

FUTURE CHALLENGES TO EUROPEAN TRANSPORT AND THEIR REPERCUSSIONS ON
TRANSPORT R & D

by

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1. INTRODUCTION

Time horizons in transport planning are typically 10-20 years. Although the changes in transport occurring over such periods may be limited in relative terms - the roads, the airports, the railways of today will mostly still be there in 20 years' time, as will some of today's transport means - the absolute size and the direction of changes are determined much more by other factors, such as industrial and technological developments, economic growth and changes in society at large - than by changes in the transport sector itself. Therefore forecasting and planning for transport on a 10-20 year horizon must necessarily encompass those sectors outside transport most relevant to the supply of, and demand for, transport. This seemingly trivial conclusion is in practice very difficult to respect. The long-term forecasts for air passenger transport made during the 1960's to support decisions on new airports and on investments in new aircraft have demonstrated this; not so much through excessive optimism about growth rates of passenger flow - who could have foreseen the increase in energy prices, the low economic growth rates etc. of the 1970's? - but because they used a simplistic projection of fixed annual growth rate of passenger flows, unrelated to the economic and social factors generating them.

In this paper we therefore take as our point of departure an analysis of perspectives for economic and social development in Europe in order to draw conclusions about the future context for its international transport. We then consider some trends in transport itself, complemented by reference to recent trends in one country (Denmark).

These analyses indicate five major developing challenges for international transport in Europe. Following the discussion of these, the paper concludes by suggesting some fields for further R & D as particularly appropriate for action at multi-national level.

* FAST: Forecasting and Assessment in Science and Technology.

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The main sources for this paper have been Allport and Gwillian (1982), FAST (1982) and Holst (1982).

2. THE NEW ECONOMIC AND SOCIAL CONTEXT

Europe faces major and multiple problems, and is in poor shape for tackling them. The various countries of Europe are, to varying degrees, hit simultaneously by the accumulation of massive deficits in their balance of payments, even greater public sector budget deficits, high unemployment rates, high inflation rates, ageing, and even declining populations and a high, though declining dependence on external energy supplies.

If we gave priority to only one of the problems we could certainly solve it, but at the price of aggravating the others. Such is the present crisis; the various problems with which we are confronted call for mutually incompatible or contradictory solutions. The result is a state of despair because even if the identification of the 'evils' of the crisis (high inflation, high interest rates, high unemployment) may be agreed upon we have still not found policy measures capable of leading us out of the crisis. The variety of measures adopted in different countries reflects more than ideological differences between the regimes in power; it reflects a widespread lack of understanding of the economic and financial functioning of our economies and societies in the present situation.

Notwithstanding the complexity of these deeply intertwined problems FAST (1982) suggests that the main uncertainties and selection problems for future development of Europe lie in four areas; two problem-oriented: how are we to tackle the employment problems and the energy problems during the 1980's; and two technology-oriented: how are we to develop and use the new information technologies and the new biotechnologies.

In the Western World we have already embarked upon a comprehensive process of readjustment to alternative (or at least to more expensive) energy sources, and a series of major long-term energy research programmes has been launched. We are still far from the target and to get there calls for a great deal of R & D effort; nevertheless the process has started and progress is being made. This is much less the case for the other three areas mentioned, on which we shall now concentrate.

These three areas have been the research themes of the FAST-Programme of the Commission of the European Communities. As regards the possible future developments of European society and the associated risks and opportunities the results of the FAST-Programme are both simple and unclear. Simple, because an 'extrapolation scenario' (based on present trends in industry, economy, technology, social

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values and norms, and institutional structures) presents such sombre prospects as to be politically quite unacceptable. What such projections make clear is the essential need for a redeployment process implying major industrial, economic and social readjustments. On the other hand the results of FAST are unclear, because nobody can possibly foretell the outcome of this future readjustment process and cannot therefore confidently present any detailed scenarios for Europe 2000.

The 'extrapolation scenario' is unacceptable because it will confront Europe with two crucial problems :

- An employment problem on a colossal scale, both in quantitative terms (i.e. number of jobs) and in qualitative terms (i.e. shifts in the employment structure). At present, the number of unemployed in the 10 EEC-countries is 11 million i.e. an unemployment rate of about 10%. Demographic trends and structure imply that the EEC labour force will steadily increase, by approximately :

1 000 000	per year	from 1982	to 1985
300 000	" "	" "	1985 - 1990
100 000	" "	" "	1990 - 2000

To achieve an unemployment level of 2% in 1995 would therefore entail the net creation of 1 million new jobs a year between now and then (in the 'golden sixties', about 260 000 new jobs a year were created).

