

CANADA'S TRANSPORTATION

ELECTRONICS PRODUCTS

&

CAPABILITIES

April 6, 1995

CANADA'S TRANSPORTATION ELECTRONICS PRODUCTS & CAPABILITIES

Vartek
19 Donegani, #402
Pointe Claire, Quebec, H9R 2V6
514-695-0222
Bill Powell, Vice President
Vehicle tracking systems

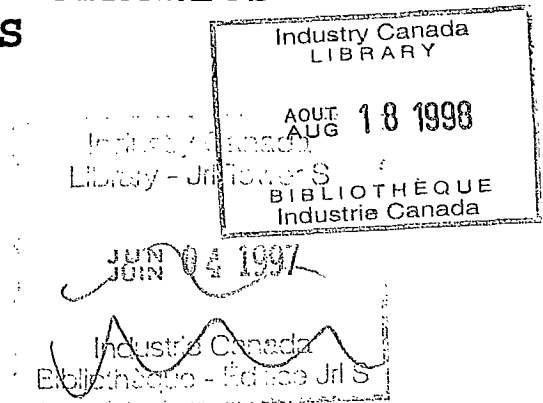
Fiberlign, Division of Preformed Products
24 Colonnade Road
Ottawa, Ontario, K2E 7J6
613-226-4000 FAX 613-226-4602
Gregory H. Boyle, President
Fiber optic communications equipment for controlling freeway
traffic management systems

International Road Dynamics Inc.
702 43rd Street
Saskatoon, Saskatchewan, S7K 3T9
306-653-6600 FAX 306-242-5599
Rod Klashinsky, Marketing/Sales Manager
Weigh-in-motion systems and sensors, real-time automatic vehicle
location systems

IBI Group
230 Richmond Street West, 5th Floor
Toronto, Ontario, M5V 1V6
416-596-1930 FAX 416-596-0644
Kevin L. Bebenek, Associate
Full planning, design and integration services. Simulation
software, traffic and road information system, advanced traffic
management system and field controller

DALSA Inc.
605 McMurray Road
Waterloo, Ontario, N2V 2E9
519-886-6000 FAX 519-886-8023
Tom Mitchell, Marketing Manager
CCD Image Sensors and Cameras. Variable and high frame rate area
scan cameras

Automatic Vehicle Location Systems Ltd.
190, 7330 Fisher St. S.E.
Calgary, Alberta, T2H 2H6
Tom Lockhart
403-253-8112 FAX 403-253-1985
Systems integration, design and implement Automatic Vehicle
Location systems for a variety of applications



Pulsearch Navigation Systems Inc.
Bay E, 6815 40th S.E.
Calgary, Alberta, T2C 2W7
403-720-0277 FAX 403-720-0044
James McLellan, V.P. and General Manager
Integration of Global Positioning systems with data acquisition,
dead reckoning, vehicle tracking, and specialized air navigation
systems (e.g. aerial photography, crop spraying, etc.)

Alcatel, SEL Division
1235 Ormont Drive
Weston, Ontario, M9L 2W6
416-742-3900 FAX 416-742-1136
Mark Halinaty
Advanced Train Control Systems (ATCS), Inductive Data
Transmission Systems, Low Density Control Systems, and Integrated
Signalling and Information Systems.

Centrodyne Inc.
3485 Thimens Blvd.
St Laurent, Quebec, H4R 1V5
514-331-8760 FAX 514-339-1078
Carlos Parente, Marketing Director
Electronic trip recorder

Canadian Marconi Company
600 Dr. Frederick Philips Boulevard
Ville Saint-Laurent, Quebec, H4M 2S9
514-748-3070 FAX 514-748-3055
Sylvain Savaria, GPS Applications & Sales, Transportation
Electronics (GPS)
Global Positioning Systems for AVL applications

Array Systems
410 Magnetic Drive, Suite 24
Downsview, Ontario, M3J 3H9
416-736-0900 FAX 416-736-4715
Rob Bruce
Software for real-time tracking on transit system

AVeL-TECH Inc.
1685 rue Fleetwood
Laval, Quebec, H7N 4B2
514-668-2835 FAX 514-668-6644
Michel Jarry, President
Automatic vehicle location system, radio comms

