

## APPENDIX A-2

### REPRESENTING THE CANADIAN TRANSIT INDUSTRY'S RESEARCH AND DEVELOPMENT NEEDS: CUTA'S R&D COORDINATION AND STRATEGIC RESEARCH PROGRAMS

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#### I. INTRODUCTION

Research and Development (R&D) is essential for any industry seeking to improve its effectiveness and efficiency through innovation, and is thus an important concern for the Canadian Urban Transit Association (CUTA).

CUTA is the national association representing the interests of transit systems and all other organizations involved in transit in Canada. CUTA believes that transit-related research is enhanced by a more active involvement of the transit industry. Unfortunately, transit systems generally have little involvement in transit-related research, and are often just the recipients of the end-results of research projects that have been carried out by other organizations. CUTA believes that transit systems and their industry association should be more active in defining research needs and priorities, and in participating in research projects in order to enhance their quality and effectiveness.

This is made somewhat difficult because of the highly decentralized environment for transit R&D in Canada. The responsibility for operational and capital subsidies is shared between Provincial and Local governments in Canada, but subsidy levels vary widely, as does the amount of transit R&D, from Province to Province. The Federal government has no mandate in urban transit per se. However, the Federal government does have a mandate in some related areas, such as technology development, energy conservation, safety, transportation for the disabled, etc., and fund some R&D activities in these areas. As a result of this situation, transit R&D activities tend to be carried out in isolation, with a frequent risk of duplication of effort.

Despite this somewhat confusing situation, there was a belief within CUTA that R&D matters should be a concern to transit systems, and to the industry as a whole. As a result, one of CUTA's eight formal goals is: To promote and support transit-related research and development.

CUTA has also identified three ongoing objectives that are related to this goal:

- to identify and communicate transit-related R&D needs and priorities
- to promote sufficient R&D funding from all levels of government and the private sector, to ensure that Canada's urban transit industry maintain its leadership role in technical innovation, and
- to provide a forum and to facilitate the coordination of industry-related R&D activities.

CUTA established in 1983 an R&D Coordination Committee, and has carried out a number of activities, in particular since 1985, to pursue the Association's research-related objectives. This paper discusses CUTA's R&D Coordination and Strategic Research Programs and outlines in the conclusions three dilemmas that have been identified through our experience with transit R&D. The combination of these two programs has enabled CUTA to pursue a comprehensive approach to the transit R&D challenge, that is appropriate for the Canadian context.

#### II. CUTA'S R&D COORDINATION PROGRAM

In order to better represent the transit industry's interests in areas related to research and development, the Canadian Urban Transit Association (CUTA) has developed since 1985 a National Transit R&D Coordination Program. This program, carried out with financial participation from Transport Canada, has five main objectives:

- identify and communicate R&D needs and priorities, and promote research projects to address these needs
- facilitate research that addresses priority industry needs
- monitor R&D activities and conduct an annual inventory of R&D projects
- disseminate research results through various means (e.g. articles, newsletters, conference sessions, special workshops)
- generally serve a communications and coordination function among transit systems, funding agencies, R&D institutions, and manufacturers.

##### Identification of Priority R&D Needs

The first of these objectives, the identification and communication of R&D needs and priorities, is a key aspect of this Program, since this provides the basis for discussing with funding agencies and research institutions specific research projects that would be of benefit to transit systems. As part of its efforts to pursue this objective, CUTA has organized a number of specific activities described below:

- National Workshop on R&D Needs (1985): This brought together transit managers from across Canada to discuss in a highly structured environment areas where research would be needed over the next fifteen years. These discussions and the resulting list of over sixty topics are documented in the July 1985 report entitled "Research and Development Needs of Urban Transit". The workshop led to the identification of an initial list of fifteen high priority research needs.

- Ongoing Process to Identify and Communicate R&D Needs: Following the initial workshop in 1985, CUTA's R&D Coordination Committee has had the ongoing responsibility of identifying the industry's R&D needs. Each year, CUTA's Manager of Research submits to the Committee for discussion, possible modifications to the List of Priority R&D Needs. These suggestions are based on surveys, informal discussions with transit managers and knowledge of projects underway. The Committee discusses and approves an annual List of Priority R&D Needs. This List is then recommended to CUTA's Board of Directors.