Much larger than the net changes will be the gross shifts in employment possibilities between various regions, various sectors and, in particular, between various functions. In every type of employment, the job content and the technical aids employed will change fundamentally over the next 20 years.

- An industrial adaptation problem of comparable magnitude. It will be seen, simply by considering the EEC's external trade balance that the Community is a net importer of all categories of commodities such as agricultural products and foodstuffs, energy and raw materials. Not merely the economies of the Member States, but also the entire structure of their societies, are based on openness vis-à-vis the rest of the world. This relationship depends upon the EEC-countries having something to offer in exchange for the vital imports. The only realistic possibility seems to be industrial exports. This has hitherto been the role of our industrial goods; but the future appears to hold out bleaker prospects. The new information technologies (including all forms of automation, communication and computers) are vital elements of all industrial production and in this area Japan and the USA, in particular, have gained a major lead on the European industry.

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The European societies will therefore be forced to change, slowly but pervasively; the question remains to what extent we ourselves shall be able to control the change. The social and economic context in Europe over the coming decades has important implications for the future development of its international transport. We shall emphasize three :

1. Transport issues alone will not be top priority issues.
2. Transport and telecommunications are the nervous system for the social and economic functioning of our societies. The past has shown that major societal changes and major innovations in transport (the railways, cars, passenger aircraft) have accompanied each other, and the same will continue to apply. To respond effectively to the main challenges facing European societies - international competitiveness, adaptation to and adoption of new technology, unemployment and energy provision - will therefore have strong bearings on international transport. We shall have to identify these relationships and act correspondingly.
3. We are preparing to enter a process of substantial change, the end-point of which is beyond our ability to forecast. Therefore no 'grandiose' plan for transport corresponding to a predetermined future should be developed. In the choice and design of the transport projects actually to be implemented over the next years, priority should be given to the flexibility and robustness of their viability with respect to the uncertainty of future economic and social developments.

We consider next the trends already at work in transport itself before returning in the final chapter to the main challenges to international transport in Europe, and the related R & D needs.

3. SOME LONG-TERM TRENDS IN TRANSPORT IN EUROPE

Our emphasis is on international transport but for obvious reasons we can rarely give figures and results which apply exclusively to this sector. International transport is intrinsically integrated into the total transport system in Europe - as regards infrastructure, rolling stock and management - and the transport statistics do not consider international transport as a separate category.

The approach adopted in the basic study for this paper (Holst 1982) made use of four principal 'dimensions' of transport : demand, costs, management and technology. This ensured to a certain extent that factors both external and internal to transport were taken into account. It is on this basis that we suggest the following trends as being important for the future development of international transport in Europe :

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1. Increasing internationalisation of transport in Europe, both passenger and freight.
2. Increasing vulnerability of the modes predominantly used in international transport.
3. Decreasing relative importance of railways in international transport.
4. A maintenance of status quo in management attitudes to international transport i.e. treating it as a 'step-child' as compared with national transport.
5. Increasing oil-dependency of transport.

Re 1: Increasing internationalisation of transport

That transport in Europe has become increasingly international is unquestionable. It is illustrated in the case of passenger transport by the high growth in air transport (see Figure 1) which in Europe is predominantly international.

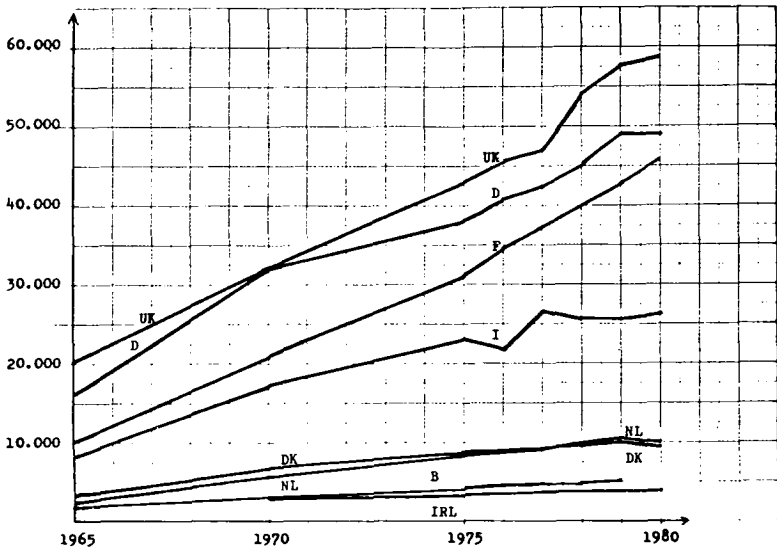


Figure 1 : The number of air transport passengers in EUR - 9
 Source: Statistical Yearbook 1980, Transport,
 Communication, Tourism. EUROSTAT 1982.

