

STELLA Transatlantic Thematic Network
Sustainable Transport in Europe and Links and Liaisons with America

Focus Group 2 - ICT, Innovation and the Transport System

First Focus Group Meeting - National Science Foundation, Arlington, VA
15th January to 17th January 2002

Overview and Post-Meeting Position Statements

Compiled by
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This document provides an **overview** of the principal research directions identified by authors in the first meeting of STELLA Focus Group 2. This is followed by a compilation of **post-meeting position statements** from participants. Participants were requested to prepare short statements that reflect their perspectives on what is vital to the interests of STELLA -- areas of research, needs for application, targeted themes for future focus-group meetings, suggested transatlantic research questions that would benefit from comparative research, and areas that they regard as having been neglected during the discussions in Arlington. These position statements provide the basis for a brief **summation**.

Overview
ICT, Innovation and the Transport System

The workshop presentations and associated discussions suggested a number of fertile areas for further work. These include:

- ***Intelligent Transportation Systems (ITS)***: There were interesting contributions (from *Shields, Tsamboulas* and *Noronha*) on the 'state of play', in both North America and Europe, with respect to the application of ICTs to road transport. The different models of ITS deployment, and the differing contexts into which ITS is being deployed, would seem to be worth investigating. Co-operation with the ATLANTIC network will be valuable in this area of work. The 'social construction' of ITS, in

both Europe and North America, including an analysis of the various actor networks involved in its development, might also be a topic worthy of investigation.

- **Logistics, Freight and E-commerce:** ICTs are already transforming the operation of freight transport and logistics systems ('e-logistics'), whilst the advent of e-commerce poses new challenges to distribution systems, value chains and the very boundary of the firm. A number of the workshop papers (by *Savy, Nagurney* and *van Geenhuizen*) focused on this theme, and began to define potentially fruitful agendas for the exchange of comparative research experience, for example with respect to the urban form implications of e-commerce in the differing contexts of North America and Europe. Co-operation with the ATLANTIC network is also likely to be beneficial in this area of investigation.
- **Urban Form and Tele-activities:** The complex inter-relationships between land-use/urban form, transportation and ICTs provide a rich area for research investigation on both sides of the Atlantic. The implications of teleworking and teleshopping for land use and the spatial structuring of urban regions were explored in workshop papers by *Gillespie, Niles, Gertz* and *van Geenhuizen*.
- **ICTs and Travel Patterns in Space-time:** New research is emerging in North America (represented in the workshop by the paper by *Kwan*), which is re-visiting the 'space-time prisms' of time-geography within the context of the 'human extensibility' afforded by ICTs. Three-dimensional GIS techniques are permitting the visualisation of the complex ways in which ICTs are altering the space-time constraints of daily life. The stimulation of a European counterpart to this leading edge research would be a worthwhile objective to pursue through the STELLA network.
- **ICTs and 'People Logistics':** A closely related topic concerns the way in which the types of 'e-logistics', which are being applied in the freight transport field, can be applied to the organisation of the movement of people. Examples presented at the workshop included the use of ICTs in the introduction of demand-responsive transport systems targeted at deprived communities (*Grieco*) and the emergence of new types of 'location-based services' linked to the integration of mobile cellular and GIS technologies (*Kim*).
- **The Use of ICTs in Transportation Research:** A workshop paper by *Lee-Gosselin* revealed the emerging scope for GIS and GPS techniques to be incorporated in a range of innovative ways into research on transport behaviour, including travel surveys, micro-behavioural modelling and activity pattern visualisation in space-time. The trans-national exchange of experience in this promising emergent area is an obvious objective of the Focus Group's activities.
- **The Integration of ICT and Transport Infrastructures:** The workshop paper by *Malecki* highlighted the extent to which ICT network infrastructures are subject to the same kinds of forces that have influenced the deployment of transportation infrastructures. Beyond these similarities, it is clear that, increasingly, ICT and transportation infrastructures are being planned in co-ordinated ways, though the role of the market in such integration varies between North America and Europe (and indeed within these continents). Comparative trans-Atlantic research on the different forms such integration is taking would appear to be a fruitful line of investigation.
- **ICTs and the De-coupling of the Link between Economic Growth and Transport Growth:** One of the potentially significant possibilities associated with ICTs (noted in

the workshop paper by *Lakshmanan*) is the de-coupling, through various forms of e-materialisation, of the link between economic growth and the growth of transportation. The validity of the de-coupling thesis needs careful investigation, and would benefit from comparative work looking at the stability over time of the relationship between economic growth and transport (disaggregated by mode and type of transport) in North America and Europe. Careful co-ordination would be needed with STELLA Focus Group 1 (Globalisation, E-economy and Trade) in order to avoid duplication of effort.

- ***Transport, ICTs and the Knowledge Economy:*** Although not covered explicitly in any of the workshop papers, a closely related topic to the one above would be a consideration of the changes in the demand for transport associated with a 'weightless', knowledge-driven economy. The inter-relationships between the use of ICTs for inter-firm and intra-firm communications on the one hand, and the generation and possible substitution of business travel on the other, would appear to be a fruitful area for empirical investigation.
- ***ICTs, Mobility and the Conceptualisation of Space-Time:*** Underpinning all of the above, there is a need, highlighted in the workshop contribution by *Janelle and Gillespie*, for conceptual work to clarify the nature of important space-time transformations associated with ICTs (including time-space convergence, space-time compression and human space-time extensibility), and the implications of these transformations for social patterns and processes, including space-time reorganisation processes.

Participant Post-Meeting Position Statements / Comments

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For future work and meetings in the different Focus groups, I would think it advisable to try to choose a few problems where there have been some actual experiences, particularly in situ in different countries or cities. Then the results of these experiences could be constructively compared (comparative research or meta analysis...). Examples: the experiences of satellites towns or decentralisation of activities with mixed development initiatives, measures for regulating congestion in towns, pricing policies, the various uses and impacts of internet and GSM in passenger and freight transports (LBS), light trains development in and around towns, monitoring travels, etc. Without doing any new research, it would give additional value to previous research. Naturally, it would require some recommendations or common format for the presentations, which would be given in order to facilitate the comparison. That would have to be organised by the Focus leaders or delegated to someone who is particularly interested in a sub-topic.

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The relationship between ICT, mobility and spatial development: from analytical research to policy recommendations.

By definition the STELLA focus groups are covering very broad research areas. But with a limited number of only three meetings it is necessary to concentrate on a selected number of topics. These topics should have a clear transatlantic focus and they should not be covered by other scientific activities (conferences etc.).

In Arlington it became clear that there is a lot of ongoing research activity to identify behavioural changes initiated through ICT but so far this research activities doesn't translate to any policy recommendations. Identifying and discussing policy recommendations for this research area seems to be a very promising topic where the two remaining workshops are able to provide a real contribution to the ongoing discussion in Europe as well as in North America. This objective would be clearly "output – oriented" and suited for dissemination activities.

Network activities tend to concentrate on defining new research needs (we never know all what we want to know), but the focus group "ICT, Innovation and the Transport System" also offers the opportunity to step back and establish a link between the output of completed research and the need of local decision makers in this policy area.

It is obvious that ICT is influencing spatial development. But most city and regional planners, transportation planners, and city officials don't have any idea about possible effects, and they don't know how to address this development. Currently the scientific community is not able to support this need for recommendations.

Therefore one goal of the remaining two workshops could be to create a strong link between the effects of ICT and the land use planning system! The influence of ICT on the future of the city is a clear challenge for the planning system. It raises also institutional questions because the speed of change in ICT development and in the public decision making process in planning and policy is completely different.

The focus "identifying and discussing policy recommendations" for decision makers makes it useful to include representatives from local governments. This would further stimulate the exchange of ideas and experience. The objective -- to derive policy recommendations from a constantly developing research area where there are still a lot of knowledge gaps -- is ambitious, but it is nevertheless a realistic approach for the two remaining 3-day meetings.

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I was able to attend only a small portion of the Arlington meeting, so my comments are based on my general thinking regarding the STELLA effort. Having read all the comments submitted by others, as well as the STELLA project summary, I find that I have little to add to the many interesting ideas presented. Rather, I will give some general comments on developing a topic agenda for this focus group.