Upon approval, detailed research problem statements are developed by the Manager of Research and reviewed by the Committee. Each problem statement outlines the nature of the problem requiring research and specific research elements that would be useful to transit managers. The list of R&D priorities and problem statements are then circulated to transit systems, funding agencies and research institutions for their consideration. The objective is to encourage organizations involved in transit research to carry out research on these identified topics.

- Special Workshops on Automatic Vehicle Location (1987): In some cases, CUTA has organized special workshops on specific topics that bring experts together with the prime purpose of identifying and prioritizing research needs in the given area. For example, special workshops have been organized by CUTA on *Automatic Vehicle Location Systems* in 1987, and on *Urban Bus Design Improvement* in 1988.

Exhibit 1 presents CUTA's 1990/1991 *List of Priority R&D Needs for the Transit Industry*.

### Facilitation of Research

CUTA's identification of research needs and development of research problem statements have considerably stimulated thinking and discussion of transit research topics in the industry. As a result of CUTA's efforts to promote research in these priority areas, several research projects have been conducted over the last few years by various organizations. Exhibit 2 lists the reports produced as a result of these studies and the organizations involved.

Active CUTA support has been given to all of these projects in order to facilitate their conduct and make them as valuable as possible for transit managers. This facilitation has taken various forms:

- participation by CUTA staff on the project committees
- identification of potential project committee members, either experts or transit staff with a keen interest in the topic

- access to CUTA information sources (Library, statistics),
- suggestions of contacts and references, etc.

As well, CUTA staff have participated in several other R&D projects in the areas of expert system applications, microcomputer-based systems, alternative fuels, fare collection systems, prototype service standards, market research, ride-sharing, and privatization. This has helped provide a transit operator perspective into these projects as well as represent National R&D concerns.

### Monitoring Transit R&D Activities

Another important aspect is to monitor R&D activity on a regular basis. This serves as an input into the identification of R&D needs, is an important element in the dissemination of research results, and helps to reduce duplication of research efforts.

Since 1984, CUTA has prepared, on an annual basis, a report that inventories current transit R&D activities in Canada. An effort has been made to develop a format that will be useful to transit professionals while keeping the document concise. Entries are categorized by subject, and contain concise project descriptions and key contacts for further information. Exhibit 3 lists the categories used in the 1989 Inventory, and the number of entries per category.

Exhibit 4 provides a sample page from the Inventory to illustrate the format used. This format has proven to be very useful for transit professionals who typically obtain research results directly from prime project contacts via the telephone. Time constraints are generally severe, and this approach allows them to rapidly determine the relevance of the results for their own given context.

### Dissemination of Research Results

The dissemination of research results has been a major concern for CUTA's R&D Coordination Program. A variety of mechanisms have been used in order to ensure that the research results reach the ultimate users of this research, in this case transit managers and staff. This not only includes the distribution of the R&D Inventory and other reports, but also such activities as:

- ensuring that R&D activities are presented at CUTA Meetings, including dedicated sessions organized by the R&D Coordination Committee
- preparing articles for CUTA's monthly publication, including a periodic column entitled "Innovations in Transit", as well as special feature articles on technological issues
- responding to ad-hoc requests for technical information

- organizing an annual award program, entitled *The Hector Chaput Award for Transit Innovation*, which has served to document R&D activities conducted internally by transit properties; and
- organizing special workshops or conferences on the following topics: Joint Canadian-German Workshop on Transit Technology (Toronto-1986); Automatic Vehicle Location (AVL) Workshop (Winnipeg-1987); Bus Design Improvement Workshop (Montreal-1988); International Conference on AVL Systems (Ottawa-1988); Workshop on Transit R&D Programs (Hamilton-1988); The Impacts of Demographic and Socioeconomic Trends (Toronto-1989); and Developing Strategies to Respond to Demographic and Socioeconomic Trends (Hull-1990)

### Communications and Coordination

Finally, CUTA's R&D Coordination Committee brings together on a regular basis representatives from transit systems, government agencies, and organizations involved in research. This is a unique forum within Canada, which has among other accomplishments, brought together for the first time the key government agencies involved in transit research. This has created a new network of contacts which has stimulated discussion of transit research, and reduced the duplication of research efforts by different organizations.