Mobile Computing Corp.
43 Lesmill Road
Toronto, Ontario, M3B 2T5
416-449-5757 FAX 416-449-4615
Allan Bowman, V.P., Business Development
Onboard vehicle monitoring/dispatch systems, Onboard weighing

AlliedSignal Aerospace Canada
240 Attwell Drive
Etobicoke, Ontario, M9W 6L7
416-675-1411 FAX 416-798-6866
Bill Coyle, V.P., Business Development
Export-oriented aerospace company seeking alliances in software
development and/or application of temperature load cell and other
technologies into IVHS markets

Motorola Canada Ltd. Communications
3125 Steeles Avenue E.
North York, Ontario, M2H 2H6
416-756-5755 FAX 416-499-8130
Ed Whitehead
Mobile communications in 900 MHz frequency band

Disys Corporation
Building 10, Airport Square, 2600 Skymark Ave.
Mississauga, Ontario, L4W 5B2
Christopher Gadula, Executive V.P.
905-625-7343 (ext. 144) FAX 905-625-7344
RF Transponders & systems for harsh environments

MARK IV INDUSTRIES
6030 Ambler Drive
Mississauga Ontario, L4W 2P1
905-624-3025 FAX 905-624-4572
Paul A. Manuel, Sales Manager
Tranponders, road-side readers, lane kits

Intergraph Canada Ltd.
National Transportation Marketing
2580 Matheson Blvd. East
Mississauga Ontario, L4W 4J1
L4W 4J1
905-625-2081 FAX 905-625-6445
Kevin McConomy or Michael Power
GIS Systems and applications, yellow page information

Research In Motion (RIM)
180 Columbia St. West
Waterloo, Ontario, N2L 3L3
John H. Latham, Director, Business Development
519-888-7465 FAX 519-888-6906
RIMGATE: interfaces mobile data users with cellular data networks

ABL Canada Inc.
8550 Cote de Liesse
St. Laurent, Quebec, H4T 1H2
Peter Ficocelli
514-344-5432 FAX 514-344-5439
Video highway surveillance system: all media/bandwidths

UMA Systems Inc.
5080 Commerce Blvd.
Mississauga, Ontario, L4W 4P2
Ms. Fran Fendeleit, Marketing Manager
905-238-0007 FAX 905-238-0038
Scheduling/dispatching software

Teleride Sage Ltd.
156 Front Street West, Suite 500
Toronto, Ontario, M5J 2L6
Dr. Josef Kates, President
416-596-1940 FAX 416-595-5653
Integrated software solutions for mass transit industry

EIS Electronic Integrated Systems Inc.
150 Bridgeland Avenue
North York, Ontario, M6A 1Z5
Dan Minor
416-785-9248 FAX 416-785-9332
RTMS Radar Traffic Detector

Applied Analytics Corporation
550 Alden Road, Unit 11
Markham, Ontario, L3R 6A8
905-475-2221 FAX 905-475-2965
Blake Reid, President
Potential application of POS (Position & Orientation System)
technology to surface transportation

GIRO Enterprises Inc.
75 Port Royal East
Montreal, Quebec, H3L 3T1
514-383-0404 FAX 514-383-4971
Nigel Hamer
Transit scheduling/operations and fleet management systems

Software Kinetics Ltd.
65 Iber Road
Stittsville, Ontario, K2S 1E7
613-831-0888 FAX 613-831-1836
Tony Moretto, Stittsville office
Atlantic (Dartmouth, N.S.) office: Barry Mooney (902-481-3680)
Mobile data/packet radio for police, 3D sensor visualization,
expertise in fault tolerant systems, and systems simulation

Geoplan Consultants Inc.
115 Prospect Street West
Fredericton, N.B., E3B 2T7
506-451-0055 FAX 506-450-4838
David Loukes
Geographic Information Systems/software for transportation appns.