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Increasing transport distances have been a general phenomenon, both locally due to urban sprawl (Drewett, 1980), and internationally due to internationalisation of trade and communication. It is a trend which has been stimulated not only by increased transport efficiency, but also by economic growth. Several investigations have shown (Morris and Wiggan 1979, Dahlman and Klevmarcken 1971) that additional income to a very high degree is spent on transport, and expenditure on communication and transport as % of total consumer expenditure has steadily increased during the 1970's for the European household (Social Indicators p. 93 EUROSTAT, 1980). Thus any positive economic growth in Europe is likely to lead to longer distance travelling which in Europe inevitably leads to more international travelling. The trend in employment away from the secondary sector (industry) to the tertiary sector (services), which has a higher intensity of (international) business travelling, gives further stimulus to the trend of increasing international passenger transport.

In the case of freight the internationalisation is equally clear. Table 1 shows that international freight has shown significantly higher growth rates than has national freight.

Country	Type of freight	Growth from 1970 to 1973	Growth from 1973 to 1976
Germany	National	+ 10%	- 9%
	International	+ 59%	+ 28%
France	National	+ 7%	- 7%
	International	+ 42%	+ 10%
Netherlands	National	+ 2%	+ 8%
	International	+ 43%	+ 14%
UK	National	+ 4%	- 9%
	International	?	?

Table 1 : Growth in freight measured in number of tons transported.

Source: Statistical yearbook 1976 Transport, Communication, Tourism. EUROSTAT 1978.

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This is partly due to the increasing importance of foreign trade - the importance of foreign trade relative to GNP has for the Member Countries of the EEC increased from approximately 20% in 1973 to 25% in 1980. This trend is likely to continue, with perhaps an even higher growth rate; but this will be compensated by the fact that the highest growth will be in services, where telecommunication rather than physical transport will be the main carrier. The fact that many products related to new (information) technology require a global market, either because of strong economies of scale in production or because of highly specialised products, will also be a stimulus for future growth in international trade and transport.

Re 2: Increasing vulnerability of transport modes used in international transport.

The exceptional growth in international transport during the 1960's was facilitated by concurrent improvements in transport technology and infrastructure. Bigger and faster aircraft were the 'technological fix' responding to the demand for international travelling. The situation is now somewhat different. We are approaching the capacity of some bottlenecks in infrastructure (airports), the relatively high energy consumption of aircraft has become crucial for reasons of finance and security of supply, and the financial situation of most European Airlines is catastrophic in spite of significant national subsidies.

In freight also, one mode is predominant : the truck. In spite of all the attempts to promote competing modes, in particular railways, and of all the good arguments which can be advanced against the use of the truck for long distance freight - energy consumption, traffic safety etc - road has steadily advanced : see Table 2.

International Freight (10 ⁶ tonnes)	G E R M A N Y						F R A N C E						N E T H E R L A N D S					
	1965		1976		1977		1965		1976		1977		1965		1976		1977	
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Road	25	15	85	29	91	31	17	19	59	43	61	45	13	12	37	20	41	21
Rail	55	33	72	24	65	22	49	54	47	34	49	33	11	10	12	6	12	6
Inland Waterways	89	52	138	47	139	47	24	27	32	23	32	23	89	78	137	74	142	73

Table 2 : Model split figures for international freight.

Source : Statistical Yearbook 1977, Transport,
Communication and Tourism. EUROSTAT 1980.

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One reason may be that only the truck benefits from the existence of an effectively working international infrastructure in Europe. However it has implied that international freight in Europe becomes increasingly uni-modal.