First, the opportunity to develop a sustained working relationship between North America and Europe presents the challenge of identifying topics for which collaborative exchange and research is likely to lead to the greatest possible benefits in intellectual contribution and real world problem solving. Therefore we should be thinking about the areas where differences among nations and regions may be particularly relevant.

In considering relationships between ICT, transport and urban form, the following factors are relevant: 1) technological change, 2) structural economic change, 3) socio-economics and demographics, 4) spatial structure, 5) transport supply, 6) public policy, and 7) culture and values. The “meta question” is whether the first two factors have such powerful effects that transport and spatial outcomes will be quite similar across developed countries, or whether the remaining factors (particularly 6 and 7) will shape rather different outcomes across nations. Some examples:

- ICT and work patterns: The general trend in work patterns is toward increasing flexibility in when, where and how work is performed, facilitated in large part by ICT. This increasing flexibility is taking place in quite different contexts. The US labor market is more fluid than labor markets in the European Union. Labor protection regulation is limited, and labor unions have been in decline for some years. In contrast, European workers enjoy more job protection, etc. US labor markets are more fluid also due to higher rates of migration. We therefore might expect that job flexibility is more extensive in the United States, as both employers and workers have taken more advantage of ICT flexibility. Work flexibility should impact travel patterns, e.g., more off-peak commuting, more dispersed and irregular travel (due to home-based work). The question is then, to what degree do public policies and social values mitigate the impacts of ICT on work patterns and the resulting longer term impacts on travel and land use?
- ICT and consumption: There is a great deal of speculation regarding the possibility of e-shopping to substitute for physical movement (putting aside for the moment the issue of goods movement). The conventional notion is that ICT makes it possible to shop anywhere, anytime from the comfort of one's home. But shopping is a social and communal activity, and in the United States it appears that e-shopping is an enhancement to the physical activity. E-shopping also requires confidence in Internet transactions security, ownership of a credit card, etc. Public policies and social values may affect these things, and, therefore, influence e-shopping behavior.

Several similar ideas were presented in the comments of others (Kwan on space-time constraints and activity patterns in space-time, Lee-Gosling on democratization of work, Miller on space-time activity data analysis).

Second, all of the STELLA focus groups have the challenge of breadth vs depth. There are innumerable topics worthy of research and discussion, and casting a wide net provides the highest likelihood for innovative ideas and approaches. On the other hand, sustained attention to relatively few main topics is more likely to lead to deeper insights and contributions to understanding. Having been involved for the past year in an effort to foster interdisciplinary ICT research at USC, my impression is that this area is particularly fragmented (I am tempted to say self-organizing). If we are really fortunate, clusters of people/ideas will sort themselves out, and we may use these clusters as the basis for workshops, etc.

Third, although the STELLA authors state that the 5 focus group areas are distinct, I am not so sure. My two examples above might well fit into the Society, Behavior and Public/Private Transport area, and at least 2 of the presentations I saw in Arlington might have been part of the Environment/Safety/Health/Land use/Congestion area. Therefore we may have to make special effort to define an agenda that is as specific to ICT as possible.

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**Transport, Information Communication Technology and Public Service Failure:
Community Monitoring and Demand Responsive Transport**

The purpose of this position statement is to identify and explore the contribution that community monitoring under an ICT regime can make to the mapping of public service failure and to the development of dedicated community-anchored, demand-responsive 'public transport' provisions. The argument as presented is focused primarily on the United Kingdom and has emerged out of a concentrated program of action research undertaken with low income, non-car owning, public transport deprived communities. Institutional arrangements affect the adoption and operation of ICT - top down initiatives have ignored the appropriate design and development of ICT and ICT aligned to transport from the bottom end. High quality public transport corridors have lower information requirements than low-income enclaves serviced by irregular and unreliable transport fleets. Information on travel has a major market at the bottom end, which is not well met within the context of British institutional life; similarly, flexible routing and demand responsive transport are also appropriate technology responses to the health and transport interface of low-income community needs. The viability of community monitoring is a direct result of the distributed character of the new information communication

technologies and this distributed character permits changes in governance and forms of public service management. A more open form of public sector transport management is now possible: software for fleet scheduling and passenger reservations can now be operated by communities and neighbourhoods themselves and linked with the hiring of a vehicle from an external agency. For example, Budget Rental could operate as a form of extended car-pooling or vehicle club. Community mobility clubs could provide low-income communities with the levels of connection necessary to bargaining and persuasion for the better resourcing of their environments. Our argument here is that the over-dominance of modal shift transport policy away from motorisation has neglected major equity issues in respect of low income transport services with negative consequences for health, wealth, welfare, education and social esteem. Today we want to open up the vista of hybrid public/community transport systems: the primary network continues to be served by the commercial interests, and the secondary network, which is poorly served, has seen the major withdrawal of services (a withdrawal which has gone unmapped by transport experts and the planning profession). These secondary networks would benefit from the development of demand responsive community services operated by the community and in the community interest. The failure to explore these community forms is the outcome of the historical neglect of the views and needs of low-income users. Community monitoring of public service failures maps local needs. The global display of these mappings can contribute to the development of the social capital necessary for the emergence of ICT community transport systems that connect with high quality primary networks and serve internal local needs. Transparency of needs impacts on governance, which results in the rebalancing of communities.

Although our focus here has been primarily upon the UK experience, there are best practice lessons to be learnt by the UK from European and North American locations which have directly involved communities in the planning and operation of transport provision through the use of new information communication technologies. The STELLA network can do much to remedy the governance and service deficits existing in the UK in respect of transport provision by providing best practice information and the development of an expanded knowledge base on demand responsive transport.

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There are many players in business for the location-based services (LBS). There are thin clients, usually mobile, and thick clients. From the service providers' side, there are companies such as Nokia and Motorola providing hardware; there are Microsoft and Oracle providing software tools, and proxy and brokers providing "responses" to users "requests". In many cities in the World, the travel cost function based on the fixed distance unit cost would not provide accurate cost figures to users. Frequently, we found it is much faster to get to a point in a city by taking longer belt parkway routes rather than taking shorter city streets. In addition, certainly during peak hours in all cities and most

of time during the day in major metropolitan areas in the World, the congestion factor has to be included in calculating cost functions.

One of the biggest challenges that transportation planners and engineers face these days is to provide current and future road/traffic conditions based on real time data. Obtaining real time data and providing the current road/traffic conditions in many cities in the World is no longer an issue due to the availability of beacon, GPS, loop detectors and video cameras. Recently, personal communication systems (PCS) may provide a role as a medium for collecting inexpensive real time traffic data.

The following are few sample issues we need to explore for providing bases for agents that are willing to provide efficient and accurate location-based services:

1. Efficient means to incorporate real time data in a cost function for providing the best routes to users,
2. How to guide users in dynamically changing road/traffic conditions,
3. Formulating operational functional forms for estimating routing costs,
4. Development of efficient and accurate solution algorithms,
5. Development of interoperable LBS systems among North American, European, and Asian countries.

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New Information Technologies, Human Behavior in Space-time, and the Urban Economy

The use of new information technologies (IT) is associated with distinctive patterns of human activities in space-time. Analysis of these patterns could provide part of the empirical basis and/or behavioral foundation for enhancing our understanding of the interaction between new IT and the urban economy. Two themes, identified as important areas for future research, are outlined as follows.

1. Space-time constraints and activity patterns in space-time - In a time-geographic perspective, an important transformation that may result from new IT is the relaxation of many of the traditional space-time constraints that limit human spatial mobility and activity space. For example, as many activities no longer need to be performed at certain places or times (e.g., through e-shopping), more time may become available for undertaking many other activities, and more flexible spatial and temporal arrangements of human activities become possible. Research that focuses on identifying the distinctive patterns of human activities and trips associated with different levels of IT usage may therefore shed important light on how different urban areas and activities will be impacted upon.