Hermes Electronics Limited
40 Atlantic Street
Dartmouth, Nova Scotia, B2A 4A1
902-466-7491 FAX 902-463-6098
Ottawa Contact, Brian Wattie 613-591-2527
Seeking to apply diverse technologies (gained through 35 years in
military ASW) to IVHS-related markets through corporate alliances

CAE Electronics Ltd.
8585 Cote de Liesse
St. Laurent, Quebec, H4L 4X4
514-341-6780 FAX 514-341-7699
Max Rutherford, V.P. Business Development
Large manufacturer of aircraft simulators is seeking alliances in
application of technologies/expertise to IVHS in areas of:
systems integration, real-time simulation (using scenario
observation), training applications using simulation, and
information and management systems

Applied Silicon Inc. Canada
220, 2427 Holly Lane
Ottawa, Ontario, K1V 7P2
613-738-2434 FAX 613-738-0750
Mr. Eli Fathi, President
Video logging/monitoring system to capture, digitize and compress
real-time video images for processing, storage and transmission
purposes. Applications include security and surveillance,
medical imaging, road traffic management, and quality control

Virtual Prototypes Inc.
4700 de la Savanne, Suite 300
Montreal, Quebec, H4P 1T7
514-341-3874 FAX 514-341-8018
Mark Schwartz
Computerized prototyping tool for IVHS applications

Minelec Limited
2170 Dunwin Drive, No. 3
Mississauga, Ontario, L5L 5M8
905-828-1520 FAX 905-828-1525
Alan Blevins, President
Automatic Radio Identification System (ARIS) for public transit

Cygnus Technology Ltd.
154 Main Street
Fredericton, New Brunswick, E3A 1C8
506-459-4606 FAX 506-452-9321
Ms. Kim Munn, V.P. Marketing
"Cygnet" voice/data networks for emergency vehicle responses

Compusult Limited
40 Bannister Street
Mount Pearl, Newfoundland, A1N 3C9
709-745-7914 FAX 709-745-7927
Barry O'Rourke, President
VISION: Vehicle Information System Integrated On-line Network

Vapor Canada Inc.
10655 Henri Bourassa W.
St Laurent, Quebec, H4S 1A1
514-335-4200 FAX 514-335-4231
Mike Hardt, Director, Sales and Marketing
Vehicle location and other systems for mass transportation
markets

ROADsoft Solutions Inc. subsidiary of M3i
Suite 135, 1111 St. Charles Street West
Longueuil, Quebec, J4K 5G4
514-928-3332 FAX 514-442-5076
Bruce Seidel, V.P. Marketing & Sales
Computer Assisted Dispatch/Automatic Vehicle Location system
graphic display system

Avcan Technologies, Inc.
11465 Baynes Road South, Unit 1
Pitt Meadows, British Columbia, V3Y 2B4
604-465-5854 FAX 604-465-8894
Bob McLennan, CEO
GPS productivity tools, vehicle tracking, surveillance

Digital Dispatch Systems Inc.
7100 River Road
Richmond, British Columbia, V6X 1X5
604-270-1171 FAX 604-270-9160
Jonas Lingren
Dispatch systems using mobile data terminals and proprietary
UNIX-based software

Epic Data International Inc.
7280 River Road
Richmond, B.C., V6X 1X5
604-273-9146 FAX 604-273-1830
Helmut Eppich, President
Integrated data collection systems

Pacific Avionics & Instruments Ltd.
4200 Cowley Crescent
Richmond, B.C., V7B 1B8
604-278-2105 FAX 604-278-9729
Custom comms equipment incl. GPS vehicle tracking systems
Gordon Bott, Director of Maintenance

Pacific Insight Electronics Inc.
624 Lakeside Drive
Nelson, B.C., V1L 5S7
604-354-1155 FAX 354-1166
Mr. Daniel Cooke, Sales & Marketing Mgr.
Vehicle security and electronic control systems

Silent Witness Enterprises Ltd.
17761 Unit B - 66th Avenue
Surrey, British Columbia, V3S 7X1
604-574-1526 FAX 604-574-1527
Mr. Jack Gin, P.Eng.
Onboard electronic vehicle monitoring systems

Spectrum Signal Processing Inc.
8525 Baxter Place, 100 Production Court
Burnaby, B.C., V5A 4V7
604-421-5422 FAX 604-421-1764
Barry Jinks, President
DSP hardware/software for wide variety of applications: potential
for IVHS

CDL Systems
100 Discovery Place One
Calgary, Alberta, T2A 2K7
403-289-1733 FAX 403-282-1238
Dave Weiler
Real-time mission control system for vehicles

Interalia Inc.
Calgary, Alberta
4110 - 79 St. N.W.
Calgary, Alberta, T3B 5C2
403-288-2706 FAX 403-288-5935
Bob Cormack, V.P. Operations
Vehicle voice announcement/voice capture system