Re 3: Decreasing relative importance of railways in international transport

The boom in international travelling during the 1960's was absorbed by air transport, and benefitted the railways only marginally. Even on distances below 400 km air transport has predominated over rail, in particular on international routes. The same has happened in freight as we see from Table 2. Railways have lost approximately one-third of their market share in international freight over 10 years. Part of the explanation is that the relative importance of those commodities where railways dominated (bulk commodities such as coal and other raw materials) has decreased, but this can hardly explain all the decrease.

Notwithstanding all the difficulties associated with the definition and calculation of public subsidies to national railways, it seems quite clear that they are high: see Table 3.

National Railway Companies	Trends in Financial Support			Percentage of total costs including capital financed from revenue
	1975	1976	1977	
BR	100.0	83.4	73.0	71,2
DB	100.0	96.0	106.8	61,2
DSB*	100.0	97.5	91.4	61,0**
FS	100.0	100.5	95.1	32,0
NS	100.0	126.1	131.4	55,5
NSB	n.a.	n.a.	n.a.	59,6
SJ	n.a.	n.a.	n.a.	83,1
SNCF	100.0	99.4	105.3	49,6
SNCF	100.0	104.8	123.5	55,3
VR	n.a.	n.a.	n.a.	50,2

Table 3 : Trends in financial support to national railway companies in Europe and the percentage of total costs including capital financed from revenue.

Source: Gwilliam and Pridaux : "A comparative Study on European Rail Performance", 1980.

*) Financial years : 1975/76, 1976/77, etc.

***) For all DSB activities proportion is 65,7 %
Estimate above relates to rail activities only.

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This development is in spite of a relative growth of infrastructure investment in transport such as shown by Table 4.

YEAR	Three modes of transport	Railway	Road	Inland Waterways
1973	21 393	3 917	16 888	588
1974	24 410	4 670	19 093	647
1975	26 808	5 375	20 687	746
1976	28 042	6 144	21 106	792
1977	30 206	6 779	22 530	897
1978	33 506	7 496	25 077	933
1979	37 462	8 308	28 171	983

Table 4 : Infrastructure investments for three modes of transport in EUR-9.

Figures are in millions ECU (European Currency Unit).

Source : Statistical Yearbook : Transport, Communication, Tourism, EUROSTAT 1980.

The growth in investments has not been accompanied by a growing role of railways in transport in general and in international transport in particular.

Re 4: status quo in management of international transport

When international transport was a negligible part of all transport it was logical to have a purely national planning and management of transport followed by an adjustment and coordination phase on an international level, mostly organised as a series of bilateral contacts, to ensure a certain effectiveness of international operations. Although international transport has now grown in significance, in spite of the very important limiting 'effect of frontiers'*, this procedure is still being followed. Each country develops its own plans and implements its own projects. When these national 'blocks', whatever their excellence in isolation, are juxtaposed, they do not necessarily form the optimal basis for international transport. The APT (Advanced Passenger Train) in the United Kingdom and the TGV (Train à Grande Vitesse) in France are

* The EEC/OECD/CEMT study COST Action 33 : "L'avenir des transports de voyageurs en Europe" suggests on the basis of model runs that there exists 'effects of frontiers' limiting passenger flows by a factor of 5-10.

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or will turn to be magnificent improvements; but they will never jointly constitute a rapid European train due to incompatibility. International transport deserves and needs better care than can be devoted to it by the occasional efforts of national agencies.

Air transport has from its very beginning adopted an international approach, but national monopolies and the absence of real competition from railways have led to a tradition of bilateral international agreements, thus going one step further than the national approach used for the other modes but in practice not very different.

Re 5: Increasing oil-dependency of transport

Transport in EUR-9 not only consumes more and more energy, both absolutely (from 124.43 mill. tce in 1975 to 149,23 mill. tce in 1980) and relatively (from 21,1% of all energy consumption in 1975 to 23,5% in 1980), but has also become almost totally dependent on oil (98% in 1975 as compared to only 75% in 1960) (Holst 1982). More than 80% of the oil is used in road transport, and the proportion accounted for by road transport is steadily increasing.

The oil dependency might be reduced in three ways : by using sources other than oil e.g. substitute fuels; by the electric car, with electricity being produced on the basis of coal, nuclear power or renewable energy sources; or by improving the energy-efficiency of the transport means. All three paths are being researched and may well be fruitful, but with significant impacts only towards the end of the decade.