In spite of the highly decentralized institutional framework for transit research in Canada, CUTA has become a central clearinghouse for information and discussions.

### III. STRATEGIC TRANSIT RESEARCH PROGRAM

Although the R&D Coordination Program had achieved substantial results in many areas, its impact on the choice, timing, and direction of studies that were actually being initiated was uneven. As a result, CUTA's Board of Directors decided that there was a need for a National Research Program that would ensure that the strategic needs of the transit industry were being addressed.

It was felt that a National partnership to fund such a program had considerable merit, since there are many potential actors who are, or should be, involved in transit R&D including: the Federal government that has a very strong interest in promoting technology development and transfer on a National basis; the Provincial governments that provide operating and capital subsidies to municipalities and conduct various R&D activities; and the transit systems that have the "needs", and will ultimately implement the research results. CUTA is the only organization that brings together all of these R&D partners. Financial participation encourages a more active interest in the projects by transit systems, but the sharing of the cost reduces the financial burden for each participating organization.

After a complex prioritization process six topics were chosen for research under this program:

- An Ergonomic Study of the Driver's Workstation
- The Impacts of Demographic and Socioeconomic Trends on the Future of Urban Transit; and Potential Strategies
- Procurement Requirements and Practices to Ensure the Long-Term Structural Integrity of Urban Buses
- Standardization of Electronic Fare Media
- The Use of Automatic Vehicle Location for Planning and Management Information
- The User's Viewpoint on the Interior Bus Design

These topics were considered "strategic" for the transit industry for several reasons. In some cases, they are likely to have major structural impacts on transit operations and/or related technology in the future. They are also likely to have broad impacts on the industry, affecting most, if not all, transit systems. In fact, several of these projects would lead to the development of uniform specifications. Finally, in the case of at least three of the projects, the timing is such that there is an urgent need to address the underlying choices before individual technological choices preclude the possibility of any nationally coordinated effort.

After discussions with potential funding organizations, the Strategic Transit Research Program (STRP) was approved and launched in late 1989. This two year, \$600,000 program is being funded by a coalition of seventeen organizations, including Transport Canada, the provinces of Ontario, Quebec, Alberta, and British Columbia, and twelve transit systems. Oversight of the program is being provided by a Steering Committee which includes representatives from the participating organizations. Oversight of the actual projects is provided by ad hoc Project Technical Committees.

The objectives of the program, which is well underway, are to:

- conduct research on the six pre-determined strategic research needs over the next two years
- spread widely the financial burden for conducting this research
- actively ensure involvement of all key concerned parties on a National basis during the research, through the means of committee meetings and conference calls, to ensure the highest quality research and the strongest basis for disseminating and implementing any results or recommendations from this research
- provide a high degree of industry control and participation through CUTA management of this research program, and complement CUTA's R&D Coordination Program
- strengthen the Canadian transit industry through a concerted and cooperative coordination effort that will lead in certain areas to the development of standardized specifications for technology.

This research program is well underway and is now in the process of yielding very interesting results.

#### IV. THREE DILEMMAS AND CONCLUSIONS

Promoting and conducting research in the urban transit industry is a difficult task, and is especially so in Canada's highly decentralized environment. In the course of promoting and organizing transit R&D activities, three specific dilemmas have been identified.

##### Dilemma One:

*The industry focuses more attention on (maintaining) operations, than innovation.*

Generally, transit managers are not asked to be innovative by politicians; managers are typically hired for their operational or administrative skills (in contrast with innovative private sector industries). Furthermore, although risk-taking is essential for innovation, there are high costs and low rewards for taking risks in the political public sector environment in which transit operates. Innovation is further hindered by the short-term perspective of the policymaking environment. Finally, managers are given little analytical resources (staff or money) with which to develop innovations.

##### Dilemma Two:

*There is a disparity of perspectives between R&D users (transit systems) and funders or performers of R&D.*

Transit managers are primarily interested in solving existing problems. They tend to focus primarily on short-term needs. They are mostly interested in applied research which documents the "best existing practice" (e.g. syntheses) that help them formulate current operational and capital decisions.

Government agencies and researchers are primarily interested in developing new methodologies or new technologies. They tend to focus more attention on longer-term opportunities that move forward the "state-of-the-art" (e.g. basic research or technology development).