Mobiltext Data Ltd.
3640 26th Street N.E.
Calgary, Alberta, T1Y 4T7
403-291-2770 FAX 403-250-6795
Rob Slevin, Marketing Director
Vehicle monitoring, communications management & truck dispatch
systems

Novatel Communications Ltd.
6732 8th St. N.E.
Calgary, Alberta, T2E 8M4
403-295-4500 403-295-0230
Ms. Lindae Stokes, Corporate Communications
OEM GPS Cards, cellular radio communications system

QC Data
7210 Blackfoot Trail S/E
Calgary, Alberta, T2H 1M5
403-640-2966 FAX 640-2973
Laura McGregor
Automated Vehicle Navigation & Location System using GPS cards

Display Systems International Inc.
2213C Hanselman Court
Saskatoon, Saskatchewan, S7L 6A8
306-934-6884 FAX 306-934-6447

Dale Lemke, President

Computerized character/image generation systems: applications in transportation terminal market (e.g. Atlanta Georgia airport)

Kanotech Information Systems Ltd.
575 Park Street
Regina, Saskatchewan, S4N 5B2
306-721-2362 FAX 306-721-2474

Len Exner, Marketing

Desktop GPS software for light rail rapid transit systems, road condition management, etc.

Massload Technologies
211 - 47th Street East
Saskatoon, Saskatchewan, S7K 5H1
306-242-2020 FAX 306-931-1991

Troy Holmes, Marketing Manager

Loadcells for truck & rail, on-board digital weighing systems for trucks

Norac Systems International
809 46th Street East
Saskatoon, Saskatchewan, S7K 3L3
306-664-6711 FAX 306-664-6664
Bill Strelioss, President
Onboard weighing systems for trucks

B.C. Research Inc.
3650 Westbrook Mall
Vancouver, B.C., V6S 2L2
604-224-4331 FAX 604-224-0540
James Hill, Director of Marketing & Sales
Vibration & impact assessment in transportation systems and general human/machine interface problems

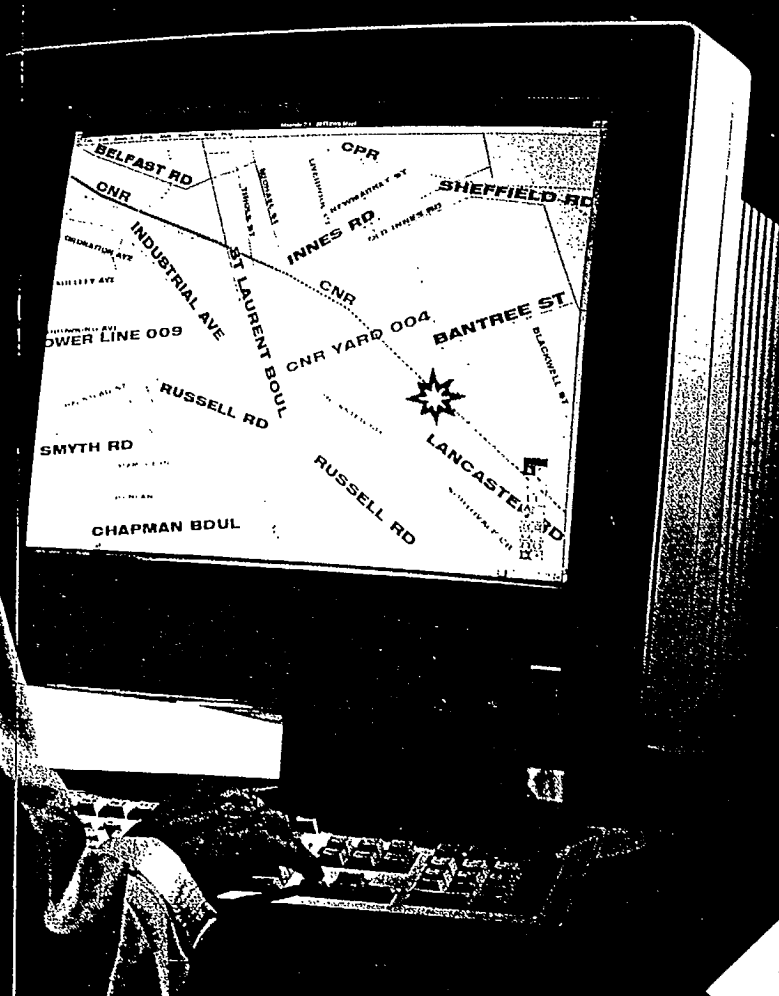
N.B. This preliminary directory is prepared for your reference by Industry Canada, with the assistance of Western Economic Diversification, Federal Office of Regional Development (Quebec), and the Atlantic Opportunities Agency. For more information, or clarification of any items, please contact the companies above.