2. Physical-virtual interaction - How human activities in the physical world and cyberspace interact with each other (i.e., physical-virtual interaction) and impact upon the urban economy may also be examined through a space-time displacement perspective. This perspective suggests that the time people spend on new IT takes time away from other activities, and there are distinctive geographical consequences associated with such time displacement. For example, if people spend more time using the Internet, they may spend less time on social activities; and as Internet users purchase online, they may spend less time shopping in and making trips to stores in the physical world. If there is considerable space-time displacement between people's activities and use of new IT,

research that focuses on the activity-travel behavior of people (e.g., shopping behavior) may help identify important links for deciphering the impact of new IT on the urban economy.

Two important questions that emanate from these two themes are: (a) How do new IT impact upon the economic bases of cities as it changes the space-time patterns of human activities? (b) How can the interaction between new IT and the urban economy be measured and analyzed? These questions indicate some fruitful directions for approaching empirical research that seeks to enhance our understanding of the vastly complex interrelations among new IT, human behavior and the urban economy.

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A recent committee meeting of the National Academy of Sciences considered transport and environment research issues that are related to emerging technologies. I have drawn on reflections from that meeting for suggestions about a possible STELLA research agenda.

1. As is illustrated by much that has been published about ATT/ITS, the toughest research issues are those that are related to user response to technological change. The sustainability balance sheet following the introduction of new technologies depends substantially upon large numbers of micro-decisions, on the part both of consumers and suppliers, about how to exploit the new opportunities they provide. Importantly, the designers and promoters of new technologies do not necessarily anticipate all of the new opportunities: some are "discovered" or invented by consumers. There are clearly many issues of interface between people and ICT technologies that will keep human factors and ergonomics specialists very busy for years to come. But there also are higher-order system effects of ICTs. The aggregate effects of user responses to simultaneously introduced innovations, and interactions between responses, are even more difficult to anticipate than how a particular technology will be exploited.

2. Taking up this last point with respect to travel behaviour: arguably, ICT are collectively changing the ways that people go about organising their activities in time and in space (see point 2 of slide 18 of my Arlington presentation for some further thoughts here). The point is that we may focus on one or two classes of ICT-enabled opportunity or market, and miss how ICTs are changing the whole landscape. For example, I would argue that the "democratisation" of work that is spatially and temporally flexible is an order of magnitude or two more important than videoconferencing or telecommuting, both of which are socio-technical innovations that have disappointed their promoters.

3. I also mentioned in the "challenges" slides at the end of my Arlington presentation that ICTs open new possibilities for real-world (i.e., out-of-the-lab) experimentation. One aspect of this is the application of gaming-simulation principles that have been used with success in transport for more than 30 years to investigate hypothetical situations. For example, a number of us in recent years have had some fun thinking up ways to test

different value-pricing experiments using combinations of prototype ATC technologies and Stated Response survey techniques. The potential is the more interesting because with ICTs, experiments can sometimes be modified in real time to take advantage of current circumstances (e.g., weather, gas price wars, etc.). I would like to see a part of the STELLA discussion take up the opportunities of ICTs as aids to data collection and experimentation in general.

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The Internet as a Network Infrastructure: Issues for Research

The Internet is a basic element of the information and communications technologies (ICT) on which much economic and social activity now depends. However, surprisingly little research has focused on the Internet as an *infrastructure*. Most research that has been done on the Internet has looked at its nodes rather than its links, although the links should be the more critical elements from a network perspective. Research on nodes has highlighted that some shake-up may have taken place in the USA urban hierarchy as “new network cities” have surpassed larger cities. Overall, the urban hierarchy still prevails: the largest number of backbone connections is found in the largest urban size class.

Rather than assume that the Internet is a ubiquitous form of ICT, we need a better understanding of its infrastructure and the consequent availability of high-bandwidth applications in transport and elsewhere. There are several difficulties with analysis of the Internet as a network infrastructure: (1) the Internet is an amalgam of many separate networks; (2) there is no data source with comprehensive information; (3) deregulation in many countries has compounded these difficulties; (4) the Internet is very much a “work in progress” as new links on backbone networks are added and upgrades of bandwidth and technology are made on existing links.

Examination of the Internet network at present suggests that the best-connected places on the Internet also have the largest number of “big pipes” – high-bandwidth links. Bandwidth concentrates at “funnel points” that are remarkably similar to transshipment and break-of-bulk points in land-borne transport. Internet network links approximate long-distance, non-stop flights as well as “local” shuttle services, stopping off at several hub interconnection points. The complexity of private interconnection (interfirm peering and transit agreements) suggests that transport analogies apply to the Internet only with significant adjustments.

These thoughts suggest research needs. Among them:

- Research on Internet traffic flows. What routes do packets actually take?
- Research on the “middle mile” – the links between backbones and the last-mile connections to users, including regional, local and metro fiber networks.
- A focus on demand, not supply (e.g., backbone links). For example, ISPs and their connections reflect local demand and network responses to it.

- Research on the effects of competition. Are there monopolies at some Internet hubs? Where is redundancy (connection to multiple networks) possible? And where is it not possible? What can policy or public/private action do? Entrepreneurial cities and towns work to improve their connections, but where? And how?
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The breadth and fit of the discussion [Focus Group II meeting in Arlington] was close to what I was hoping for when I first reviewed the [STELLA] proposal back in Brussels. It did give rise to an idea. I will be participating in the Transportation Research Board's Environmental Research Conference on March 23, 2002, on the "Sustainability, including Climate Change" working group. It struck me that this might be an opportunity to suggest U.S. research that might tie in to STELLA's overall mission - sort of anticipating research subjects that might resonate in an ultimate STELLA recommendation about study areas of common trans-Atlantic interest. I realize this is a bit early on, but this conference will set the TRB Environmental research agenda framework for the next two years, which coincides remarkably well with STELLA.

If you have subject areas of particular interest in the transport/environment area, please don't hesitate to send them my way over the next month or so. I can probably use the idea to scope a U.S. research topic in such areas a public transport telematics to reduce trip distances, or the use of public transportation and non-automobile modes to reduce air pollution.

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Transportation researchers and analysts are facing a major challenge at the onset of the 21st century. This challenge is extending our place-based theories and methods: these perspectives and tools are increasingly archaic for understanding and planning in a crowded and connected world. The world may be shrinking, but it is also shriveling and fragmenting: the fabric of distance is changing from a smooth surface to a dramatic landscape with abrupt changes, tears and folds (Tobler 1999). Activities are becoming less connected to places due to information technologies (Couclelis and Getis 2000). Place-based urban theory is limited: von Thünen could not have dreamed of this complex geography of transportation, communications and urban systems as he waited patiently for his sluggish horse carts to return from the market with news about prices. The "friction of distance" concept at the center of most transportation theory and methods is stunningly irrelevant to telecommunications. The static and place-based organization of data and information in most geographic information systems (GIS) is ineffectual as an analytical platform to answer key questions at the forefront of transportation and urban theory and policy.

We do not need to abandon place-based theories and methods but rather extend them to encompass dynamic, mobile and active objects that operate within a dynamic geography at multiple spatial and temporal scales. Elsewhere I have referred to this as a "people-based geographic information science," thinking mostly about time geography and activity theory approaches to understanding and planning transportation and communications systems (Miller 2002), although these ideas can also encompass dynamic and mobile but inactive objects such as freight. Part of this challenge is exploiting the massive, ill-structured, noisy and non-scientifically sampled spatio-temporal data available through real-time geo-monitoring systems, such as transportation systems (ITS) and location-based services (LBS) (also see Raper 2000).

An opportunity for collaboration between European and North American researchers is integrated and comparative analysis of space-time activity (STA) data to understand how individuals organize activities in space and time, the role of transportation and telecommunication in these processes, the emergence of urban structure from these interactions and its influence on activity organization. A massive amount of STA data from different geographic, social, economic, demographic, cultural and technological contexts and over time is essential for exploring and analyzing the enormously complex information space. Position-aware devices, wireless Internet and other technologies are almost mature enough to facilitate large-scale and highly detailed STA data collection. We need to develop efficient computational tools for exploring and analyzing these data and communicating information to decision makers and stakeholders. We also need internationally accepted protocols for STA data collection, classification, metadata as well as privacy protection and ethical use.

