppliers.

In the following chapters 4 through 7 we discuss issues related to the infrastructure. In Chapter 8 we look at the issues relating to trials.

Reminder

As a reminder of the economies of scale that can arise from infrastructure, consider the diagram below, which looks at satellite TV cost per student/hour using four levels of transponder cost (500, 100, 1500 and 2000 ecu per hour). For a course with 1000 students, the cost per student/hour is less than 2 ecu.


Cost per student per hour at transponder costs per hour shown
Cost per student per hour (ecu)
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
500
1000
1500
2000
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
Number of students on course

# 4 Technological and other factors

Setting up a new telematic infrastructure can be very expensive. To give some examples:

- One satellite TV transponder costs about 5 million ecu per year to rent.
- The UK has recently spent 21 million ecu on merely a pilot phase for the new SuperJANET broadband academic network.
- Connection at 64 kbit/s into a switched Europe-wide network from a major PTT can run at around 40 000 ecu per year, leading to a potential bill of 20 million ecu per year for a 500-node Euro Study Centre network.

Thus we do *not* propose a brand new infrastructure. The first thing to do is to look at the existing network suppliers of potential relevance to the sector.

## 4.1 Services from suppliers

This section consists of an overview of the main telematic services available in Europe which impact on open and distance learning. But first we need to give this overview some context. The main one is that of location of learning.

**Locations** of interest to tertiary education are:

1 Home

2 Workplace

3 Study Centre

4 College or university.

This classification is important since the location makes a large difference to the range and cost of telematic services that are deployable.

### *4.1.1 Overview of **services** available now across Europe*

At the current stage of technology, deployable Europe-wide telematic infrastructures fall into two categories of relevance:

1 Satellite television

2 Terrestrial data network connecting European learning locations in, or associated with, tertiary education institutions.

(We shall briefly look later at broadband networks, which will in time break down such divisions.)

Homes and very small businesses Europe-wide still only have the public switched telephone network (PSTN) as a universal service. Although ISDN is spreading fast in some countries, we do not expect it to be relevant to home users until after the year 2000. Home users will continue to use modems, though at higher speeds (V.32, 9600 bit/s and more) and with more advanced protocols (PPP, etc).

Businesses Europe-wide (and tertiary institutions) have an increasing range of digital services that they can use, many more than the traditional service of X.25, although connectivity at speeds above 64 kbit/s is problematic in many areas,

especially for international links. We expect Euro Study Centres to use such technologies for their wide-area network links.

Important universities and large businesses in favoured locations (eg "wired cities") have access to a limited number of high-bandwidth services, such as the slowly emerging academic broadband academic networks in UK, France and Germany.

Satellite television direct to home (and more so to other sites) can be provided across Europe including much of central and East Europe. However, as regards coverage EC-wide, it is the case that Greece, Southern Italy and the extreme west have a more limited choice of systems and require in general larger dish sizes. (In particular, coverage by the main commercial satellite TV supplier is not adequate in such regions.)

Almost all universities and many other tertiary education institutions are connected free of charge (or at a subsidised rate) to the academic computer networks; but these have limited bandwidth and constraints on services offered and quality levels. Some tertiary institutions will want better or different services from those that the academic networks provide, especially for connection to non-university sites such as companies to which they are providing training.

#### *4.1.2 Technological issues*

These fall into three main areas:

- standards
- coverage
- tariffs.

Standards

There are many difficulties with standards for European networks. These include:

- Tension between international standards (such as from ISO) and so-called *de facto* standards – a recent example is the situation of OSI versus TCP/IP.
- Tension between today's technology standards and tomorrow's – such as worries about FDDI and Frame Relay being obsolete since ATM is emerging
- Different national implementations of standards. Because of the process of defining standards, many standards (such as those in the OSI series) have a wide range of options of which developers typically implement only a subset. There are some current difficulties with Europe-wide ISDN implementations.

Coverage

Services vary widely in their coverage of countries. Even when a service is available within a country, it may be restricted in coverage – for example to some regions, to urban areas or to business lines.

It is not realistic in this report to provide an exhaustive treatment of coverage. Thus we shall give a few typical examples only. (These have been drawn from JANUS Deliverable 9 on Market Research.)

Tariffs

As a recent Touche Ross study for CEC stated, after analysing the last 10 years of telephone tariffs in the EC: "The only thing that one can say about tariff trends is that there are no tariff trends." However, we shall make some tentative statements.

First, we look at tariff differences between countries. Note that:

- The difference between leased line tariffs in the most expensive and least expensive EC country is of the order of 4:1.
- There is a rough correlation between cost and degree of deregulation. UK is the cheapest.
- Tariffs are changing fast. For example, the Netherlands PTT recently cut its rates within Europe by up to 15%.

Trends are harder to discern. We would argue that:

- The emerging pattern of deregulation will continue, patchily, under the impact of commercial pressures and CEC initiatives (Open Network Provision etc), and this will lead to lower tariffs, but gradually. (We suspect that the world recession is now slowing down deregulatory moves in Europe.)
- Equalisation of tariffs across Europe will continue but affect Mediterranean Europe last.
- There will be further rebalancing of tariffs between categories of customers – this will tend to favour business subscribers but disadvantage domestic subscribers (including students studying at home).
- Satellite tariffs will drop, as will terrestrial tariffs.
- It will be a long time before we reach US levels of tariff. These can be as little as 10% of European tariffs for the same bandwidth.
- There will be significant reductions in tariffs on a basis not of cost of link, but of *cost per bit carried*, as newer higher-capacity networks are deployed.

Some commentators do not even agree with our view that UK tariffs are the "asymptote" towards which others are tending. (There was much discussion on this, within JANUS and with IDATE within CCAM.)

### *4.1.3 Leased lines*

The main technology used for building data networks is still leased digital circuits:

- It is estimated that currently 99% of LAN interconnection in Europe is carried on leased circuits.
- Most other technologies do not as yet have significant Europe-wide deployment, or if they do, do not have a mature product range supporting them (especially in the vital area of routers).

- Leased circuits carry no volume charge, so that there is no "tax on success" – in other words costs do not rise as usage rises. (On the other hand, this makes them expensive for low-volume use such as in start-up situations.)
- Analogue circuits can now be replaced by digital circuits in most West European countries.

Leased digital circuits at 64 kbit/s are available in every EC country, except for Greece. Currently in Greece the only way to provide international 64 kbit/s service is via satellite links; but the Greek PTT tell us that it will soon be possible to have 64 kbit/s terrestrial circuits inside Greece and from Greece to elsewhere.

We are not saying that other technologies are not relevant (to some degree) to users intending to run telematic networks. For example, sites such as Euro Study Centres may well use X.25 or ISDN technologies.

*4.1.4 X.25*

X.25 is a traditional networking service. Every country in Western Europe and several in the East (Poland, ex-Yugoslavia) has a public X.25 network. (Some countries have several.) In many countries it is not possible to dial in to X.25 at more than 2400 bit/s; although there are some X.25 services (such as from Transpac) where 9600 bit/s dial-up is possible. Few X.25 services allow X.32 dial-up (in other words, full X.25 support over dial-up, not just terminal access).

X.25 is not suitable in most circumstances for LAN interconnection. Thus we do not expect that it will be suitable for connecting Euro Study Centres.

*4.1.5 Frame Relay*

This is a much talked about but little deployed service, oriented to interconnection of LANs. It is mainly deployed at present in the US, and even there on a limited basis. A few European PTTs, including BT, plan to roll it out soon. It is operational in Finland at present.

Some commentators predict that Frame Relay will never be comprehensively deployed, since it will be overtaken in the market by ATM.

*4.1.6 ISDN*

ISDN is a very relevant technology for telematic networks. ISDN is available now in several countries including France, Germany and the UK – but only in France is it available on a national basis.

In January 1994, European ISDN coverage is predicted to be as follows:

| UK | Fra | Ger | Neth | Bel | Den | Ital | Lux | Ire | Spa | Port | Gree |
|---|---|---|---|---|---|---|---|---|---|---|---|
| all | all | 80% | 60% | all | all | 50% | all | 60% | 50% | 80% | 20% |

In January 1996, European ISDN coverage is predicted to be as follows:

| UK | Fra | Ger | Neth | Bel | Den | Ital | Lux | Ire | Spa | Port | Gree |
|---|---|---|---|---|---|---|---|---|---|---|---|
| all | all | all | 80% | all | all | 80% | all | all | 80% | all | 80% |

However, all these figures still obscure the fact that if one is not in one of the towns or cities with ISDN, then the availability of ISDN is *zero*.

### *4.1.7 Fractional megabit services*

As regards leased digital circuits, there is currently a coverage gap between 64 kbit/s and 1 Mbit/s.There is very fragmentary coverage of these services in Europe, either for leased lines or for dial-up; and in several countries they are only available in certain areas such as major cities. However, North American experience suggests that these services, so-called "Fractional T1 service" are an important area; and we cannot imagine that the European PTTs will ignore them for long

There is now a Switchband 384 kbit/s dial-up service introduced by several PTTs. This is mainly used for video-conferencing. Its coverage is very limited.

### *4.1.8 Megabit and broadband services*

Within many countries there are available 2 Mbit/s leased circuits, but prices are very high. Links at this speed are possible between some countries.

At the broadband level (which we somewhat arbitrarily define as starting at 34 Mbit/s) we enter the arena of experimental networks with very limited operational capability.

### *4.1.9 Coverage outside EC*

Open and distance learning in Europe are not confined to the EC – indeed some organisations such as EADTU have active members in most EFTA countries. Satellites and even terrestrial networks do not stop at EC boundaries – most EFTA countries have similar network capability to EC countries – better, in some cases.

However, as soon as one moves into Eastern Europe, coverage falls off sharply. In case one argues that coverage in Eastern Europe is not relevant, there is an argument that an increasing number of agencies regard Europe as *one* area in which to provide service; so that a service gap in one country could affect deployment in all countries. (Indeed, there are countries within EC where coverage is limited – for example, Greece has no illumination from the commercial Astra satellite TV service, and as yet no access to international digital circuits.)