Some recent fluctuations in the trends

Some recent figures, based on data from Denmark where the Ministry for Public Works issues a monthly bulletin on traffic indicators with a delay of only 1-2 months, suggest that there may have occurred since Summer 1979 a change in the long term trends outlined above (see chapter 6 in Holst 1982 for the underlying analysis):

- Household expenditure on transport was the first to change in the Summer of 1979
 - by buying fewer and more fuel-efficient cars;
 - by reducing the total car mileage;
 - by substituting by public transport for transport by car; spontaneously in the case of commuting, and six months later in the case of long distance transport;
 - by reducing travel of the "luxury" type such as long-distance holiday and weekend travelling.

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- Business expenditure on transport has also started decreasing, but the change of trend occurred 6-8 months later than in the case of households. What we now observe is that :
 - freight volumes are decreasing;
 - numbers of airline passengers are decreasing, much more on chartered flights than on scheduled flights.
- The railways are profiting from growth in passenger numbers, even in a shrinking total market, but suffering from a declining freight market in both absolute and in relative terms.
- The market for air transport is shrinking, more in the case of private than in that of business or professional travel.
- Road transport, both passenger and freight, has also decreased, but by less than the other modes.
- The energy-efficiency (energy input relative to transport output) of car transport has improved by 8% from 1978 to 1981.
- Traffic safety has been steadily improved since 1978, and not only through the reduction in traffic volume. In particular the total number of accidents during the summer period has decreased.

It is too early to conclude whether these fluctuations are the beginning of new trends or a small disturbance of the past trends. The author ventures the personal guess that the latter will be the case, for two reasons. Total transport demand will not decrease in spite of new facilities, services and prices in telecommunications, due to a basic need for face to face contact. The Danish figures do suggest a shift from private to public transport, but the author has serious doubts as to whether public transport can adapt its capacity and its service sufficiently quickly to seize this opportunity. Therefore we are likely to experience a drift back to the previous use of the car.

4. THE FUTURE CHALLENGES TO INTERNATIONAL TRANSPORT IN EUROPE

The trends in transport outlined in the previous section prompt us to underline five challenges to international transport in Europe :

1. The management and organisation of international transport

The increased internationalisation of transport in Europe which is not accompanied by a similar internationalisation of planning and organisation of transport, and the increased vulnerability of the predominant modes in international transport imply a need for better planning and coordination, at an intermodal and international level, of international transport in Europe. A need which also calls for institutional arrangements.

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2. The future of European railways

The future for railway freight seems particularly gloomy, nor are the prospects for international rail travel encouraging. Do we adapt to this situation or do we try to change the trends? Could we not obtain better value for the money we currently pour into the railways?

3. The vulnerability of European Airline Companies

Stagnating markets and increasing operating costs put the already financially weak airline companies (with some exceptions admittedly) in a very difficult position. This is also a direct risk to Europe which has based international travel in general and business travel in particular on air transport.

Setting transport in the general social and economic context outlined above underlines firstly the importance of the three challenges already mentioned.

A future where Europe is still relying upon a high degree of national specialisation has to regain international competitiveness and has to show flexibility and adaptability requires an international transport-system which is both effective and flexible. The vulnerability due to the unimodality of the international transport system and the use of railways in a half-hearted way requiring many resources and to little benefit for international transport seem unacceptable. Either the resources spent on railways could be better spent on other modes, or we should remove the obstacles for making better use of railways. Secondly, the relations between international transport on one hand and the issues related to new technology and energy on the other hand make us emphasize two more challenges :

4. Higher prices and sources of energy

Transport consuming 25% of all energy and being entirely dependent on oil not only makes transport in Europe very vulnerable but also places it at the centre of the energy issue in Europe. Transport must contribute both to improving energy-efficiency and to using other sources than oil.

The very long lead times before any substitute fuel and the infrastructure for its production and distribution can be developed, make the transport-energy issue a genuine long term issue where reactive measures are doomed to fail.

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5. New Information Technology and transport

Three kinds of relationships between new information technology and transport are of strategic importance :

- a) New information technology offers great opportunities for a more effective transport provision : more energy-efficient engines, better information and document processing systems for the operation of public transport. Railways, in particular, the only guided form of transport, are offered ample opportunities for more efficient operation.
- b) New services in telecommunication may have significant impact on the time/space budgets of people. This will affect transport demand, not through a substitution between transport and telecommunication, but by changing when and where to travel.
- c) The transport sector is a key sector for stimulating the development of new information technology. The production of cars, products in the car and the operation of transport systems offer numerous application of new information technology and can thus serve to pull the development of capabilities in new information technologies and orient the development in the direction of societal needs.