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The following elements might be more explicitly addressed in a position statement:

- the link between ICT and sustainable transport
- the relationship between integral freight logistics and ICT
- the way decisions are taken by freight forwarders and carriers

- the type of information and data that would be necessary to study the phenomena indicated in the position statement.
 - the type of issues that lend themselves for comparative Transatlantic research.
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A popular government-sponsored urban planning concept in North America is promotion of transit-oriented development (TOD), by which I mean promoting high density, mixed-use development around high-capacity rail transit stations. The metro areas of San Diego, Los Angeles (several sub-regions), San Jose, San Francisco, Portland, Seattle, and Vancouver BC are in various stages of implementing this concept, focusing just on western North America. Within this concept, rail transit is built from scratch, or existing lines are extended, to create or expand new nodes of dense land use. The desired outcome on a regional scale is a change in trip-making behavior to more walking and transit use, and less automobile use. European experience is often described (perhaps too casually) as a model.

The promotion of rail transit and mixed-used, high-density land development around train stations is widely considered by professional planners to be the epitome of "smart growth" and "sustainable transport." At the same time, my interpretation of research on the topic (<http://www.globaltelematics.com/mineta/>) concludes that the achieved travel behavior shifts from this strategy are slight compared to the public investment cost of implementing the new modal choice. In response to my criticism about the cost versus results, planners will say, be patient. The beneficial impact of a rail-TOD urban development strategy may be many decades, 50 or even 100 years.

Now, if that time frame is to be used, then the growth of ICT applications should be considered as one of means to influence the relative mix of walking, transit, and automobile travel. Since billions of dollars are necessary for the implementation of rail-TOD, the relationships between ICT and this popular smart-growth planning paradigm are worthy of international research. What has been the effect to date of ICT applications and related social and business influences upon the outcome of the rail-TOD strategy where it has been underway for multiple decades? What emerging and ongoing spatial and trip-making outcome trends in regions where transit choices are offered can be empirically linked to the influence of ICT on technological, economic, and social development? What can research say about the likely influence of these trends upon the regional efficacy of expanded TOD as a strategy to reduce the market share of automobile use? What can be done to make TOD work better in the face of ICT?

The subject is very far-reaching, encompassing the influence of ICT (1) on the performance and attractiveness of transit versus automobiles, (2) on residential and business location preferences, and (3) on personal and business activity and movement patterns, to name just three large topics from a list that could be longer.

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Beyond policy and in the realm of transportation practice, three elements of sustainable transportation planning are

- Good decision models (e.g. sensitivity to economics, esthetics, ...)
- Good information (e.g. population growth, traffic growth ...)
- Open and consensual decision process.

The research agenda arising from these elements must therefore include:

- Documentation and modeling of processes (e.g. social: impacts of ICT); identification of principal decision model domains and the key issues within them that pertain to sustainability;
 - - Appropriate analytical tools and methods of information delivery; characterization of information quality, fitness for use, on-demand availability and cost;
 - - Collaborative decision tools, including innovative use of ICT (e.g. internet-based public consultation).
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My concern is in some ways complimentary to Andy Gillespie’s opening talk where the focus of the discussion, from a European perspective, was on the intersection of movement, city planning, and the future city under various levels of increasing digital commerce. The US side of this problem is largely similar: the clustering of companies and innovators that make up and support this service economy cluster in Edge Cities (Reston, Oracle, ... Dublin, Qwest). These edge city office blocks import workers, and their desire for visible freeway locations in premier showcase locations goes hand in hand with a presumption that you will drive to their campus office. Therein lies the crux of the problem in the US case: there is rarely an easy cross-town public transit option.

The location of these clusters has a major connection to issues in public transport. A major accessibility problem for the US is evident following the movement of many off the welfare rolls to work. This problem is caused by lack of convenient access and mobility to reach [what were until recently] plentiful jobs.

If a call center employs large numbers of low paid routine workers, access close to public transport is desirable. But it is unlikely to be available. Even if the centers are located in the city, almost by definition they will be too low density for the provision of public transit access. The ideas expressed by Grieco also resonate, but perhaps with a different tenor in the case of the US: clearly we have public transit systems which are failing the customers: buses run empty in low density suburbs, and are at the same time unavailable on key cross town routes. Where have the systems failed? More importantly, transit

systems should be built on routes where an underserved demand could be shown to exist. Information and communications technology alone will not make it possible to make a gem from the rough materials at hand, but it ought to be a goal to have a demand sensitive system, that is efficient, and for example runs at a cost lower than the cost per passenger mile of a comparable taxi system.

To draw this point towards the theme of the conference, I'd like to remind us through a paraphrase of Don Janelle that space time transformations have consequences for the social patterns and processes. When this statement is read though, we almost always imagine improvements in levels of service: thus time space convergence is the norm, not time space divergence. And when we think of daily activity patterns, space time compression (intensification of daily life) again is our norm. I would submit that a worthy cross-disciplinary research program could be built around the notion of space time divergence, and disimprovements in selected accessibility for some sectors of the population. Thus, while it may indeed have become easy over time to reach Detroit from say Fort Wayne (like the classic time space convergence studies) it may well have become impossible to get to the suburbs of Detroit from poor inner city neighborhoods carved up by freeways. If the jobs are in growing centers on the edge of the city, what chance has an inner city resident of reaching a suitable employment opportunity? Intensifying accumulation might require us to rethink the repacking of our inner cities.

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I found the position papers extremely interesting, facing several novel issues. Mainly I liked the focus on space-time transformation, owing to ICT.

In this context, I would like to underline the relevance of developing specific topics, under the ICT umbrella, e.g.:

- the change of paradigms or modelling (i.e. decay function, behavioural models, forecast methods, etc.);
- the dynamics of accessibility and the related urban forms;
- the evolution of demand and supply sides in both passenger and freight transport;
- the evolution of intermodality in both passenger and freight transport;
- the related change of value of time in both passenger and freight transport.

in a systematic comparative analysis between Europe and US-Canada, at different spatial levels, at both the theoretical and empirical viewpoint, by investigating concepts, data, and mostly the different speed of ICT-transport dynamics and behavioural responses in the two/three country contexts. An interesting research issue in this framework could then be the investigation of parallel case studies, and hence, the analysis of results, transferability, evaluation methods, etc.

As a consequence, I think that a Transatlantic co-operation in this focus group – which research topic is strictly interrelated with the other 4 focus groups – should offer lessons on why and where to revisit ‘old’ space-time concepts and ‘types’ of analysis, as well as to offer empirical evidence and reflections on the ongoing (un)sustainable transport-ICT scenarios. Probably sensitivity analyses could also be used in this respect.

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It is not a vision that we will live in a world of pervasive information technology and computing in a foreseeable future. Therefore the main problem will not be to generate more information and to increase capacity of telecommunication systems. Instead the most crucial problems will be

- Coping with complexity problems of pervasive computing.
- Adjustment of information to the purposes and the processing capacity of the agents, eventually screening of information.
- Reducing vulnerability and increasing robustness of telecommunication systems.
- Partitioning the markets in private and public.

Complete information does not mean that life will be easier for the agents. Therefore a new layer will arise in the information system, which is the layer of software agents. These artificial agents will filter information and prepare it in a way that the user will not be overstressed with information processing work. In the transport sector this task will be taken by personal travel assistants that will be able to adjust to the personal needs of the user.

Another response to complexity is that not every agent receives the complete information. Information can be screened according to preferences or legal aspects. For instance, complete information for all traffic users on a bypass road in case of a gridlock on a motorway will not lead to an optimal rerouting of traffic. Restricting the distribution of this information to those users, only, who actually could enjoy benefits in the final state of the system, can improve utility compared with the complete information state.

The transport system will increasingly be characterized by information aided or guided management and control. Central control systems (e.g.: GPS-based routing, tracking/tracing, payment) may become more and more vulnerable in the sense that small actions are sufficient to destroy the functioning of the system. Emerging fields of research and development will be: decentralization, redundancy, self-organization, risk management and precaution.

Information can only be complete if it is public. But it can be questioned that information in general is a public good. Therefore it has to be analyzed to which extent information markets should work under private, regulated or public regimes. A further question is to what extent the public can enforce the application of IT in transport, i.e., in the case of electronic payment of user charges. It is well known that dual payment systems are extremely expensive while electronic systems can be established at low cost once the basic electronic equipment in the vehicles become mandatory.