Some East European countries (ex-Yugoslavia, Poland, Hungary) have data networks in the early stages but a knowledge of what they can do. Some specific points:

- Ex-Yugoslavia already had considerable data networking. (The YUNAC academic network had 400 connected hosts, with 64 kbit/s digital links for international access.) However, the fragmentation and political problems makes it an uninteresting prospect for most agencies.
- Hungary has a rudimentary academic network but (surprisingly) very little commercial data networking.
- Poland has a public data network connecting 18 cities and an active academic computer network linked to the West.

## 4.2 "Environmental" issues

These issues cover such topics as legislation, trainer training, student preparation, and programme development.

### *4.2.1 Legislative issues*

This covers a variety of topics. As an important example but outside the scope of this study, copyright issues are by no means solved at a European level.

Concerning telematic networks, an important and traditional question is that of providing an subsidy to educational users of telematic networks, for example by a discount or by relief from VAT. Several years of studies have not shed much light on this issue. There still remain two fundamental objections:

1 Deregulatory issues

2 Monitoring and control.

Deregulatory issues

Such a subsidy appears contrary to the deregulatory principle of non-discrimination between customers. Why should educational users get a discount rather than the elderly? (Why not teenagers, for that matter?) Advice to us from a "new-style" PTT – BT – has been that such discrimination would be contrary to the regulatory status of BT, both in the previous duopoly and under the revised regime recently introduced. As other PTTs become deregulated and commercial, they will probably have to take the same view.

However, it is possible under the rules to provide discounts to customers based on traffic patterns, which may *indirectly* benefit certain categories. For example, a discount for low volumes of calls indirectly benefits the elderly, many of whom use their phone as a lifeline rather than routinely. A discount for evening use (as in most countries) indirectly benefits students using telematic networks from home after work.

Monitoring and control

If there were a discount for educational users, how does one (a) monitor who is an educational user, and (b) control when the alleged educational user is carrying out an educational use? This issue is similar to that of the "acceptable use" criteria on academic networks, which has proved impossible to control in practice – indeed, on some of the networks (such as US Internet) no monitoring or even accounting is possible! (One apocryphal estimate is that in order to introduce billing on the US Internet, the capacity of every network switch would have to be doubled!)

Some educational organisations (such as the UKOU) use special passwords to control access to the network; but it is in the nature of passwords that have to be known by hundreds or even thousands of people, that in fact they become known by anybody who wants to find them out.

Other solutions include reverse-charge calls and dial-back (where the network calls the user back after the user has logged in). Both these solutions suffer from the problem that they increase the time it takes for the user to log in to the network; and increase the complexity. In brief, they violate the goal of "one click and you're online".

#### *4.2.2 Trainer training*

Teachers need training to prepare them to cope with telematic networks. This is needed at two levels:

1 Training of an educational technology nature in how best to use the medium.

2 Training in the "mechanics" of using particular technologies.

#### *4.2.3 Student preparation*

Students also need training. Even with the spread of computer literacy, there are few students familiar with telematic networks (even, or especially, modems!).

## 5 Existing European Telematic networks relevant to education

In the last chapter we looked at services in Europe which provided "raw" network services. In this chapter we look at those agencies operating at the "Value Added Network" level which are of relevance to open and distance learning at the tertiary level. These may provide guidance as to the kind of infrastructure that will be needed to be set up to service all the needs of the tertiary open and distance learning sector.

Largely for historical reasons, we shall treat satellite TV services all in this chapter. (There is an arguable case that providers of "raw" satellite capacity should have been covered in the last chapter; but it makes for a more coherent presentation to discuss them here.)

### 5.1 Networks for data

The paradigm for all academic computing networks is the Internet.

#### *5.1.1 Internet*

This was set up in the late 1960s to link the major US universities into one network for sharing of computing resources. In the mid 1970s the TCP/IP protocol suite was defined and used throughout the network. In the 1980s the Internet expanded rapidly until in the early 1990s it connects every significant university and college site in the US. (And has connections to many other academic computer networks world-wide.)

For most of its history the Internet was run in a centralised way as a monolithic network. However, in the last few years the Internet has fragmented. In the US it is now a collection of inter-operable networks, each run by a different Network Management Agency. These networks are usually not split by state boundaries – they may be based on compact geographical regions (such as the Bay Area round San Francisco), communities of like-minded organisations (such as High Energy Physics), or groupings of states (such as in the mid-West or the New England area). We believe that this fact has significant implications for European academic networking.

The Internet is perhaps best known for its fostering of the TCP/IP protocol suite in all its ramifications. As every schoolboy knows, the TCP/IP suite is not standardised by ISO (or CCITT), but by the Internet Activities Board. Despite (or because of?) this,

the TCP/IP suite has become one of the most successful network standards in the world.

### *5.1.2 European Academic Networks*

In several countries of Europe, academic computer networks were also set up in the 1970s and 1980s. Unlike the US, they did not on the whole adopt TCP/IP, preferring to use manufacturer-specific protocols or versions of the emerging OSI standards. Those which were set up earliest (such as JANET in the UK) have had perhaps the greatest difficulty in coming to an operationally viable view of network standards.

The UK was for many years in a particularly difficult situation, since it had adopted the (very) pre-OSI standards called the "coloured books" which had neither the merits of OSI nor the wide acceptance of TCP/IP to recommend them. (But that of course is hindsight.)

Academic networks that were set up later (such as IRIS in Spain) had a much easier time, since they could go straight to TCP/IP. (Note that no operational national academic network has been able yet to adopt full OSI for its network standards; though some have successfully adopted parts of the standard – a particularly successful standard has been the X.400 email standard.) The timescale for adoption of OSI should be kept under permanent review.

So far, although the national academic networks do inter-operate, there are no moves to join them together in any real sense into one supra-national network. The RARE organisation operates as a coordinating agency.

### *5.1.3 Trans-national academic networks*

There are some examples of trans-national academic networks in Europe. The best known example is EARN.

EARN, the European Academic and Research Network, was set up by IBM originally to link the main university centres running IBM mainframes – but since then it has branched out to include some other models of computer. It has a rather limited number of functions based on proprietary IBM protocols – for example although it supports email there is no support for terminal access (like telnet on the Internet).

The relationship between EARN and national agencies (including PTTs) has not always been harmonious.

### *5.1.4 Strengths and weaknesses of academic networks*

<u>Strengths</u>

- Network access is often free to universities or at a fixed cost. However, in several countries such as the UK there are moves towards tariffs based more on cost of provision, and we expect this to become the approach in most of Europe in the longer term.
- The networks are all interconnected to each other and the Internet in the US, forming a large community of millions of users.

- There is also connection at the email level to many other networks including several (but not all) commercial email services.
- Most (but not all) universities are connected.

Weaknesses

These weaknesses are analysed from the point of view of suitability for a Europe-wide infrastructure.

- The networks are on the whole not interested in servicing the needs of educational users except when on campus. For example, the UKOU has spent much effort in organising the installation of modems on JANET and other networks, and progress has been slow.
- For similar reasons, the networks are on the whole not interested in ISDN since the nodes on the network are normally connected by leased digital circuits or X.25.
- The networks have in the past played the role of a testbed for protocols and architectures as well as (some would say, instead of) providing the best service for users. This has led some networks to over-concentrate on OSI despite the wishes of users. For example, JANET in the UK was forced to provide a TCP/IP service only when faced with the likelihood of major defections from its ranks to a rival network.
- Operational management has been a concern in the past but they are now getting much better run.
- International links have been limited in capacity but are now getting the bandwidth required through developments such as IXI, EBONE, etc.
- Connection to companies is still limited, and restricted (at least in theory) by the "acceptable use" guidelines. In the US these appear to be swept away both in practice and in strategic terms by the drive towards a continent-wide National Research and Education Network – not so (yet) in Europe.

### *5.1.5 PTT networks*

X.25 dial-in networks

Every PTT runs an X.25 dial-in network. Speeds are usually restricted to 2400 bit/s. They are on the whole not easy to use, with bad interfaces and complex registration procedures for new users.

Only in countries which have worked at developing videotex services have such problems been overcome – but only in a way specific to videotex. Despite some national pride issues, the general opinion is that videotex is an aging technology not very relevant to education. Having said that, there are many lessons that network planners of dial-up networks could learn from videotex networks.

Value-added networks

PTTs run a number of value-added networks oriented to education. Several appear now to be suffering from obsolescence – such as Campus 2000 in the UK with a command-line interface running on obsolete Prime minicomputers. Modern

windowing developments on the US-oriented value added networks – such as AppleLink on the General Electric network – seem either to have been ignored by the PTT educational providers, or else they cannot, on their own, cost-justify the additional investment. In the latter case, they may form natural partners (active but not dominant) in a future educational infrastructure.

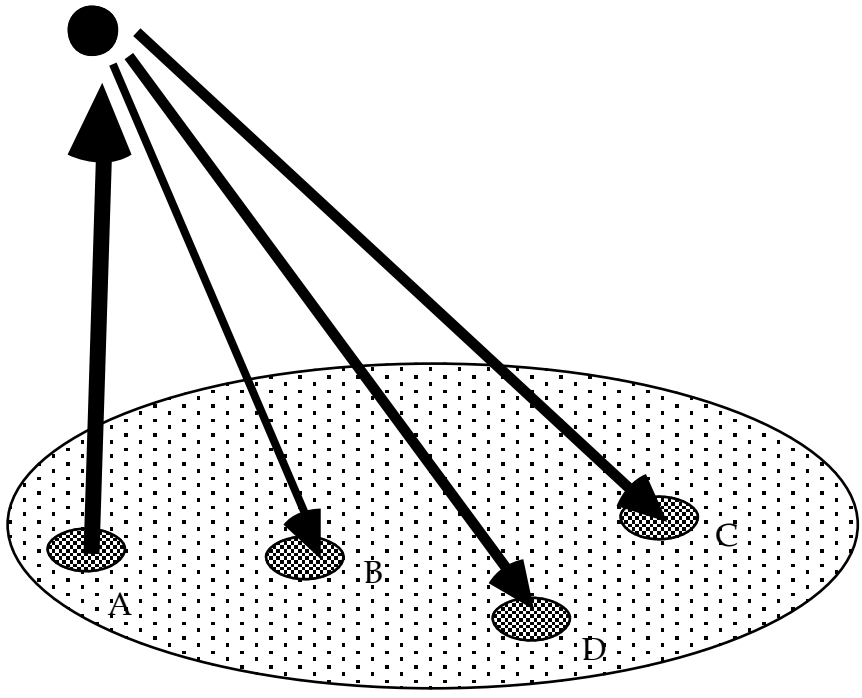
Future PTT plans in this area are not clear despite the existence of the EPOS consortium (of some PTTs but with notable absentees). EPOS has not yet been able to present a network plan for large potential users such as some of the EADTU members – perhaps it is too soon to expect that.