The expectations with respect to research that emerge from these two perspectives are not often compatible.

##### Dilemma Three:

*There is an exaggerated emphasis on demonstrations, technological in particular, often to the detriment of research.*

Demonstrations of new technologies have considerable appeal to government agencies (and to suppliers), because of their very tangible nature and government agencies' interest in product development. Demonstrations can also serve the needs of individual transit systems, when they believe that the given technology will address a specific problem they face.

Unfortunately, demonstrations often become closed-circuit experiments where only the individual transit system, technology supplier, and funding agency monitor the demonstration and gain expertise from it. Results are rarely widely diffused, especially if significant problems develop. Furthermore, the amount of resources devoted to demonstration projects often reduces the opportunities for industry-wide research on problems; this is unfortunate since this type of research often enables a better matching of needs and technological opportunities.

##### Conclusion

CUTA believes that the combination of the R&D Coordination and Strategic Research Programs has been an effective comprehensive approach to address these dilemmas. The two-pronged approach of the R&D Coordination and Strategic Research Programs, has helped to create a logical and continuous chain of communications during the entire research process: from the identification of research needs (as seen jointly by transit systems and government agencies), to the carrying out of research, to the dissemination of research results, to the recommendation of needed demonstrations, desirable practice or National technical specifications. It is only through the successful building of such a continuous chain of communications that effective research, technology development, and technology transfer can truly occur.

The challenge remains nonetheless for CUTA and the Canadian transit industry, to determine whether such a comprehensive, and at the same time delicately balanced, approach to transit R&D can be maintained on an ongoing basis.

#### EXHIBIT 1

##### THE CANADIAN URBAN TRANSIT ASSOCIATION'S 1990/1991 LIST OF PRIORITY R&D NEEDS FOR THE TRANSIT INDUSTRY

(Research needs that are being addressed by CUTA are indicated.)

##### Strategic Management

- The Impacts of Demographic and Socioeconomic Trends on the Future of Urban Transit, and Potential Strategies (CUTA-STRP)

- Transit's Role in Environmental Protection (CUTA)
- The Relationship Between Parking Policies and Transit/High Occupancy Vehicle Modes

### Marketing

- Marketing Tools and Strategies
- Advertising Techniques
- User Information; Techniques and Systems
- Bus Destination Signs; A Multi-Perspective Assessment of Alternative Technologies

### Fares

- Methods for Measuring and Reducing Fare Evasion and Internal Monetary Losses
- Standardization of Electronic Fare Media (CUTA-STRP)

### Transit Planning

- Priority Measures and Systems for Transit
- On-Board Passenger Data Collection; A Review of System Requirements, Techniques & Technologies

### Human Resources

- Driver Hiring, Testing and Training
- Strategies in Labour Relations

### Operations and Maintenance Systems

- Maintenance Management Information Systems
- Automatic Vehicle Location (AVL) Issues:
  - a) Costs and Benefits of AVL Systems
  - b) Use of AVL for Real-Time Service Control
  - c) Use of AVL for Planning and Management Information (CUTA-STRP)
  - d) Use of AVL for Transit Priority
  - e) AVL for Small Transit Properties
  - f) Real-Time vs. Schedule-Based Public Information Systems
  - g) Voice and Data Radio Communication Systems
  - h) Development of a Bus-Stop Information System Using AVL
  - i) Real-Time Systems for Passenger Counting

### Equipment

- Standards for Wheelchair Securement/Passenger Restraint Systems for Specialized Transit (CUTA/CSA) Vehicles
- Urban Bus Design Issues:
  - a) Seating/Steering System
  - b) Ergonomic Study of Driver Workstation (CUTA-STRP)
  - c) Re-Design of Other Workstation Components
  - d) Manual of Standardized Design Options

- e) User's Viewpoint on Interior Bus Design (CUTA-STRP)
- f) Improved Climatic Control/Air Quality
- g) Safety Aspects of Urban Buses
- h) Brake Performance
- i) Vehicle Procurement Requirements and Procedures to Ensure Long-Term Structural Integrity (CUTA-STRP)
- j) Corrosion Prevention
- k) Impacts of Health & Environmental Regulations on Bus Assembly and Maintenance
- l) Identification of Electrical System Problems

### Abbreviations used:

CUTA-STRP: CUTA's Strategic Transit Research Program  
(This 2 year research program is funded by 17 organizations including Transport Canada, the provinces of Ontario, Quebec, Alberta, and British Columbia, and 12 large transit systems.)