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ICT AND THE GOODS TRANSPORT AND LOGISTICS SYSTEM

1. INTRODUCTION : GOODS TRANSPORT AND LOGISTICS AS A STELLA ISSUE.

Goods transport is a substantial part of transport system. It is a massive consumer and provider of IT. Reciprocally, IT plays a major role in present restructuring of this industry on both sides of Atlantic.

2. IT, GOODS TRANSPORT AND LOGISTICS PROCESS

IT is a transverse technology, all its components are used in transport and logistics: informatics (including computer aided manufacturing, logistics specialised software, logistics module in SAP), telecommunication (from mobile phone to dedicated high-flow line), computer to computer (EDI, Internet, Intranet), GPS, etc.

IT is now a crucial element of the transport process, considering its different layers: traffic, transport and logistics. It also enables to integrate a complex chain consisting in pick up, short and long distance haulage, sorting, loading and unloading, transshipments (sometimes through a "hub and spokes" scheme), delivery; plus, possibly, customs clearing, administrative, commercial and financial transactions, etc. Transport therefore relies on a double network, for physical and for informational flows.

This is even more important when transport service is included into a wider "logistics service", comprising: transport, handling, warehousing, packaging, physical distribution; plus, possibly, inventory management, quality control, post manufacturing, maintenance, purchasing, etc. IT is in the same time a support for service and a specific additional supply.

3. IT, ORGANISATION AND MARKET OF GOODS TRANSPORT AND LOGISTICS INDUSTRY

IT use and supply are part of the organisation of firms, of their competition, of industrial structures for transport and logistics.

IT is a key topic for transport groups organisation, for control and transmission of data concerning both carrier and shipper, while the carrier / shipper interface becomes more complex and intense. Transport and logistics large groups insist on their IT services supply and have to decide whether it is an additional department or branch besides specialities such as mail, parcel, full truck load, forwarding and logistics services, or a transverse function, joining all specialities for a one stop shopping comprehensive supply, particularly for large accounts, multinational shipper companies. In some cases, a shift can occur from logistics to supply chain management under the service provider's responsibility.

Another tendency is due to economies of scale. IT is a fixed cost industry (cost is nearly independent of volume, marginal cost is nearly nil), which gives an advantage to larger firms and is a factor for more concentration.

Development of e-logistics, beyond diversity of predictions, must be approached through a market segmentation separating high value products from consumption goods. Virtual transactions are not the main problem, the real issue is physical distribution, in terms of cost, lead-time, reliability, particularly for B2C. This gives a strategic advantage to post offices and other dense parcel networks: Takyubin, UPS. Can local correspondents, taking care of delivery, provide an alternative solution to new comers? E-logistics must choose among outsourcing or setting up an integrated distribution, relying on a dedicated e-logistics network or on an additional use of existing network, at least as a transition during launching phase. The importance of logistics for e-business makes it a factor for vertical integration, under the distributor's control or the transport and logistics operator's control.

Finally, IT contributes to a change in the limits of the firm, for co-ordination inside a widened network, to achieve a radical extension in terms of diversification of services and of spatial coverage of supply (up to continental and global). This implies alliances, joint ventures, mergers-acquisitions and subcontracting, which is a massive practice among transport and logistics firms (the larger the firm, the higher the percentage of outsourced services in its turnover). International groups and alliances, including transport and post offices firms, create groups of unprecedented size. An outstanding question is the divide between actual integration of transport services, including logistics, into coherent groups, or division separating marketing firms, in a principal position, from operating firms, in a subcontractor agent position. Controlling the IT system is, in this context, a strategic issue.

4. CONCLUSIONS: A NEED FOR MORE COMPARISON

Freight transport and logistics are involved in a sharp and massive change, where IT is a central element. Those emerging issues have still to be confirmed, all the more so as they have not the same appearance in Europe, North America (and Asia). More intercontinental comparison research programs are highly desirable.

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Papers presented at this kick-off STELLA/STAR Focus Group 2 meeting suggested a wide range of research topics for a better understanding of the effects of information and communication technologies (ICT) on sustainable transportation. These papers could be grouped into three general research areas. The first research area looks at how ICT and innovation are changing life styles, accessibility/mobility, travel patterns, and urban form. It is clear that social, economic, cultural and behavioral differences between population groups and across the Atlantic are important considerations in this line of research. The second research area has a focus on freight transport, logistics and supply chain, especially on how the private sector is changing its strategies and practices of logistics supply chain management in response to the new and innovative information and communication technologies. The third research area is on the potential of using various technologies, such as the Internet, geographic information systems (GIS), global

positioning system (GPS), remote sensing, and location-based service (LBS), to facilitate the research needs and to develop innovative approaches of moving toward more sustainable transport systems.

Although a steady progress is being made in the research community to uncover the complex effects of ICT and innovation on transport, there are many research questions that remain to be answered. Among these research challenges, I would like to propose two specific themes as part of the overall research efforts that could contribute to our understanding of the complex relationships between ICT, innovation and the transport system.

1. An activity-based approach to understanding intersections between ICT and transport.

Previous research suggests the existence of both substitution and complementarity effects of ICT on transport (e.g., Gertz 2002). While the substitution effect is expected to lead to a reduction of trips, the complementarity effect often encourages the generation of other trips. For example, savings in work trip time for telecommuters could encourage a higher trip frequency for other purposes. Teleshopping, in many cases, replaces shopping trips by individual consumers with delivery trips by parcel delivery companies. It is critical to analyze the interactions between the reduction of trips and the redistribution of trips introduced by the use of ICT (i.e., where do transport in the virtual space and transport in the physical space intersect with each other?) With the increasing use of ICT in our society, we are observing redistribution of trip origins/destinations, redistribution of trip purposes, and redistribution of time/day of travel in urban areas due to the substitution and complementarity effects of ICT. Conventional transport models fail to address many of these changes. As a starting point, the constrained travel choice behavioral models developed since the 1970s could be adapted to the study of ICT effects on transport patterns. For example, we could expand the choice set of traditional travel modes to include the ICT alternatives and incorporate the constraints in accessibility and mobility associated with the various alternatives for different population segments. Furthermore, we could extend the concept of “market segmentation” to “activity segmentation” in the modeling framework. Activity segmentation is aimed at identifying the types of activity that can be carried out completely with ICT (e.g., *e-ticket*), partially with ICT (e.g., order a book from amazon.com that requires a delivery trip), or with the conventional transport means (e.g., pick up a child at a day-care center). Research of the activity segmentation will help us gain a better understanding of where and how transport in the virtual space and transport in physical space intersect with each other.

2. Representation and modeling of the time dimension in ICT/transport research.

Several papers given at the meeting pointed out the importance of time within the context of time-space convergence, travel activity diary data, logistics supply chain, and location-based service. Many changes introduced by the use of ICT are making the spatial separation less critical and time consideration more important due to the faster transport and communication technologies. Conventional transport models and analysis tools however are mainly space-based, with limited flexibility of handling the time dimension in a dynamic and interactive manner. In order to analyze what and how ICT and

innovation are causing changes in life styles, accessibility, activity patterns, and urban form, we need to develop models and techniques that can better represent and integrate time with spatial and other relevant data. These models and techniques should be able to support analysis of interactions between space and time for various activities in both virtual space and physical space. Visualization of travel diary data as a space-time aquarium using GIS is one example (Kwan 2002). The NCHRP 20-27(3) project recently proposes a multidimensional transportation GIS data model that addresses the time dimension (Koncz and Adams 2001). We need to look into the feasibility of extending such transportation GIS data models to represent activities in both virtual space and physical space and their interactions over space and time. This research theme is expected to help us develop a spatiotemporal data model that can serve as a common database to support various analysis and modeling needs of ICT, innovation and the transport system.