A problem that affects PTTs – and dates from the early days of RACE if not before – is a tendency on their part to decide what educational users want without consulting them in depth. EADTU stands willing to enter meaningful discussions with the PTTs about European network needs.

### 5.2 Networks for television – satellite and cable TV networks

The networks discussed in the previous section have all been computer networks. Though certain computer networks do use satellite links (such as several military networks connected to the Internet), such networks do not support television.

Pan-European networks supporting television have up to now used different technology and different organisational approaches. The typical approach is to use a geostationary satellite. We show this schematically below.




Programmes are transmitted from an *uplink* (node "A" in the diagram), up to the satellite, from where they are transmitted down to reception sites (nodes "B", "C", "D" in the diagram). There are a wide variety of satellites – the main ones are the Eutelsat system of satellites (operated by a consortium of European PTTs), the commercial Astra system, and the national satellite systems (such as in France,

Germany and Spain). Depending on the system, there can be millions of such reception sites (as is the case with Astra), or maybe just a few hundred.

### *5.2.1 EuroPACE*

The full name of EuroPACE is "the European Programme of Advanced Continuing Education". It was a satellite service using one of the Eutelsat satellites. It aimed to provide high quality courses in the fields of advanced science, information technology, engineering and technology management. It had a clear industry focus but drew on expertise from universities, scientific centres and industries as receivers and deliverers of programmes. It produced its own programmes with the support of, and in response to, the needs and prevailing expertise of members. Courses or training modules typically entailed between six to twenty hours of study/viewing.

For reasons which are much discussed but not yet generally agreed, EuroPACE was unable to capture enough market share. It is closing down the satellite service, and entering a period of discussions of future approach.

### *5.2.2 EUROSTEP*

EUROSTEP is the European Association of Satellites in Training and Educational Programmes. It is both a forum for European users of satellites for education and training and a satellite broadcaster of education and training programmes. Until recently it used a TV channel on the experimental Olympus satellite. Now it broadcasts up to four hours per day on one of the Eutelsat satellites (a different one from that which EuroPACE used).

We regard EUROSTEP as an interesting model, with strengths but also weaknesses:

Strengths

- A strong membership.
- The only serious player left in educational satellite television in Europe.

Weaknesses

- The satellite used is not relevant to users at home.
- Perhaps because of that, it has failed to capture the interest of some of the major actors in educational television, in particular the UKOU/BBC.
- A very diverse membership leading to a very diverse and perhaps incoherent range of programmes.
- Only about 500 registered sites, plus (recently) several hundred inherited from EuroPACE. Commercial satellite systems have millions of receive dishes (see later).

### *5.2.3 Channel e*

Channel e was a European information, education and training channel, originally an experimental project undertaken by the European Institute for the Media, formerly based at the University of Manchester but now in Dusseldorf, Germany. Channel e began by taking one correct decision – using a TV channel on the Astra

satellite. However, it was unable to build on this. It remained a very small part of one commercial channel with which it had little coherence.

It later moved to occupy a thirty minute per day time slot on the popular Superchannel TV service. (Superchannel for obscure reasons is not on Astra but on Eutelsat; however, it is relayed on most European cable TV systems.)

*5.2.4 North American experience*

The area of educational satellite TV is very active in North America.

We summarise experience with two large systems.

NTU

The National Technological University (NTU) is a satellite-based provider of graduate engineering education to industries in the United States. It has no campus for students and no professors on the pay roll and no research apart from educational technology. Students study at their own plants and homes, take some of their exams at local universities, and graduate in a teleconference ceremony. The course suppliers are member universities, the clients are the corporations or government agencies which have satellite reception sites and site coordinators who maintain daily contact with the NTU and the students. The NTU administers the credit and non-credit programme which enrols 3000 students per year and has the potential to offer over 4000 courses from its 29 affiliated universities. The non-degree programme began in 1987, and enrolled over 30 000 participants in 1988 and 45 000 in 1989, in short courses, seminars and teleconferences on state-of-the-art technology and management subjects.

Member universities of NTU supply exactly the same graduate courses offered on campus, the great majority of which are broadcast live from special classrooms and uplinked to the satellite. NTU chooses its courses on the basis of demand and availability of broadcasting time. Professors are generally available for telephone calls from NTU students during agreed-upon office hours, as well as during the live broadcast of each class.

NTU is considering expanding to Europe and to Russia.

Knowledge Network

This is a highly interesting example in terms of the organisational arrangements.

Knowledge Network is an educational communications service in the province of British Columbia in Canada, financed by the provincial government. This province covers an area about two-thirds the size of Western Europe with a population of under 3 million, mostly concentrated in the south-west round the city area of Vancouver.

Programmes are distributed via the Anik satellite: the more isolated homes have large TVRO dishes which can pick up Knowledge Network programmes (dishes were installed mainly to pick up US TV), but urban homes receive the programmes via cable systems. (Cable systems must carry the programmes.)

There are two not completely distinct types of programmes:

1 *Teleseries*

These are programmes with general educational value. They are normally bought in from other production agencies including BBC and PBS in the US. Most programmes are transmitted purely as programmes, but some colleges build courses around the programmes.

2 *Telecourses*

These are programmes which are part of a fully-fledged distance teaching package run by one of the educational institutions in the state Open University consortium. A classic example is a history course run by Simon Fraser University built round a well-known TV series from the UK called "The World at War". Despite (as some might say) being based on a popular TV series, the course included the traditional panoply of university distance education including course books, correspondence back-up and a final examination.

Institutions wishing to use Knowledge Network are responsible for producing their own programmes. The network will advise and guide, including setting of minimum production standards, and will even hire out studios; but does not impose editorial control.

Since a whole channel is available but production budgets are usually small, there is a wide range of types of video material disseminated including locally-produced documentaries, lectures, and studio discussions as well as bought-in material from the best of the public and commercial companies.

Course enrolments vary from 100 or so up to over 1000; but an important part of the justification for the channel is the much larger viewing figures from the general audience.

### *5.2.5 Consumer-oriented satellite TV*

For all practical purposes, this means Astra.

Astra and the bouquet of channels on it have been one of the few success stories in the satellite TV industry. From the earliest publicity in 1985, Astra described itself as the "hot bird" – hot in the sense of exciting, in that every satellite television channel should be carried on it. It has virtually achieved this aim, and some would say it is hot in the other sense of having singed most of its rivals including Eutelsat and all the national satellite operators.

Recent successes for Astra include the selling of capacity to Spanish operators despite the Spanish national satellite. Also significant is the statement by the BBC that they would use Astra for future European services. (BBC were for a long time reticent about throwing in their lot with other operators.)

The Astra satellites are owned by SES, that is, Société Europeène des Satellites. SES is a private company registered in Luxemburg with some very influential Europeans on its board. SES currently operate two satellites, Astra 1A and Astra 1B. The next satellite, Astra 1C, is being built and Astra 1D is being planned.

Each satellite offers 16 channels. Thus currently SES can offer 32 channels and after 1C is launched they could offer the maximum of 48 channels. (Astra 1D is for back-up and special services.) This channel offering currently outstrips the capacity of all the national systems put together and is close to what the whole Eutelsat system can offer, but with higher power levels than Eutelsat.

We give some specific details of Astra 1A. The others are relatively similar except that being newer, technology allows some improvements. Astra 1A was launched in December 1988, is located at 19° East, and has 16 channels each of 45 watts power. Power at the ground is measured in technical terms at 52 dbW which means that 80 cm dishes can be used easily.

This high level of satellite power and small size of dish, coupled with the economies of scale, mean that satellite reception equipment is cheap, ranging from 250 ecu upwards.

Satellite lifetime is predicted at over 12 years; thus Astra 1A should still be in service beyond year 2000.

One disadvantage of Astra for pan-European coverage is that Southern Italy and Greece are not within the coverage map. However, for many current distance learning activities that is not an issue, as yet at least. Not all distance learning systems need to be pan-European; and indeed *all* satellites have coverage limitations; this is especially true now that the area of interest for pan-European education has expanded so much to the east.

There is still some capacity on Astra but not much. A recent listing of channels on Astra listed 31 channels out of a possible 32; but not all are on different frequencies since a few channels do share with each other at different times of day. As an example of Astra's pragmatism one should note that 5 of these channels are now transmitting in D2-MAC; but as an example of their commercial power one should also note that several of these "should" have been on the Scandinavian Tele-X.

About 3 million people in the UK now have dishes to receive Astra and over 50 000 each month sign up for Astra. By the year 2000 there are expected to be nearly 8 million viewers of Astra in the UK alone. Like satellite TV in general, Astra been less successful in other European countries, except for Germany where there are now nearly the same number of Astra viewers as in the UK.

None of the national satellite systems have even 100 000 dishes installed.

Despite the success of EUROSTEP (or at least its longevity outlasting the others) there are less than 1000 dishes installed specifically to receive EUROSTEP.

### *5.2.6 Cable TV*

You may ask why we are so oriented to satellite TV. Many people believe that cable TV can provide an answer for educational needs. Is this true?

Many European countries have well-developed cable TV systems. (In some countries like Belgium the vast majority of the population are connected to cable TV systems.) Thus it is tempting to believe that cable TV can be a solution for providing a Europe-wide infrastructure for delivering video.

However, the reality is that many countries such as the UK and Germany have only a small percentage of their homes connected to cable. In addition, even in countries (such as Denmark) with very high coverage, if even *one* site (that one requires to use) is not on the cable then the provider has a problem. If the site is in an area where cable TV is available, then a provider can get the site connected (at a cost); then the provider has only a small problem. But if the site is not in such an area, for example in a rural area (often the ones where distance education is needed), providers have a big problem.