CSA: Canadian Standards Association

### EXHIBIT 2

#### STUDIES INITIATED AS A RESULT OF CUTA'S R&D COORDINATION PROGRAM

##### Fare Strategies and Their Impacts (1987)

Ministry of Transportation of Ontario and the Centre for Transit Improvement

##### An Evaluation of Vehicle Diagnostic Systems for Buses (1988)

Transport Canada and the Ministry of Transportation of Ontario

##### National Workshop on Urban Bus Design Improvement; Background Research on Current Problems and Potential Solutions (1988)

Transport Canada and CUTA

##### Literature Review on Automatic Vehicle Location and Automatic Passenger Information Systems (1988)

Ministère des Transports du Québec

##### Fare Collection Systems and Equipment (1989)

Transportation Association of Canada (formerly RTAC)

##### The Role of Transit in the Subdivision Design and Approval Process (1990)

##### Guide to Transit Considerations in the Subdivision Design and Approval Process (1990)

Transportation Association of Canada (formerly RTAC)

**The Use of Automatic Vehicle Location in Small Transit Systems**

(to be published in 1991)

Ministry of Transportation of Ontario

**EXHIBIT 3**

**CUTA'S 1989 INVENTORY OF TRANSIT RESEARCH AND DEVELOPMENT; TOPIC AREAS AND NUMBER OF ENTRIES PER CATEGORY**

**Part I. Vehicle Technology**

1. Bus Design and Components (23)
2. Alternative Fuels and Energy Conservation (14)
3. Rail Systems (29)

**Part II. Information Systems**

4. Planning, Passenger Counting and Data Collection Systems (18)
5. Transit Scheduling and Dispatching Systems (11)
6. Systems for Specialized Services for the Disabled (4)
7. Maintenance Information Systems (13)
8. Integrated Operations Systems (9)  
(Including Automatic Vehicle Location Systems)
9. Public Information Systems (15)
10. General Management Systems (7)

**Part III. Managerial Techniques and Practice**

11. Marketing and Promotions Studies and Demonstrations (19)
12. Pricing and Fare Collection Studies and Demonstrations (6)
13. Service and Operations Planning; Tools and Studies (24)
14. Studies/Demonstrations of Transportation for the Disabled or Paratransit Services (14)
15. Management and Policy Analyses (16)

Note: Numbers in parentheses indicate number of projects in each category. 222 projects in total are described in this inventory.

**EXHIBIT 4**

**CUTA'S 1989 INVENTORY OF TRANSIT RESEARCH AND DEVELOPMENT; A SAMPLE PAGE**

**"Timeline" User Evaluation Study**

To examine the effect of "Timeline", a computerized telephone information system, on passenger riding habits using the ridership diary methodology. Repeated 4 times per year, with 300 Timeline TTC users and 150 non-Timeline riders each time. Ongoing.

TTC (Toronto)

**"Busline"; Integrated Automated Transit Information System**

To develop for Victoria a PC-based automated system to provide a range of customer service information on transit, including schedule, destinations, trip planning, and fare information. The system uses a telephone location database, computerized transit network, and an electronic schedule interface, and is accessed by patrons through touch-tone telephones.

BC Transit (Victoria)

Oracle Communications

**Computerized Assistance for Telephone Operators Providing Travel Itinerary Information**

To assist telephone operators answering user telephone calls to give the best travel itinerary from one point to another, taking into consideration time constraints, bus schedules, and real-time activity on the road. This system will build on the AVL system. Completed.

CTCRO (Hull)

**Schedule Trip Planning Information System**

To assist telephone information clerks to respond in a more timely fashion through computer-assisted system.

HSR (Hamilton)

**Station Platform Warning System**

To develop a system that could detect approaching trains and warn waiting patrons. A feasibility study and a technical evaluation were completed in May 1988 and September 1989 respectively. Design of the system is under way.

GO Transit

Morrison Hersfield