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Immediate actions

1. Update and expand my idea (as expressed in Washington) of creating a database that will include some key words to describe EU projects, so they can be identified/traced depending on their relevance for someone that looks for a specific area. The projects that bear relevance for US/Canada and for the STELLA Focus Group 2 (only?) can have more information and relevant reports/papers.
2. This can be put in web interactive base, so that dissemination of what is going on in Europe and the possible relevance to US/Canada activities can be found
3. If US/Canada undertakes a similar exercise, then the other half of the database can be created.
4. We (in the group) could undertake to identify common approaches/ similarities in the research projects across the Atlantic
5. Try to disseminate the "STELLA" principle to others as well. As a first attempt send to other colleagues of ours some information about STELLA and the web site address. Possibility to create a discussion forum.
6. Create STELLA as the "focal point" of exchange of information/papers/relevant work on the issues identified of bearing common interest. The two coordinators can act as catalysts/mediators of bringing researchers in contact.

7. Provide the platform for young and promising researchers to present their work. This can be accomplished in small workshops or through the Internet. To attract more young scientists, we could create electronic conferences, where reviewers appointed by the STELLA coordinators will review papers. An annual prize for the three best papers may attract more.
8. Finally, to start interactions across the two sides of the Atlantic we could invite some of these to the Annual STELLA Conferences.

Medium-term actions

1. Involve private and public sectors. Most of the STELLA participants are coming from the public (University domain). We need to involve the private sector as well. For example, if NOKIA and Motorola know that such a group exists, they might willing to exploit the possibility of co-operating with some of the members.
2. As a follow-up to the private sector involvement, the private firms will start to know and understand what is going on in both sides of the Atlantic. Hence they can "fish" for some ideas at both sides and –as a minimum' they will avoid re-inventing the wheel and learn from each other's mistakes/failures.
3. On the other hand the public sector (cities, local governments) might gain by exchanging each other's experiences/initiatives. On the other hand, the civic groups could find a "focal point" to present their views across the Atlantic.

Long-term actions

1. Development of common research activities/projects between EU and US/Canadian Universities and private firms. This can be accomplished with two alternative ways: (i) Submission to European Commission or US/Canada Governmental authorities with partners from both sides of the Atlantic: if submitted to EU, The North American partners have to secure financing from their counties (private or public funding) and vice versa, (ii) submission independently to EU or US/Canada of a joint proposal, trying to secure financing in both.
2. Develop EU/US/Canada research pathways, i.e., consortia that have common understanding and trust for acting jointly in research or consultancy/ manufacturing across the world.

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Summation

ICT, Innovation and the Transport System

This summation attempts to capture some of the central ideas raised in the position statements by workshop participants in relationship to the workshop research presentations. It also revisits some of the original motivations of STELLA, especially with regard to (1) promotion of fundamental research, (2) needs to wed research to policy formulations and applications for achieving sustainable transport systems, (3) provision of research infrastructure to encourage international cooperation, and (4) specification of issues that warrant Transatlantic comparative research.

Identifying Fundamental Research Questions

Both Harvey Miller and Shih-Lung Shaw draw attention to the weakness of descriptive and analytic tools and of classic theories for addressing the issues of how new information technologies reshape the world. These include new notions of distance and the disconnection between human activities and place/space. Miller calls for a methodology that treats ‘dynamic, mobile and active objects ... within a dynamic geography at multiple spatial and temporal scales’, which he refers to as “people-based geographic information science.” In many respects, this parallels Aura Reggiani’s request for a “change of paradigms” that is focused on the dynamics of accessibility and their impacts on urban form, changing patterns of supply and demand in transport, intermodality, and the value of time. Shaw also notes the inability of conventional transport models to deal with ICT-induced changes in human behavior (e.g., substitution effects of teleshopping and telecommuting). His suggestion on expanding the concept of market segmentation warrants investigation for improving predictive models – being able to identify activities that require only ICT, those that require a combination of ICT and transport, and those that are mostly dependent on transport.

Miller’s observations and Reggiani’s comments amplify those raised in the paper by Donald Janelle and Andrew Gillespie on re-conceptualizing the impacts of space-adjusting technologies. However, Morton O’Kelly challenges the focus on time-space convergence, as opposed to time-space divergence, and raises the possibility (if not the desirability) of reversing the processes of space-time compression. These represent fundamental questions about the nature of space-adjustment to the ever-changing technologies that link individuals, communities, cities, regions and the global system. Werner Rothengatter’s focus on intelligent software agents provides a possible solution to such problems, offering potentials to reduce information overloads, filter unwanted information, and adjust information flows to both public and private requirements. He sees this of special importance to the transportation system.

Mei-Po Kwan’s paper exploited modern visualization techniques to illustrate the value of a time-geography perspective for investigating how virtual and physical communication are integrated into the emerging activity patterns that influence daily life and commerce at local through global scales. The value of this approach was reinforced by Martin Lee-Gosselin’s observations about the uncertainties associated with human responses and uses of new ICT technologies, and on the inability of policy makers and planners to anticipate these new behaviors. These observations pose interesting questions about research methodologies for measurement, analysis, and visualization. John Kim’s position statement and research presentation describes the rapid commercialization of technologies (Location-Based Services, LBS), which in all likelihood will add exceptional flexibility to individual and firm behavior in the immediate future, posing new problems for social research and policy consideration.

The impact of the digital revolution on individual behavior (e.g., life styles and related travel patterns) is related to the spatial form and temporal dynamics of cities. Andrew Gillespie addressed this theme in the opening paper of the conference. Carsten Gertz

amplified on the links between urban form and ICT, especially in regard to teleshopping and teleworking. His statement advocates that STELLA concentrate on bridging the gap between research knowledge and policy recommendations. Marina van Geenhuizen explored the specific role of e-commerce and its likely impact on the role of cities in transport and communication. She offered a useful codification of some of the key processes involved in the restructuring of activities and organizations, and she pointed out some of the principal limitations and strengths of communication technologies as mediators of knowledge exchange. Genevieve Giuliano also explores these issues in her position statement. She raises a compelling question – how strong are the effects of technological change and structural-economic change versus public policy, and culture and values? The regional variations that exist in the Transatlantic context offer a basis for exploring this question in a comparative research framework. Giuliano offers two of many possible examples based around ICT influence over work patterns and over consumption habits.

Presentations by Anna Nagurney and Michel Savy all point to fundamental changes in strategies for the provision of freight services in response to information and communication technologies. As Savy notes in his position statement, the restructuring of the freight transport industry is occurring with great rapidity and with an element of uncertainty of what the future organization of this industry might look like. Clearly, the interactions between ICT and freight transport warrant research that could benefit from a Transatlantic perspective. This could include development and evaluation of new tools and analytic procedures, such as those suggested in Nagurney's paper. She and her colleagues are exploring models of interacting economic agents (e.g., manufacturers, retailers, and consumers) in supply chain networks that feature electronic commerce. T. R. Lakshmanan (in his paper with William Anderson) offers yet another important area of investigation – the linkage between investment in freight transportation with economic growth, raising issues of regional economic imbalance that are of concern both in Europe and North America.

ICT and Sustainable Transportation

The STELLA notion of sustainability is conceived broadly to embrace a sense of equity in the provision of accessibility, a promotion social cohesion in the form of balanced regional and community development, and a recognition that enhancement in the quality of the physical environment are all essential outcomes of transportation policy decisions. Peter Nijkamp encouraged an explicit link between ICT and sustainable transport, but this was treated only tangentially in regard to the physical environment at the Arlington workshop. In his post-meeting statement, Paul Marx notes the possibility of drawing insight from the STELLA mission to encourage American transport researchers to address Transatlantic environmental issues over climate change.

Val Noronha gets to the core of the issue in his statement, seeing sustainable transport as derivative from a planning process based on good decision models, good information, and open and participatory decision processes. He couples this with suggested research to document and model processes of ICT impact, to identifying the kinds of decision models needed for different planning domains, to specify methods for information access, and to

embed applications of ICT in public collaboration and consultation. This later point addresses issues on the social context of sustainable transport, and relates to the concern of Grieco and Hine. They illustrate major societal neglect of the interests of low-income communities in the provision of accessibility, and advocate a planning paradigm that gives voice to transport-deprived neighborhoods. O'Kelly's observations about the difficulties of transit for low-income communities in the United States offer support for this position.

While Grieco and Hine focus on social solutions to finding sustainable transport options, Kim addresses the need for technical solutions to make LBS more effective (algorithms, cost-function estimates). He raises questions of how location-based services might be developed and exploited to bring about more efficient travel behavior. It could be argued that such solutions potentially may be safer, more sensitive to maintenance of the physical environment, and more responsive to social needs. However, these prospects for applications of LBS warrant research monitoring.