One answer which may or may not be acceptable is to refuse to provide service to such a site. Providers of *training* may find this acceptable; however, many providers of *distance education*, brought up on notions of universal provision, find this less acceptable.

Some well-meaning people find even the above arguments hard to accept. Even those that do accept it still hope to find a role for cable. They argue, cannot cable be used along with satellite in a Europe-wide infrastructure?

Unfortunately not. The argument is based on the complications of *negotiation of carriage*.

Since cable TV systems are owned by different companies in different cities (even sometimes in different parts of cities), providers find themselves having to negotiate with many different cable TV organisations in order to have their material carried. This causes many difficulties:

- The general problems that multi-country TV has (copyright, repeat fees, etc). These are not trivial – they have inhibited for some years the wider use of satellite television by the UKOU.
- Many cable systems are *full up*. Thus no more material cannot be carried, however interesting (and education comes well down the list of types of material that cable TV companies are interested in).
- Cable TV companies are used to dealing with providers of *channels* – thus, large quantities of material, not one-off programmes. If a provider's material is not part of a channel, little progress can be made.
- Many cable systems charge "carriage fees", in other words, providers have to *pay* to have their material carried. Many distance education providers' activities are economically marginal already and cannot afford extra costs.
- Providers tend to lose control over what time or what day the material is presented. (This may or may not be a problem depending on the type of material.)

The conclusion we come to is that it is very difficult to make use of cable TV systems as part of a *Europe-wide* provision. No educational or training provider except Channel e has managed to appear on more than a handful of cable TV systems; and Channel e managed it because the educational offering was part (a very small part) of an entertainment channel, with much more access to funds.

The above arguments have much less force if a provider has purely local interests. (But it is hard to find enough viewers in *one town* to finance an educational channel.)

#### *5.2.7 Conclusions*

For Europe-wide provision, satellite TV rather than cable is the technology to go for.

Although it is an unpalatable conclusion to several PTTs and nation states, no satellite system other than Astra has been able to deliver significant numbers of viewers. There are few signs of this changing – the recent part-failure of Hispasat merely confirms our view.

Thus for the *home-based* learner, where the institution expects the student to bear all or part of the cost of the reception equipment, Astra is the satellite system that has to be used.

For the learner in the workplace or college, or (in those rare cases) where the learner is prepared to pay the full cost of the reception equipment, the full range of Eutelsat satellites can be used – theoretically at least.

But if one is going to invest anyway in a home-based channel (which several large members of EADTU would support), why bother with another channel? At least, not until the first channel fills up.

### 5.3 Broadband academic networks

It is now becoming technically possible for computer networks to transfer uncompressed video. In North America and in several countries of Europe the deployment of broadband networks has started, oriented to educational use.

The definition of "broadband" is flexible – we shall take it to mean a network with a bandwidth of 34 Mbit/s or over. To put this in context, an Ethernet LAN (10 Mbit/s) or Token Ring LAN (4 or 16 Mbit/s) would not be broadband, whereas an FDDI or high-speed Ethernet at 100 MBit/s would be broadband. In Europe, wide area links are normally at 0.064 Mbit/s (such as Kilostream) with a few at 2 Mbit/s (such as Megastream); so that broadband wide area networks are very rare at present. (In the US, a number of companies have wide area links at T3 speeds – 45 Mbit/s – which would fall within our definition.)

But bandwidth needs are increasing fast; and broadband networks are beginning to appear more widely.

#### *5.3.1 USA – NREN*

The incoming Clinton regime has confirmed the earlier decision of the United States Congress to approve the development of NREN, the National Research and Education Network. This is intended to provide American researchers and educators with computer and information resources that they need, while demonstrating how advanced computer, high speed networks and electronic databases can improve the national information infrastructure for use by *all* Americans (not just those in education).

It is envisaged that the NREN would connect more than one million people at more than one thousand colleges, universities, laboratories, and hospitals throughout the

country providing an advanced form of Internet (the current academic network) with multi-media transmissions, including images, voice and video.

Unlike the telephone, the NREN will also be a publications medium, distributing electronic newsletters, video clips, and interpreted reports.

*5.3.2 UK – SuperJANET*

SuperJANET is a broadband network which is planned to connect all UK universities in the next few years. The first phase of this has now been approved with a budget of about 21 million ecu. This will connect six sites with a backbone network. Further sites will be added rapidly until all universities are connected. BT is actively supporting the network, which has overtones of a technology demonstrator as well as being an operational service (which will be charged for).

An example of the imminence and *operational* relevance of SuperJANET can be gleaned from the fact that the UKOU is discussing with SuperJANET the transfer to SuperJANET of much of the future increase in inter-node traffic on the 14-node UKOU wide area network.

The SuperJANET agency is interested in educational and training uses of SuperJANET, such as video lectures over the network. However, one should note that nowadays video is not nearly such a high consumer of bandwidth as it once was, and it is dubious to use video to justify a broadband network (34 Mbit/s upwards) when a video link can be quite realistically supported on a network bandwidth of 1% of that – 0.384 Mbit/s. Applications such as LAN linking and supercomputer access are more likely to be bandwidth-hungry.

*5.3.3 France*

France Telecom recently launched a 34 Mbit/s TCP/IP research network connecting seven sites around the Ile de France. The network is integrated with the French academic network (Renater). France Telecom plan to extend this 34 Mbit/s network to 160 French research sites by 1995.

*5.3.4 Germany*

Germany also has some broadband network developments, but so far less oriented to education.

*5.3.5 Conclusions*

Despite the above examples, our view is that it is premature to assume widespread deployment of such networks in Europe in the next few years. Consequently, we are recommending that operational services start with two separate networks, one for video and one for medium-speed data. Later on, they may fuse.

### 5.4 Dial-up users

The following points summarise the situation for dial-up networks:

- There are many dial-up networks operating in Europe:
  - national public X.25 networks

  - international networks such as GNS/Tymnet (run by British Telecom) and Transpac/Infonet (run by France Telecom)
  - other US carriers (GE, etc) operating on their own in Europe.

- The national academic networks have not taken take dial-up seriously – they are still oriented to links *between* academic sites.

  (It has taken several years for the UKOU to negotiate modem access to JANET sites, and even now only a small number of sites.)

- The US market makes large use of dial-up – not just the large on-line services (CompuServe, Genie, BIX, etc) but also myriads of small bulletin boards, and dial-up access direct to the Internet using the venerable UUCP and more modern protocols.

- Possibly under US influence, the dial-up market is changing in Europe – in particular dial-up Internet services in Europe are now available – such as in the UK from Demon and UKNet (University of Kent), in Holland from EUNET.

- Speed requirements of users are rapidly increasing.
  - Users are well used to the 2400 bit/s of the V.22 bis standard.
  - Advanced users are making good use of 9600 bit/s and 14400 bit/s (V.32 and V.32 bis).
  - Data compression (MNP-5 up and V.42 bis) gives up to 4 times the "raw" modem speed.
  - As dial-up moves into the area of linking LANs or supporting heavy-duty protocols (such as X) or multi-media email transfers, ISDN is becoming relevant.

### *5.4.1 Conclusions*

The above points lead to the following conclusions:

- Dial-up must be supported on the network.
- Dial-up cannot (yet?) be entrusted to the national academic networks.
- Plans should be laid to support ISDN dial-up.

# 6 A European Telematics for Education Infrastructure

We have recommended the setting up of a European Telematics for Education Infrastructure – ETEI. This should link providers and users of learning within the tertiary education domain, wherever the providers and learners are located.

We have stated that it should have two components:

1 A computer network component including dial-up access.

2 A television service broadcasting on at least one transponder.

We now turn to the tricky questions of (a) costs and (b) organisation of such an infrastructure. This is where real-world constraints enter the idealistic picture.

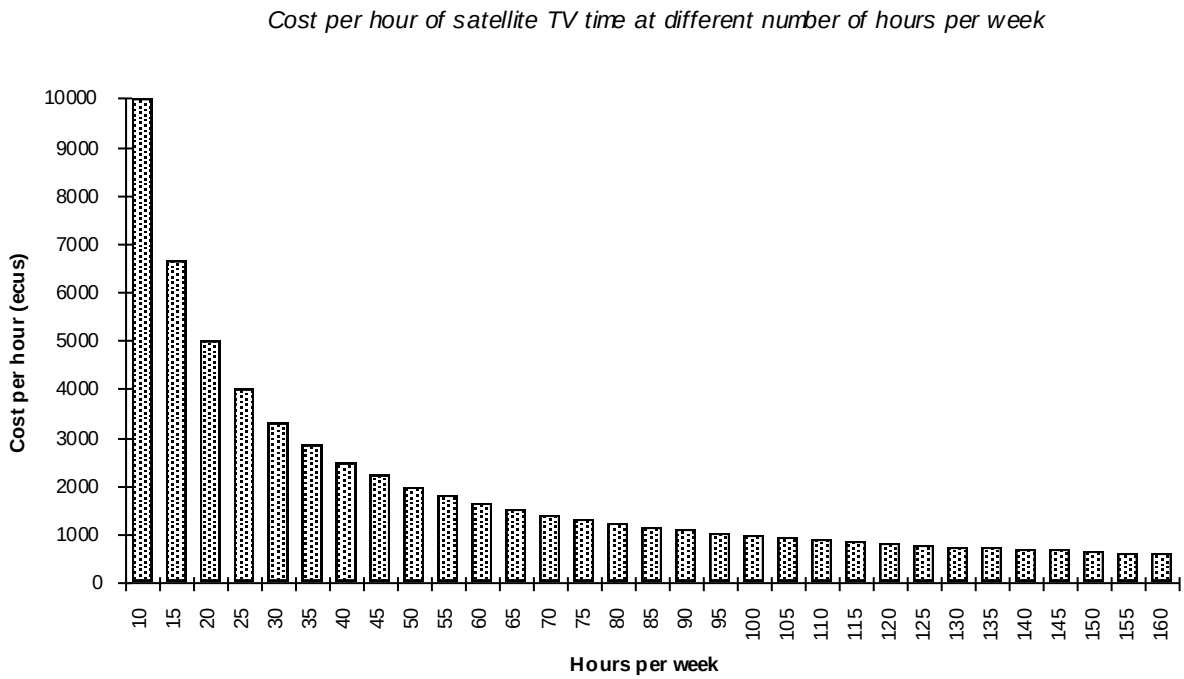
## 6.1 Costs in a "green fields" scenario

Let us consider the costs of setting up such an infrastructure from scratch.