5. R & D NEEDS

The R & D discussed below is not limited to transport technology. In fact the management of transport - the "software" of transport - will be much more severe bottleneck to an effective transport system in the future than the technology of transport. Therefore in research we should devote much effort to issues related to the management of transport. As regards technology we should first of all make full use of existing technology, and advance the technology in selected areas e.g. related to energy-efficiency.

The challenges identified above are long-term in the sense that the effect of any response to them will predominantly be seen only in the long term. It is all the more necessary to start early and to be "pre-active". This applies in particular to the R & D needs associated with the following five challenges :

1. Fundamental research on demand for international transport

Nobody can carry out any active planning or control of transport in Europe unless we have a clear understanding of our objectives, the socio-economic system we want to influence, the traffic policy variables available to us, and the consequences of alternative uses of such variables. The present

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"state of the art" in international transport in Europe is not capable of meeting these requirements. Thus we should first of all promote research to create a better understanding of the forces underlying transport demand, because this will provide the key to understanding many other issues, such as the impact of transport on economic activities and on social welfare, the impact of the many different characteristics of transport supply on demand for international transport as well as for inter-city and urban transport. It should be stressed here that what is needed is not another series of forecasts of transport demand but improved understanding of the forces behind it : to give just one example, the 'effect of frontiers' which is absolutely decisive for forecasting demand for international transport. We know approximately its effect today but we do not fundamentally understand the factors behind it and cannot therefore forecast it.

The need for a better methodology in transport planning, which in fact boils down to a better understanding of the factors behind transport demand, has been stressed by Lutin and Falls (1980) in a context quite different from international European transport; The Las Vegas personal rapid transit (PRT) system : "The history of the Las Vegas PRT system points up foremost the need for good planning. It was poor planning, not poor technology, which in the end killed the project. The Las Vegas PRT was killed because it was conceived in isolation, and not part of a comprehensive planning process which considered regional public transportation needs, as opposed to a single transportation service. The project was killed because planning for it was not conducted in non-partisan manner, in which a number of alternatives were considered by an unbiased planning organization. And finally, the project was killed because the demand for the system could not be estimated with certainty. No one was able to provide the decision-makers with credible ridership estimates, the compelling evidence that the system should be built and would be a financial success".

2. New information technology and transport

Both the supply of and the demand for transport will be affected by new information technology. R & D is needed on both aspects.

- The possibilities for using N.I.T. in railways operation need to be explored. Such research should be seen in the context of a major prospective research analysing the future role of railway, in particular in international transport. It goes without saying that R & D on the use of microelectronics to improve energy-efficiency of engines needs continuation.

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- The impact of new services in telecommunication on transport demand needs further research, first of all aiming at providing empirical evidence. As regards international transport the 'geographical collapse' of telecommunication costs (due to satellite and optical fibre technology) may have significant impact on the demand for long distance travelling. When our communication patterns 'explode' geographically people may after a while also want face-to-face contacts with those people far away and to trade with them. This issue needs further clarification.

3. Research to promote energy sources other than oil

The two long term alternatives to oil are coal and electricity generated by nuclear and renewable sources - biomass is ruled out in the long term in European conditions because we can use our land surface more effectively for purposes other than the production of energy in liquid form.

To produce syncrude on the basis of e.g. coal requires technology adapted to the local characteristics of coal and for large scale production. This will not necessarily be available in time, and present R & D efforts, which are highly concentrated geographically, may not lead to technology applicable elsewhere.

The lead times associated with new energy sources for transport must not be underestimated. If we want to make effective use of syncrude by the end of the century the preparatory R & D has to start now. Similar considerations apply for electricity but probably with an even longer time horizon.

4. An assessment of international transport in Europe

Just as transport research and planning in Europe is fragmented - by nation and by mode - so is the assessment of international transport in Europe. There have, for example, been sporadic comparisons between air fares in Europe and in the U.S.A., but we lack a comprehensive assessment of the international transport system in Europe. We need a point of reference for our assessment and we need a kind of idealised European international transport system ("What could be achieved, with the same level of expenditure as currently?") as one of the points of departure (or maybe as point of arrival) for suggesting amendments. Otherwise the amendments will remain patchy.

More detailed proposals for R & D are given in two of the background documents for this paper (Allport and Gwilliam 1982 and Holst 1982).

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