John Niles suggested yet another approach – the integration of ICT with transportation/land use planning. The example he uses is that of enhancing rail transit-oriented development (TOD) as a means to reduce reliance on automobiles.

Sustainable transport is certainly enhanced through methods that promote greater efficiency in the provision of service. As suggested in the presentation by Nagurney, freight transport logistics, and e-commerce supply-chain networks (and deliveries) offer research opportunities to explore issues of service provision in the face of energy demands and environmental implications. In this regard, a mix of technologies (e.g., remote sensing, as described in Val Norohna's paper, and environmental sensing technologies, as described by Russell Shields) is contributing to the emergence of new Intelligent Transport systems. While these offer potentials for safer, more secure, and more efficient transport, social-science perspectives are essential to the formulation of suitable policy environments for IT implementation as sustainable transport options. It may be that Rothengatter's suggested mediation over information flows via agent models warrants careful consideration for the IT agenda.

An ultimate issue for sustainability relates to the translation of basic research to the policy and planning arenas. The statement by Gertz draws attention to this need. He makes a strong argument for directing the STELLA initiative to this end.

Research Infrastructure for Promoting International Research

Michel Beuthe identifies the need to target previous research in different counties and cities – to capture added value from what we already know from existing research. This idea also lies behind the workshop presentation and position statement from Dimitrios Tsamboulas. His development of a database of major transportation studies and reports on Intelligent Transport in the European Union provides a searchable information base on previous and current research projects that might guide future work. He calls for a similar effort among North American transport researchers. He sees this as essential grounding for international comparisons. In a similar vein, Tsamboulas's encourages

promotion of a STELLA website and publications, the building of networks of researchers through workshops and conferences, and the cross fertilization of ideas among public agencies, academics, and the public sector. All of these activities constitute basic infrastructure for the promotion of sound Transatlantic research. However, other infrastructure needs are noted in the position statements. A primary area of concern is with access to data that are appropriate to different areas of investigation. For example, Edward Malecki raised several questions in his presentation about the need for information on Internet traffic flows.

Lee-Gosselin asks us to consider how new ICTs can aid research directly – certainly new tools and methods for collecting data and for organizing experiments represent infrastructure development of an important nature. The role of LBS (Kim) warrants careful thought in this regard, a question that is taken up by Miller.

Miller offers an emphatic rejection of the status quo: “The static and place-based organization of data and information in most geographic information systems (GIS) is ineffectual as an analytical platform to answer key questions at the forefront of transportation and urban theory and policy.” He advocates using the technologies of LBS to conduct large-scale, cross-national collections of space-time activity data that feature varied contexts for exploring basic research and policy issues (regions with different geographic, social, economic, demographic, cultural and technological attributes) and broad application of the time-geographic perspective. An area of application is in the development of space-time diary data for comparative research at intraurban scales, paralleling the compelling demonstrations by Kwan, and reinforced by the arguments presented by Shaw. Both Shaw and Miller see the need for new models and techniques for processing such data, and for integrating their analyses into a strong theoretical framework that is transparent to policy makers. There is also need to establish standards for the collection, classification, and retrieval of such data, along with protocols to honor the privacy of individual respondents – all issues raised in Miller’s statement.

Transatlantic Comparative Research

What problems require Transatlantic research? Operationally, common research designs in different regional settings could yield added value in new findings and broader bases for assessment and validation. Thus, both Guiliano and Shaw see the differing social, cultural, and economic norms of different parts of the Transatlantic region as providing range of situations for comparative research. Aura Reggiani makes a strong argument for Transatlantic comparative research, seeing the ICT focus group revisiting “ ‘old’ space-time concepts and ‘types’ of analysis, as well as offering empirical evidence and reflections on the ongoing (un)sustainable transport-ICT scenarios.” Grieco identifies the need to have North American - European comparisons of community engagement in transportation provision for low-income communities.

The cross-national interoperability of LBS is an area that warrants cooperative investigation among private-sector firms and government agencies, in addition to multi-disciplinary academic research. Experiences with LBS will represent a pressing research

issue that could benefit from comparative investigation in regions having differing regulatory and market regimes and different cultural attributes.

While Edward Malecki explored the Internet infrastructure within the United States and has identified key elements of its network geometry and related functioning processes, it would be interesting to compare his findings with the European situation. The links between such structures and the urban system pose issues regarding equity in regional development. Niles sees policy advantages to investigating the spatial land use and mode shift outcomes associated with the use of ICT to augment rail-tranist oriented development, benefiting from an analysis of different strategies in different national settings.

Conclusions

This document sets out an initial statement on research directions for Focus Group 2 of STELLA. These directions are based on research presentations at its meeting in January 2002 and on the thoughtful commentary via post-meeting position statements. The documentation on papers and commentaries will appear at www.ncgia.ucsb.edu/stella . These will be supplemented with a refinement of this statement, a summary of reactions of this report from the participants in the STELLA Genesis meeting in Amsterdam (8-9 February 2002), and any additional commentary provided by researchers. The discussion is seen as an open one. Additional position statements are encouraged and will be posted as they arrive. Refinements to the agenda for the group may be suggested at any time. Plans for a second meeting of Focus Group 2 (University of Newcastle upon Tyne) are tentatively under consideration for early 2003. Details will be communicated to participants. Among the many issues to be taken up over the next year will be that of how to encourage Transatlantic collaboration in areas of research central to the domain of ICT, innovation and the transport system. It is hoped that the second workshop will feature examples of collaborative research that draw effectively on cross-national context.

STELLA Transatlantic Thematic Network

Sustainable Transport in Europe and Links and Liaisons with America

Focus Group 2 - ICT, Innovation and the Transport System

First Focus Group Meeting - National Science Foundation, Arlington,
Virginia

15th January to 17th January 2002

STELLA is a Thematic Network within the Growth Programme of the European Union's 5th Framework Programme of Research & Development. The STELLA Scientific Coordinator is Peter Nijkamp from the Free University of Amsterdam. STELLA brings together networks of researchers in both Europe and North America in a quest for common research issues. The North American participants are drawn from the **STAR Network** (Sustainable Transportation Analysis and Research) coordinated by William Black of Indiana University, Bloomington. STAR is supported by the National Science Foundation.

Focus Group 2 - ICT Focus Group Leaders
Andrew Gillespie and Donald G. Janelle

For background information on STELLA and on this meeting, see
www.ncgia.ucsb.edu/stella

**STELLA Thematic Network
Focus Group 2 - ICT, Innovation and the Transport System**

Program

Tuesday 15 January

11:30 a.m. **Opening Luncheon -- Holiday Inn Arlington at Ballston**
(Arlington / Clarendon rooms) 4610 N. Fairfax Drive, Arlington, Virginia
Map and directions can be found on the hotel's web page
(<http://www.holidayinnarlingtonva.com/>)

Thomas Baerwald Welcome to NSF
Peter Nijkamp Welcome and Introductions
Keith Keen Welcome from DGTREN European Commission

Peter Nijkamp Introduction to STELLA Transatlantic Thematic Network
William Black Introduction to STAR
Andrew Gillespie and **Don Janelle** The ICT Focus Group: its overall objectives; aims of first meeting

2:00 p.m. **Virtual and Physical Communications**
Room 1235, National Science Foundation
4201 Wilson Boulevard, Arlington, Virginia

Chair: **Harvey Miller**

- **Andrew Gillespie**, *Digital Lifestyles, Mobility and the Future City*
- **John Niles**, *Telecommunications Substitution for Transportation*

3:15 p.m. **Break**

3:30-5:00 p.m. **Logistics and Innovation in Transport**

Chair: **Michel Beuthe**

- **T. R. Lakshmanan**, *Transport Investments, the Freight Services Sector and Economic Performance*
- **Tschangho John Kim**, *Location-Based Services (LBS): An Emerging Innovative Transport Service Technology*
- **Michel Savy**, *IT and Freight Transport and Logistics*

Wednesday 16 January

If you are registered for the TRB meetings, you may wish to attend **TRB session 520**

8:00-9:45 a.m. Hilton Washington Hotel, 1919 Connecticut Avenue NW, on Metro Red Line
Session 520 (Monroe East) is sponsored by the TRB Committee on International Activities and the TRB Committee on Intelligent Transportation Systems

Afternoon STELLA/ATLANTIC Joint Meeting on European Union - North American Transportation Research Networks Room 1235, National Science Foundation

1:00 p.m. **Visions from ATLANTIC**

Convener: **John Miles**

Mike MacDonald, A Review of the ROSETTA project.