Satellite television broadcast Europe-wide

A satellite television network would cost about 5 million ecu per year for a complete transponder (Astra) plus 1000 ecu capital for each satellite receiver (including a VCR). Thus a network covering 500 Euro Study Centre locations would cost 0.5 million ecu capital plus 5 million ecu per year. The costs are quite reasonable, given the potential coverage that can be gained. As an indicative example, for an organisation with 500 000 students – like the EADTU – the cost per student *per year* is only 10 ecu.

The transponder need not be fully utilised, as long as it is fairly heavily used. The diagram below gives the cost of transponder time per hour on the basis that the transponder is used for only a certain number of hours per week. Thus for 100 hours per week, the cost per hour is only 1000 ecu. On this basis a course with 100 students would pay for satellite TV capacity at 10 ecu per student per hour.




These costs ignore people costs to run the network. They also ignore the costs of reception equipment at home; but we assume that the students pay for that.

In addition, these costs also ignore the cost of producing any TV programmes for the network. However, several institutions (such as UKOU and FernUniversitat) have many TV programmes available already.

A data network connecting European learning locations in, or associated with, tertiary education institutions

Let us make the assumption that a green-fields network would have relatively low bandwidth on the backbone, say 1 Mbit/s, with 128 kbit/s links to the learning locations (Euro Study Centres).

The network charges for each node of this would lie between 5000 and 20 000 ecu per year. The exact annual costs depend crucially on such factors as speed, technological approach (such as use of satellites) and degree of integration with existing academic networks.

For example, to connect 1000 locations (500 Euro Study Centres, 500 "university" providers) would cost between 5 million ecu and 20 million ecu per year. To this should be added the cost of all the switching equipment needed for the network. This might add about 10 million ecu to the bill, leading to a bill of 15 to 30 million ecu per year. (Our earlier calculation on a different technological basis – links to a PTT switched network – suggested 20 million ecu per year. Either way, it is a lot of money.) And even at these costs, one still does not reach into the home.

To equip a learning location with 10 multi-media microcomputers on a network with a printer and a coupling to the wide area network might cost about 50 000 ecu capital. Thus 500 Euro Study Centre sites would cost 25 million ecu.

Costs would be much higher if speech or naturalistic video facilities had to be provided across the network to each microcomputer; or if the backbone required broadband capacity.

Conclusions

For the data network, these costs are frighteningly high. Since there are many data networks in existence already, including the academic computer networks, could we not use this instead? Even though they are not individually perfect, perhaps a combination of them would be adequate?

### 6.2 Issues

As well as cost and technical issues, there are a number of other issues that affect deployment of telematic networks. These include:

- technical/financial match with institutions
- constraints (or lack of) on institution behaviour.

Technical/financial match with institutions

Such a network should be *lightweight*. This means that there should be no great institutional hassle in joining the network. Technology should be affordable within institutional budgets and not too unfamiliar; the institution should not have to make radical changes to incorporate it, etc.

Constraints (or lack of) on institution behaviour

The network should be *agenda-less*. This means that an institution can use the network for a range of purposes which *it* decides, not the network.

Some past examples on non agenda-less networks include:

JANET where its critics would claim that (in the past, up to 1992) organisations had to accept the OSI approach in order to join. (Actually, a national pre-OSI approach, which had even less to recommend it.)

EUROSTEP where its critics would claim that in the past, organisations had to accept an (implicit) agenda about supporting European TV industry (D2-MAC, HDTV futures) and technology (Olympus) just to send out an hour of video.

Other current examples could be given but would only distress people.

Conclusions

Most existing networks are neither lightweight or truly agenda-less. How do we ensure that our network is both lightweight and agenda-less? (Except for an agenda of fostering telematic use, we presume.)

### 6.3 Technical factors

The precise technical details of the network are not the subject of this report. However, we make some remarks on operational and other constraints on the technical details.

Backbone

Since multiple ISDN channels are to be supported, the backbone links must be at least 1 Mbit/s links.

Protocols

A wide range of services must be supported over the network. These include electronic mail, file transfer and access, and terminal access (the last not now restricted to VT100 terminals) for centralised services.

The network must interoperate with many other networks including the academic networks and networks *inside* academic sites. This currently means that the service must support the TCP/IP protocol suite. (This is in line with current thinking of most academic networks including pan-European ones such as the multi-protocol backbone proposed by RARE.)

Other protocols may be supported and protocols must be future-proof in order not to restrict users in the long term – this will in particular mean that there should be a migration plan to OSI.

Some OSI protocols could be used in the short term – for example X.400 for email could run alongside SMTP.

Network management will be a key area; this is likely in practice to imply SNMP for a network of this complexity.

Dial-up

Users will want faster and faster speeds from their modems. This is not primarily for VT100 terminal access (which will gradually die away since it is not within the GUI paradigm) but for windows-based applications, fast email and fast downloading (file transfer).

Practically, the network must support speeds of up to 14400 (V.32 bis) from the start of service. Higher speeds may be supported as the standards firm up (such as V.fast).

The more advanced applications that users want will demand protocol support, not just for VT100 – applications will require TCP/IP and others to be available over dial-up.

Support for VT100 must also be available at first, but kept under review.

# 7 ETEI as a "broker"

Let us summarise our conclusions so far:

- In Chapter 3 we proposed a European Telematics for Education Infrastructure. (We call this ETEI for short.)
- In Chapter 4 we pointed out there that the costs of setting up such an infrastructure "from scratch" are very high. We went on to survey the suppliers of "raw" network capacity.
- In Chapter 5 we surveyed the range of value-added telematic networks that already exist, which fulfil *part of* the requirement.
- In Chapter 6 we re-visited costs and looked at some institutional issues. Green-field costs seemed a major problem in the data network side, less so in the satellite TV side.

This leads us to recommend that ETEI is set up as a "broker", not a new network with its own hardware and software.

The amount of actual "brokering" would depend on whether it was satellite TV services or data services that a particular client wanted. Essentially, there are far more viable options for a data network. But what *is* a broker, actually?

## 7.1 The broker concept

This is similar to a package holiday operator. Such an operator does not own hotels or airlines. Their "core business" is to organise holidays. But a customer cannot make up his own holiday – selection is made from a holiday catalogue.

We propose a similar system for ETEI. Thus:

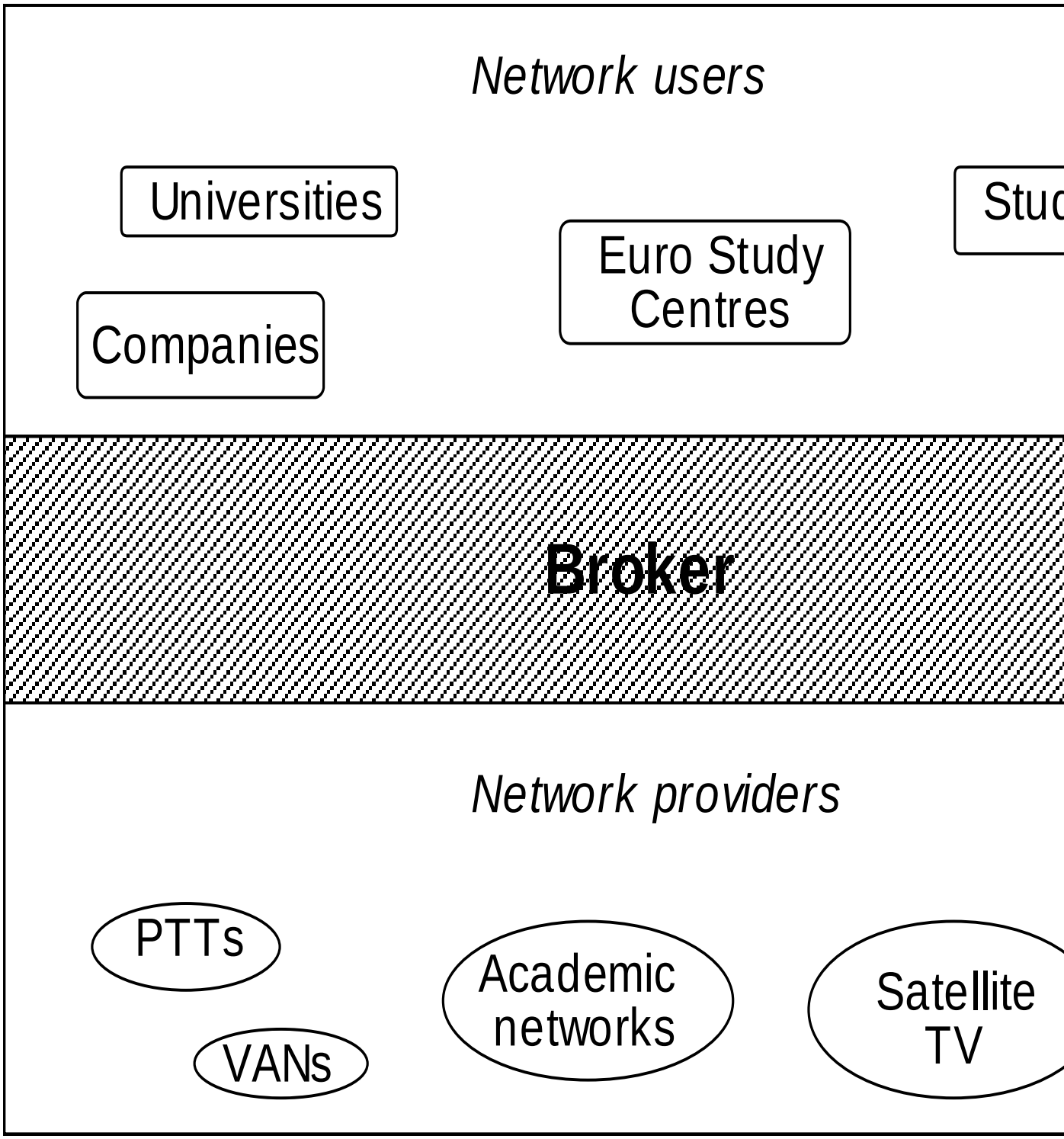
- ETEI would not own any networks.
- It would lease capacity from various networks (the aim will be to have as little as possible work done by ETEI consistent with overall value for money of the network):
  - PTT basic services such as digital leased circuits
  - PTT value-added services such as dial-in networks, Frame Relay, etc
  - Academic networks
  - Other agencies, including satellite network service suppliers (such as in remote areas)
- It would package and resell these services to organisations wishing to use telematic networks for teaching.
- Because of the very different requirements for video and data, ETEI would have two directorates (which of course would work closely together):

  S Satellite television services

  N Computer network services.

- Data broadcasting would be handled by Directorate S, but in close consultation with Directorate N. Conversely, Directorate N may deal with satellite data network suppliers (such as may evolve from JANUS).

The basic concept of the broker is summarised in the diagram below:


Network users
Universities
Euro Study Centres
Companies
Broker
Network providers
PTTs
VANs
Academic networks
Satellite TV

### 7.2 Ownership of the broker

In this section we shall discuss the issues of ownership in a general way. In a later section we shall make some specific suggestions.

It is important that the broker is responsive to users' needs. There are a number of models to avoid:

- The only link between ETEI and its users is that ETEI charges usage fees to users.

  This has the advantage of being a PTT approach.

- ETEI is funded centrally and service is free to users. This is close to the model of many academic networks in the past.

  It has twin disadvantages that (a) users do not value the service and (b) users have no real way of influencing the service.

- ETEI is funded by (a) a large number of users who individually pay quite small subscriptions plus (b) a large amount of central funds.

  This can lead to the phenomenon that in practice the secretariat acts independently of the wishes of (the majority of) members.

This suggests to us that:

- ETEI is owned, and thus controlled, by a small number of members who are the major users of the network.
- Members pay a significant fee, or maybe other forms of contribution towards ETEI (such as staff or premises), so that they value its service and can influence it. Usage charges are also made to reflect marginal costs.
- EC funds are welcome but must be kept under a certain fraction of expenditure. This is especially true for 50% funding.

Since there are in practice many hundreds of potential institutional clients of ETEI, one is forced to look towards consortia of these clients as the members of ETEI. We predict that a natural and active member of ETEI would be EADTU, which represents 150 universities and has already significant network activity.

There are some specific issues involving television (such as the small number of relevant suppliers of satellite TV capacity) which mean that the management of that Directorate (Directorate S) may work under a modified approach. See later.

### 7.3 Management

We do not believe that it will be a major problem to devise a management structure for ETEI. Factors to be borne in mind are the relatively small size of any headquarters operation and the high degree of dependence on outside agencies.

We have looked at a number of models around which we believe contain relevant exemplars:

- EADTU bureau
- some of the "balanced" centre/consortium members of EADTU such as NDEC in Eire
- RARE Operational Unit proposals
- national advisory/operational units in educational technology such as National Council for Educational Technology in the UK
- EUROSTEP secretariat.

*7.3.1 General*

There are a number of issues to resolve. A further study will be needed to do this. What follows is merely a starting point for future discussion.

Structure and ownership

We take it as granted that ETEI should be a non-profit-making organisation.

It also seems clear to us that because ETEI will have to sign major contracts with suppliers, it needs considerably more legal strength than many of the partnerships or associations common in the European education and training world.

This tends to suggest. that it should be a company. This might seem a prejudice of the the Anglo-Saxon world, but we note that EPOS (the organisation that some PTTs have set up oriented to networks for training) is a company.

However, there are other models that may be appropriate. Within a purely national context, there certainly are other models, for example the "non-departmental public body" model in the UK – but it is not clear how they would apply at the European level (or whether indeed they would be feasible even nationally).

Board

There are many issues to resolve about the structure of the "governing body" of ETEI. These include the key issue of whether it is a "board of directors" (of a company) or a "council" (for some other kind of agency). In either model, the position and role of the Chairman is crucial. We believe that the Chairman and "council" should remain firmly at a level above day-to-day management.

The board should have balanced representation from the main members of ETEI.

Management

The senior management position in ETEI would be the Chief Executive (to use the terminology current in the UK for non-departmental public bodies). Reporting to the Chief Executive would be a number of Directors, in particular for the two directorates of satellite television and network services. Directors would have a number of managers of Departments reporting to them.

*7.3.2 Directorate S – Satellite television services*

This would have two Departments:

- Learning centre services
- Home services.

These have different orientations; however, it is not clear that they need to use different satellites or even different channels. Especially during the market development phase, a *single* Education and Training Channel may be most cost-effective.

These are described in what follows.

Learning centre services

This will include services to Euro Study Centres. There are likely to be many providers wishing to use the service. Without getting into too extreme issues of market pricing of time slots (compare the "spectrum pricing" debate), we suggest that there should be some differentiation in price between times of day and days of week.

There will have to be a booking system but in order to maintain flexibility there will be a limit as to how far ahead providers can book slots.

There should be no attempt made to produce a coherent "channel" since there is not planned to be any "drop-in" audience (indeed, many programmes will be encrypted); however, it will be useful if there is a timetable of programmes available to reception sites.

Since the service is not a channel, programme types, subjects and production qualities will vary widely. This is not a problem.

Home services

This Division *would* have the task of running a "channel". (This is almost certainly going to have to be on Astra.) Since relatively few organisations appear to be interested in providing educational television for *home*-based users, this Department may require a different organisational approach from that of other departments or directorates.

One approach might be to have a small consortium of the major providers each of whom would commit to have a fixed sizable number of hours per week at set times on the network. (Say at least 10 hours per week.) Call these the "charter providers". Initially these programmes may include non course-linked broadcast of existing material. The balance of programming would reflect audience interest.

Representatives of these "charter providers" would jointly decide on any remaining issues concerned with the scheduling of programmes – inevitably a contentious issue. The remaining hours would be allocated to smaller providers – somewhat like the "independent producers" on some national television channels. The allocation of these remaining hours might be under the control of the central organisation, or devolved.

One channel

The view has been put to us that it is by no means certain that there need to be two separate satellites used for these two services, or even two separate channels. In fact, it makes good sense (in terms of keeping down the cost and complexity of receiving arrangements) that the services are available *on the same channel*, but at different times.

For reasons referred to earlier (cheapness and widespread availability of reception equipment), this implies that service should be sought from Astra, in at least in the first instance.

An example of such an arrangement (as proposed at the February 1993 consultative meeting) is given below:

| | |
|---|---|
| Morning | Schools broadcasting with a pan-European flavour |
| Afternoon | In-company training (EuroPACE-like, NTU-like) and distance education to institutional sites |
| Evening | Distance education – home users (EADTU, EUROSTEP) |
| Overnight | Delivery of video (and data) to schools, colleges, homes, Euro Study Centres |
| Weekends | Distance education shading into general cultural (example Knowledge Network) |

The idea of this channel is to avoid many of the problems that have bedevilled satellite education and training channels attacking only part of the market. Notice that the channel crosses various sectoral divides which are seen in European circles as major barriers. (But the BBC in the UK also crosses these divides – it can be done. The barriers may be supply-driven rather than user-driven.)

Other models are no doubt possible, and indeed needed in the longer term as (hopefully) demand exceeds the capacity of just one channel. But we are a long way from that now.

*7.3.3 Directorate N – Computer network services*

This Division would buy in services from other providers: PTTs, VANs, academic networks, etc; possibly even from satellite network providers either at the "raw" level or from value-added satellite network providers (such as the JANUS consortium, or part of it, might evolve into).

The methodology here is to build on best practice from the academic networks, but take a more business-like approach including being more responsive (than has been traditional) to user needs.

it is important that the Directorate takes seriously the provision of cost-effective services to *home-based users* over the *analogue network*. This has been a bit of a "blind spot" of most academic networks and many EC-funded projects who (inevitably) focus on ISDN.

Of course ISDN is also very relevant, but for institutions and Euro Study Centres, not for homes.

*7.3.4 Location of the headquarters of ETEI*

This is always a tricky question. We have considered the strengths and weaknesses of the following location arrangements, among others. (The following paragraphs do not give an analysis of these arrangements – they merely state what they are.)

- EADTU on the campus of the Dutch Ou now moving to its own building.

- This should be compared with EUROSTEP and SATURN in their own premises; and EuroPACE, of course.
- NDEC on the campus of Dublin City University, and part of the organisation but with the status of an "autonomous faculty".
- The National Council for Educational Technology (a UK public body) on the Science Park, but *not* on the campus, of the University of Warwick.
- Various UKOU arrangements for externally-funded semi-autonomous agencies over the years including ICDL (International Centre for Distance Learning) and ECCTIS (Educational Counselling and Credit Transfer Information Service).
  - ICDL is, and ECCTIS was, on the UKOU campus with separate accommodation but not a separate building.
  - One can also look at the history of the UKOU's Continuing Education Division and Open Business School over the years and consider the correlation between their success and their relocation to campus.
- NERIS (the National Educational Resources Information Service) had its location in a village near the UKOU – but maybe not near enough, given its recent problems.

It is not easy to draw conclusions in a way that would not embarrass certain agencies. However, in general terms:

- Our analysis leads us to believe that an organisation like ETEI should not be set up in a physical location isolated from other relevant agencies.
- This suggests a "host agency" concept where ETEI is set up at or very near the premises of an organisation with an interest in the business of ETEI; but with careful institutional and perhaps physical arrangements so that the "local" organisation does not unduly (even discreetly) dominate the business of ETEI.
- One can be *too* close, geographically or institutionally. But one can certainly be too far away.

### 7.4 Other points

- ETEI should be set up for an initial period of 5 years. The aim should be that after that period, ETEI evolve into a number of inter-operating infrastructure suppliers (as has happened with the Internet).
- The contract to run the Network Management Agency will be awarded to an existing organisation – or small consortium of organisations – with competence in the area.

### 7.5 Modifications to the concept

The ETEI is likely to find gaps in provision. There are many of these. Three obvious ones at present are:

i) V.32 bis dial-up across Europe

ii) dial-up services into academic networks

iii) network provision in remote and island regions, and in East Europe.