2:20 p.m. **Coffee Break**

2:40-4:00 p.m. **STELLA - Innovation in Transport-ICT**

Chair: **Roger Stough**

- **Andrew Gillespie and Donald Janelle**, *Social Science Perspectives on Transportation, Information, and Communications Technologies*
- **Dimitrios Tsamboulas**, *ICT Research at the EU level and its Relevance for the STELLA Thematic Network*
- **Margaret Grieco**, *Transport, Information and Communications Technology and Public Transport Failure: Community Monitoring and Demand for Responsive Transport Options*
- **Anna Nagurney**, *Supply Chain Networks and Electronic Commerce*

4:00-5:00 p.m. **Liaisons in Research: Bringing together North American & European Researchers in the New Thematic Networks**

Moderator: **Ken Button**

- Panel (**Aura Reggiani, John Miles, Chelsea White, Andy Gillespie**)
- Open Discussion
- Closing Comments: **Keith Keen**

5:30-7:00 p.m. **STELLA Reception** Holiday Inn Arlington, Ballston Room,
4610 N. Fairfax Drive, Arlington, VA

7:00-9:00 p.m. Werner Rothengatter, President of the World Conference on Transport Research Society, has invited participants of the STELLA workshop to the **President's Reception of the WCTRS** at TRB, Hilton Hotel, Exhibit Hall

Thursday 17 January

The NRECA (National Rural Electric Cooperative Association) Conference Room CC3
4301 Wilson Boulevard, Arlington, VA

- 8:00 a.m. **Urban Form and Changing Lifestyles / Workstyles**
Chair: **Andrew Gillespie**
- **Carsten Gertz**, *The Relationship Between Transportation, Urban Form and ICT: What We Know, What We Don't Know.*
 - **Marina van Geenhuizen**, *The Impact of the E-economy on the Function of Cities as Nodes of Transport and Communications*
 - **Mei-Po Kwan**, *New Information Technologies, Human Behavior in Space-time, and the Urban Economy*
- 9:20 a.m. **Coffee Break**
- 9:40 a.m. **Innovations in Transportation - ICT Research**
Chair: **Morton O'Kelly**
- **Russell Shields**, *Collection and Use of Highly Accurate Map Data in Transportation*
 - **Val Noronha**, *Integrating Remote Sensing into Transport Information Systems*
 - **Martin Lee Gosling**, *GPS-Supported Travel Survey Methods*
 - **Ed Malecki**, *Is the Internet a Railway or an Autobahn? Issues for Research*
- 11:30 a.m. **Closing Discussion – Future Plans for Focus Group 2 / STELLA**
W Black A Gillespie, D Janelle, A Reggiani, H.A. van Gent

Meals: With the exception Tuesday's luncheon, participants are on their own for meals. In the District of Columbia, the Dupont Circle area is one region with many restaurants (accessible by the Metro Red Line). In the vicinity of NSF in Arlington, there are several restaurants in the Ballston Common Mall and in the Ballston Metro Center, and along Wilson Boulevard and Fairfax Drive.

Transportation: NSF, NRECA, and the Holiday Inn Arlington are on the Metro system Orange Line (Ballston stop). When you come out of the Metro Station, Fairfax Drive is in front of you. Walk three blocks to the left and cross Glebe Road. The hotel is on the left. If travelling from Washington on the Blue Line, change to the Orange Line at the Rosslyn station.

Acknowledgments:

Thomas Baerwald National Science Foundation

Susan Ryan, National Science Foundation

Val Noronha, National Consortia on Remote Sensing in Transportation–Infrastructure, UCSB

Henk van Gent, STELLA Network Manager

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- **Kay W. Axhausen**, ITH, Zurich, Switzerland
- **Michel Beuthe**, Group Transport and Mobility, Catholic University of Mons, Belgium
- **Marina van Geenhuizen**, Delft University of Technology, The Netherlands
- **H.A. van Gent**, STELLA Network Manager, Free University of Amsterdam, The Netherlands
- **Carsten Gertz**, Technical University of Hamburg-Harburg, European Center for Transportation and Logistics
- **Giorgos A. Giannopoulos**, Hellenic Institute of Transport and Transport Engineering Laboratory, Aristotle University of Thessaloniki, Greece
- **Andrew Gillespie**, Center for Urban and Regional Development Studies, University of Newcastle upon Tyne, United Kingdom
- **Margaret Grieco**, Transport Research Institute, Napier University, United Kingdom
- **Keith Keen**, Directorate-General for Energy and Transport, European Commission
- **Peter Nijkamp**, Economic and Social Institute, Free University of Amsterdam, The Netherlands
- **Eric Pels**, Department of Spatial Economics, Free University of Amsterdam, The Netherlands
- **Aura Reggiani**, Department of Economics, University of Bologna, Italy
- **Werner Rothengatter**, Institute for Economic Policy, Research (IWW), University of Karlsruhe, Germany
- **Michel Savy**, LATTIS, Paris, France
- **Dimitrios A. Tsamboulas**, Department of Transportation Planning and Engineering, Technical University of Athens, Greece

North American Participants

- **Thomas J. Baerwald**, National Science Foundation
- **William R. Black**, Department of Geography, Indiana University, Bloomington
- **David Boyce**, Department of Civil and Materials Engineering, University of Illinois at Chicago
- **Kenneth Button**, School of Public Policy, George Mason University
- **Genevieve Giuliano**, School of Policy, Planning, and Development, University of Southern California
- **Kingsley E. Haynes**, School of Public Policy, George Mason University
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- **Martin Lee-Gosselin**, GRIMES, Laval University, Quebec
- **Ian MacGillivray**, Iowa Department of Transportation
- **Talia McCray**, GRIMES, Laval University, Quebec
- **Edward J. Malecki**, Center for Urban and Regional Analysis (CURA), The Ohio State University
- **Paul L. Marx**, Federal Transit Administration, Office of Policy Development
- **Harvey J. Miller**, Department of Geography, University of Utah
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- **John Niles**, Global Telematics, Seattle WA
- **Val Noronha**, National Consortia on Remote Sensing in Transportation-Infrastructure, University of California, Santa Barbara
- **Morton O'Kelly**, Department of Geography, The Ohio State University
- **Ashish Sen**, U.S. Bureau of Transport Statistics, US Department of Transportation
- **Shih-Lung Shaw**, Department of Geography, University of Tennessee, Knoxville
- **Russell Shields**, Ygomi LLC
- **Roger R. Stough**, School of Public Policy, George Mason University
- **Jean-Claude Thill**, Department of Geography, University at Buffalo (SUNY)

Participants in Wednesday's session from **ATLANTIC** include:

From North America:

- **James Richard Bishop**, Bishop Consulting
- **Kan Chen**, University of Michigan
- **William Johnson**, Consultant, Transport Research, Education & Development Services, Canada
- **David Kamnitzer**, IBI Group, Toronto
- **Chelsea C. White III**, Georgia Institute of Technology
- **James G. White**, Transport Canada, Safety & Security Group

From Europe:

- **Ian Catling**, Catling Consultancy
- **Isabelle Dussator**, POLIS Group of cities, European Union, Brussels
- **Hartmut Keller**, Technical University of Munich, Germany
- **Mike MacDonald**, Transport Studies Group, University of Southampton UK
- **John C. Miles**, Ankerbold International LTD, UK (Technical Director for ATLANTIC)
- **Steve Morello**, ISIS, France
- **Ken Perrett**, TRL, UK
- **Siegfried Rupprecht**, Rupprecht Consult, Germany
- **Keith Keen**, Directorate-General for Energy and Transport, European Commission
- **Konstantinos G. Zografos**, Athens University of Economics and Business