For such gaps the aim of ETEI should be as far as possible to encourage other providers to fill the gaps, rather than committing ETEI to becoming an operational agency. However, in some circumstances ETEI may have to take some pump-priming activity, perhaps as a joint venture with another agency.

Looking at the examples above, possible strategies could be:

i) Encourage PTTs and VANs to move forward their plans for V.32 bis deployment, perhaps helped by EC funds and/or a large trial.

ii) Work with individual universities on the academic networks to get them to install modems. (Our experience tells us that this is a slow process.)

iii) Work jointly with an agency such as JANUS which can make such provision.

One modification of the brief that we would discourage is that ETEI should have an experimental role in the technological sense. ETEI should be about *services* for education (including of course *educational* experiments and trials).

# 8 Trials on the infrastructure

We propose a number of trials on the emerging ETEI in order to get more information about the economics of telematic provision in real-world situations.

## 8.1 Choosing the trials

Our list of trials has been drawn up based on the following factors:

- The scenarios (themselves based on idealised best practice).
- Input from the survey (though this was fairly general).
- What other projects are doing and appearing to find useful.
- What is likely to be of interest to the constituency. (We have good information about plans and needs of members of EADTU – less good about other organisations. However, note that EADTU includes many "traditional" universities as well.)

## 8.2 Trials

This is our current list (as presented at the consultative meeting):

| *"Media"* | *Sample application* |
|---|---|
| Broadcast video | Post-graduate course for credit |
| Voice mail and audio conferencing | Language teaching |
| LAN linking | (Euro)Study Centre support |
| Video conferencing | Virtual summer school |
| CD-ROM plus dial-up | Multi-media courses database & registration |
| Email & computer conferencing | Remote tutoring and self-help groups |

We look at these in turn.

### *8.2.1 Broadcast video*

The suggested application area is post-graduate courses for credit. (This has an overlap with specialised training provision, but it is a traditional area of activity for distance education – for example the EMOT and EMBA courses under the COMETT programme.)

The technologies for broadcast video would include satellite delivery including for home-based users but could also include ISDN-based video delivery.

This trial is of interest to EADTU; but also impinges on the EuroPACE proposals.

### *8.2.2 Voice mail and audio conferencing*

The suggested application area is language teaching. This is an area where EADTU members have not been strong (although expertise is building up, for example at the UKOU). However, it will appeal to many universities in the "traditional" sector. It also appears to have impact on the CONDAT study for SMEs.

### *8.2.3 LAN linking*

The suggested application is Euro Study Centre support. The aim would be to support an initial group of Euro Study Centres for a wide range of teaching tasks.

Applications would include:

- Delivery of EDDiE-type information services.
- Courseware sent over the network.
- Tutoring using ISDN-based audio-graphics and computer conferencing.

The technologies should be satellite- and ISDN-based. Some other points:

- The EADTU aspects of the trial would be oriented to students in universities, not training. However, this trial could appeal to all three sectors in the CCAM study.
- The ISDN can transmit text (and graphic) course material, and limited animations/motion video.

### *8.2.4 Video conferencing*

The suggested application is the "virtual summer school". The term "summer school" normally means a week-long course where students on a distance education course come together in person for tutorials, group work, laboratory experiments, and so on. Two large members of EADTU (UNED and UKOU) run extensive summer school programmes – some of the others are actively considering introducing the summer school concept.

The idea comes in two flavours:

a) Linking together of two summer school sites using video conferencing and other telematic techniques (conferencing and email). This could be done between summer school sites run by the same organisation. For example, for reasons of accommodation and student preference the UKOU uses more than one site at a time for the same course. It is moving towards non-UK locations for summer school for its non-UK students – linking such non-UK locations to the UK summer school "hub" could be very useful educationally since the non-UK locations are likely to contain quite small numbers of students and tutors and so have less scope and variety of courses. Another, perhaps more interesting model would be to link summer school sites run by *different* EADTU members – however, this raises tricky questions of compatibility of syllabus between courses.

b) A more radical development is to *replace* a summer school experience with a week of "telematic saturation" producing the simulation of a physical summer school. This could go on at various levels of commitment. At the lower levels it could consist of extensive use of television satellite programmes (say 2 or 3 hours per day), preferably with heavy feedback by audio or email, spread over a week – rather like the theme weeks that restaurants or even TV stations have from time to time. At higher levels of coupling it could involve students spending several hours a day at the local Euro Study Centre coupled

to other centres by video, audio-graphics and email, engaged in intensive lectures, tutorials and group work.

### *8.2.5 CD-ROM plus dial-up*

The suggested application is a multi-media courses database allowing on-line registration for courses. This could spin off from a stage in the development of the EDDiE database. (The idea is reminiscent of certain applications in the travel trade; and ideas for the COSTEL "Pick & Mix" system.)

EADTU would produce a multi-media CD-ROM consisting of a directory of courses *plus* fragments of courseware. The CD-ROM would be supplied to Euro Study Centres. Prospective students could browse the CD-ROM and when they found a course that was interesting they could click on a "confirm" screen which would contact the relevant institution's central computer system and book them onto the course. (This would be the ideal, but there are a number of educational and financial issues to solve first, such as "Is it educationally acceptable for students to order a course and charge it to their credit card?" Initially it might be necessary to for the system merely to contact the central system to provide further information on the course, leaving the actual booking subsystem to a later phase of development.)

Technically this trial could be run also with home-based students but the educational worries about such an activity would be greater with home-based students. In a Euro Study Centre there would be additional sources of information and advice for the student to draw on.

### *8.2.6 Email & computer conferencing*

The suggested application is remote tutoring and self-help groups for students at home. This may seem like not a new sort of trial, but we beg to disagree, for the following reasons.

While computer conferencing has become quite widely used, it has somehow not broken out of being a niche application. There are many reasons for this, including cost and complexity of telephone access and lack of integration with organisational purposes, but one till now has been largely overlooked – the systems that are deployed (students might say "inflicted on them") are many years out of date in their interface design and integration with the printed components of the system, namely word processor files.

Attempts are being made, in JANUS and other DELTA projects, to retro-fit windows interfaces to the current (so-called) widely used traditional conferencing systems such as CoSy, and we wish such activities well, but it is not the only approach. The other approach is for organisations such as the UKOU to write off their large investment in such 1970s-style conferencing systems and start again. This is a radical approach with large risk factors. Will organisations take such a step without evidence? We think not. They need evidence that such a radical step would solve the impasse they are in with existing systems.

This trial would aim to do this. It would overcome both (a) the problems of cost and complexity of telephone access by using the appropriate telematic network and (b) the problems of lack of integration with word processors by using a modern (post-

1990) conferencing system with a windows interface which is well integrated with word processors on the student microcomputers.

If there is a free choice of such software in a green-fields situation unconstrained by finance, then software is commercially available to meet this requirement – more than one choice, in fact.

Connection speed issues

A related axis of this trial would be to try out various connection speeds for the network, from 2400 through 9600 up to and including ISDN access at 64000 bit/s. This is to test out the hypothesis that above a certain bit rate, it is *educationally immaterial* at what speed the connection to a conferencing system is made.

This would not just be a dry academic finding – it would have substantial investment implications. As a possibly unlikely example, if, given the right interface there was no difference in educational effectiveness between 2400 bit/s and 9600 bit/s, then there would be no point in PTTs investing possibly millions of ecus in upgrading their existing 2400 bit/s dial-up X.25 networks to 9600 bit/s for applications such as email and conferencing.

We say that it is an unlikely example, but it is true that on modern commercial windows-based conferencing services such as AppleLink the majority of users seem to be happy with 2400 bit/s access except when downloading large files, and one could argue that downloading is not strictly a conferencing activity. (One could also argue that if downloading was replaced by a downloading *request* system which resulted in a floppy disc of requested files being posted out, then downloading would be a lot less used. Such a methodology could apply also to database searches, another large application of X.25 networks.)

### 8.3 Correlation with other studies

We believe that the network approach outlined above would satisfy the *telematic network* needs of the two other sectoral studies. There is no need in our view to set up *another* telematic network broker. In particular:

- dissemination of satellite television for training
- access to databases, whether of courses, courseware or research/news data

and

- tutoring over ISDN

can be satisfied on our network. (In other words, the broker will ensure that such services are provided if a user constituency requires them.)

Given a common understanding of the role of Euro Study Centres, the dissemination points of the CONDAT proposal could be identified with Euro Study Centres. The CONDAT sectoral resource centres would be connected into the "EADTU" telematic network (probably on leased digital circuits) which would allow access to them from Euro Study Centres, homes, institutions, etc. From what we understand of the EuroPACE sectoral resource groups, any databases that they generate would be mounted on host systems on the network.

Where we differ from the other two sectoral studies is that they want *more* than a telematic network. Thus CONDAT recommends a "Management Centre", IDATE (trying to synthesise all the studies) recommends a "Eurofile" centre. We are not sure what EuroPACE really recommend in operational terms.

We are not against other studies recommending more than a telematic network, but we would claim that the role of a telematic network (and its associated network management centre) should be separated from the role of management centres offering more general functions. Telematic networks are best managed by telematic network managers. It is not the core business of EADTU to run such a centre and we humbly submit that it is not core business for EuroPACE (as was), CONDAT or IDATE, let alone questions of having the correct range of skills.

Having settled (to our satisfaction) the issue that we should all be able to agree on the need for a telematic network management centre, what about the other functions?

Non-telematic functions and the need for centres

There our view is that, unlike telematic networks, where the overall job is not being done at all at present, the task of these other management centres overlaps substantially with existing organisations, agencies and projects. As an obvious example, before any discussions about databases of distance learning courses were to take place in CCAM circles, there would have to be rationalisation of such ideas with plans emanating from the EC-funded EDDiE study which involved many of the major European actors.

As another example close to the heart of some of our authors from the educational technology domain, the idea that IDATE propose of one centre containing a comprehensive range of skills in educational technology as a sort of "Euro advice centre" seems totally unrealistic. (In fact it is unrealistic even within institutions – both the UKOU and Dutch Ou have very large departments of educational technology but both would admit that relevant educational technology skills are spread over other departments as well. Indeed at the UKOU a large wide-ranging project such as JANUS calls on five separate departments for just such reasons. So even one large institution cannot have just one all-embracing centre of expertise.)

Furthermore the idea seems close to the kind of thinking some years ago which the EC rightly turned its back on, the "DEUCE" concept of one central institution as the European Electronic University. Instead EADTU with others agreed that a distributed model was best. (This also now seems consistent with the principles behind subsidiarity.) Such a distributed model requires a telematic network to support it, of course – and this is covered by the EADTU proposal.

It should not need saying that EADTU proposals on networks are not designed to be exclusive to EADTU. This is true in a practical as well as a theoretical sense – to see that one only has to look at the collaboration in JANUS with non-EADTU partners and the existing moves towards network compatibility between EADTU key members and other agencies – including SATURN and EUROSTEP as well as national agencies.

# 9 Conclusions and implications

In Volume 1 of the EADTU CCAM Report we looked at the cost-effectiveness of telematic networks for distance learning at the tertiary level. Our general conclusion was that in order to be cost-effective, they have to be used extensively, for many students and for many study hours per student. (Note that our conclusions are valid for training applications as well as for education.)

However, it is in the nature of new developments – and not just in education – that they tend to "start small" and only later attain a critical mass which makes them cost-effective. So how to overcome this start-up hurdle?

In Volume 2 (this volume) we proposed that to overcome this problem, a European Telematics for Education Infrastructure be set up to offer cost-effective and easy to use network services so that even early adopters of telematics can benefit from economies of scale.

The other studies have proposed their own solutions, and further integration has to be done. We believe that an approach based on ours will be an appropriate model to go forward with.

Once a common model is agreed, more work of course has to be done at a detailed level. Section 9.1 below gives an overview of what has to be done next.

## 9.1 Detailed planning for ETEI

The planning for the ETEI can benefit from planning that has been carried out for other networks. Studies that are worth revisiting include planning for:

- the RARE Operational Unit
- SuperJANET
- JANUS pre-operational service (ongoing – see for example Deliverable 18 and the forthcoming Deliverable 22)
- wide area networks in the member institutions of EADTU – in particular UKOU.

Based on these, we propose the following as an initial set of headings and subheadings for the planning for ETEI:

- Ownership and management:
  - board/council
  - management team and responsibilities
  - organisational structure
- Purchase of network services:
  - EC guidelines (such as Services Directive)
- Commissioning of services
  - carried out by whom?
  - work to agreed standard
  - acceptance criteria

  - liaison with suppliers
  - liaison with sites
- Network management
  - requirements
  - cost
- Maintenance
  - requirements
  - cost
- Standards
  - purpose of standards
  - who sets them?
  - who implements them?
  - updating agreed standards
  - development of new operating standards
- Code of practice
  - who can use the facilities – "Acceptable Use" guidelines
  - how much should be charged?
  - can/should charges be subsidised?
  - which part of system gets subsidies? (end-users, providers, …)
- Revenue policy
  - pricing policy (related to actual telematic cost, use of equipment, flat-rate charge, per-capita charge, etc?)
  - charging mechanism
  - subsidies.

### 9.2 Appropriateness of organisations

There is no point in proposing new organisations (even small ones) in a vacuum. The EC and each country has many existing organisations and agencies involved with education and with telematics – some would say too many – and any proposal should state how it fits in with these.

We have not dealt with such real-world issues up till now because we wished our arguments to stand on their own merits, not the merits of the organisation proposing them.

However, now is the time to make a few remarks. This is rarely done – often various factors such as commercial sensitivities or modesty prevent realistic appraisals of organisational strengths in documents of the kind we give below. But even we shall be fairly discreet and cryptic, for various obvious reasons.

The EADTU is getting more and more involved in telematic networks. At an operational level, all of its main members make some use of telematic networks for teaching:

- television (including satellite television) is used by FernUniversitat and UK Open University
- computer conferencing and videotex are used or about to be implemented at UKOU, UNED, FernUniversitat and Dutch Ou.

Most of the smaller members and consortium members also make use of systems such as conferencing or email in their teaching or course development.

In addition, the EADTU (including the UKOU) is the major actor within the JANUS project which is piloting a satellite-based network, within DELTA. JANUS management assure us that although based largely on a specific technology (VSAT), the network is designed to provide a general range of services managed in a technology-independent way – looked at in this light it becomes a precursor of the ETEI Network Services Directorate rather than a potential service provider to ETEI; in fact, it might split into two consortia eventually, one for each role.

Thus the EADTU would be interested in becoming a founder member of ETEI. In addition EADTU would wish to have a seat on the board/council.

This does not mean that EADTU wants to *run* ETEI. In line with current business thinking, EADTU wishes to focus on its core business of facilitating its members' activities in teaching at a distance. However, EADTU would be interested in exploring the possibility of one of its member sites hosting ETEI (thus providing an organisational base) – while preserving a suitable "arms length" relationship. In order to preserve the arms length relationship – so-called "Chinese walls" in UK terminology – it would be appropriate for ETEI to be either a separate organisation from the member (compare the NERIS – UKOU situation) or *at the closest* an autonomous spending unit within the member (compare NDEC within Dublin City University or ICDL within UKOU). Neither form of the relationship would prohibit ETEI buying specialist services from the member (or indeed other members) but would tend to rule out, for example, the idea of ETEI being just an informal group within one of the member's faculties or divisions.

EADTU would of course be willing to work along with other organisations on the board of ETEI. However, it is important that the other organisations are themselves either (a) direct users of telematics networks (such as a large traditional university) or (b) associations who accurately represent the interests of such *users* via membership of the association (and this is not true of all such organisations). Agencies who are purely advisory or consultative or "mere" programme or network suppliers would not seem relevant to have an ownership share in ETEI or any rights over nominating management; however, this would not rule them out from nominating non-executive directors.

Satellite TV

The situation with satellite television is somewhat special. Currently there is only one remaining agency in existence with serious operational capability in satellite education and training TV, namely EUROSTEP. We assume that EUROSTEP would want to become a founding member of ETEI. Indeed, some would go further and suggest that EUROSTEP undergo fission and remodel its operational half as the core

of the Satellite TV Directorate of ETEI, while keeping the membership/advisory half outside.

We have earlier argued that there is no real division between education and training. Many of the members of EADTU undertake both vocational training and high-level professional training/updating. Thus we are not sympathetic to the idea of having a separate training channel (or even worse, as with EuroPACE, on a separate satellite). Such separation *may* occur once a viable market has been established, perhaps if there is a need for more than one channel's worth of capacity.

Of course, there is no reason in terms of ETEI why there should not be a group of training-oriented providers who band together to use ETEI for delivering training – but over the same channel as for education. Their voting power on the board of ETEI will in the end depend on level of usage – but the existing TV output of EADTU members would provide a substantial core of programmes.

Information dissemination

EADTU remains committed to the idea of better dissemination of information on *courses*. EADTU has been actively involved in the courses database area through the EDDiE project; and several members of EADTU have been involved as project leaders or subcontractors in several database services, such as ICDL, ECCTIS and NERIS.

For that reason, EADTU would support moves to widen the current EDDiE circle of partners to include other agencies interested in this area, with a view to formulating a proposal for EC funding under an appropriate programme.

However, EADTU remains sceptical about the other database aspects proposed elsewhere.

Proposal

EADTU is willing to be involved in leading the development into the next phase of ETEI – which is effectively a planning and trials phase. EADTU would work with a relevant agency, such as EUROSTEP, on the satellite TV planning. EUROSTEP would be encouraged to commission experts in the area of satellite TV for *training* (and they would be likely to have come from EuroPACE). CONDAT would seem to be an appropriate lead in the area of services for training.

IDATE might wish to lead on (a) analysis of market demand for the network and (b) the regulatory impediments, although for the first part of the work we feel it would be prudent for them if they worked alongside SATURN.

EADTU would rapidly make temporary arrangements (for example, at the secretariat or with one of its members) to host the nascent ETEI Agency, while entering negotiations with its membership over longer-term solutions for the headquarters and other arrangements for ETEI.

## 10 Reports consulted

We are of course familiar with what might be called the "traditional" telematics in education literature and have been responsible for some of it. For this report we have cast our net rather more widely including into the schools arena here and abroad.

We give a selection of such papers below and some other ones that we found useful or stimulating (or sometimes both). Unfortunately not all the papers are easily accessible – those that are public or available at nil or low cost or via libraries are marked with an asterisk.

There is a large need for more published material in this area.

*Bacsich, Kaye, Lefrere. "New Information technologies for education and training – a brief survey" Oxford Surveys in Information Technology, vol 3, Oxford University Press 1986

*Bacsich, Bates, Nouri, and Vinckel. "The potential of VSATs in education and training" JANUS Deliverable 10, 1993.

*Bacsich. "Services on VSAT" JANUS Deliverable 18, 1993.

Bacsich. "Satellite TV" Report to COMETT DECAD project, 1993.

*Bates. Broadcasting in education: an evaluation. Constable, 1984.

*Bates (editor). Media and technology in European distance education. EADTU, 1990.

*CEC. "Memorandum on Open Distance Learning in The European Community", CEC, November 1991

*Collis. "Telecommunications-based training in Europe: a state-of-the-art report" in The American Journal of Distance Education, Vol 5. No 2.

*Ford. "Universities without walls – information technology opportunities for higher education establishments" Digital Equipment Corporation, 1992.

*Keegan 1990. Foundations of distance education (2nd edition). Routledge.

Larmouth et al. "Distance Learning – Report of Phase 1 study" Report to British Telecom, 1993.

*NCET "On-line – electronic mail in the curriculum" NCET, 1991

Sherwood-Roberts and Vervest. "Technology options for multimedia in distance learning" Report to CEC, 1991

Wilson. "Building a cathedral" Paper presented to NCET workshop on the Future Curriculum and Electronic Communications, January 1993.

Wilson. "The future of electronic communications in education and training" Report to National Council of Educational Technology, 1993.

Newsletters

There is a lack of newsletters in this area. One that we have found useful as a way of keeping in touch is:

> "Using Telematics in Education and Training" published by pjb Associates, 10 Green Acres, Stevenage, Herts.

Other relevant information can be found in "EADTU News" and in "EUROSTEP Bulletin".

A useful US perspective can be gained from "Ed", the newsletter of the US Distance Learning Association.