Cliff Oldridge
Industry Canada
Ottawa, Ontario
613-954-3326 FAX 613-991-9469

February 10, 1995

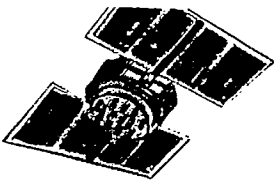
SatSting™

SATELLITE-BASED VEHICLE TRACKING SYSTEM



S₂R₂K
ADVANCED TECHNOLOGIES INC.

SATELLITE-BASED VEHICLE TRACKING SYSTEM



SRK
ADVANCED TECHNOLOGIES INC.
VARTEK



WHAT CAN SATSTING PROVIDE ?

For Personal Vehicles...

- ◆ THEFT RECOVERY
- ◆ PANIC BUTTON
- ◆ 24 HOUR MONITORING
- ◆ PRIVACY PROTECTION
- ◆ IMPROVED INSURANCE RATES
- ◆ TRANSFERABILITY
- ◆ PROTECTION FOR YOUR LOVED ONES

For Transport Carriers...

- ◆ FLEET PRODUCTIVITY
- ◆ IMPROVED DISPATCH CAPABILITIES
- ◆ OPTIMIZE LOAD/VEHICLE AVAILABILITY
- ◆ ROUTE OPTIMIZATION
- ◆ "JUST IN TIME" SUPPORT
- ◆ CARGO/DRIVER SECURITY
- ◆ LOW OPERATING COSTS
- ◆ WILL INTERFACE WITH EXISTING RADIO
- ◆ MONITOR FLEET MOVEMENT

Optional Equipment...

- ◆ COMMUNICATION TO AN LCD SCREEN
- ◆ BACK-UP POWER SUPPLY

WHO SHOULD USE SATSTING ?

Freight Industries

- ◆ TRUCKING
- ◆ RAILWAYS
- ◆ COURIERS
- ◆ ARMoured VEHICLES

Car Fleet Operators

- ◆ CAR RENTAL
- ◆ UTILITIES
- ◆ TAXI / LIMOUSINE

Government

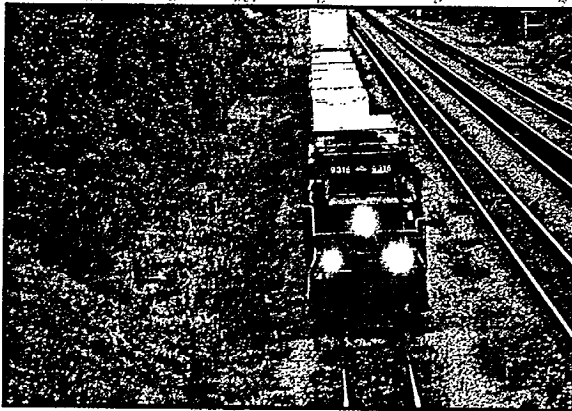
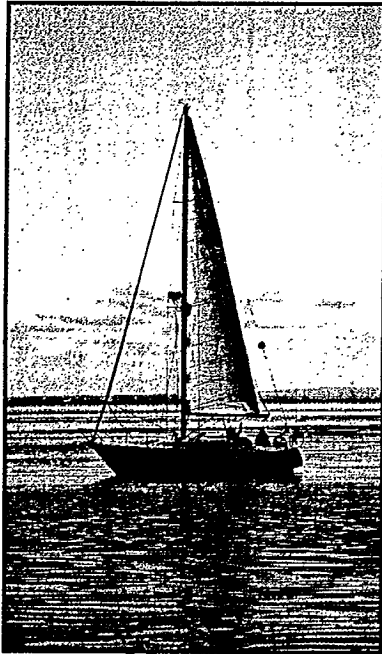
- ◆ POLICE
- ◆ AMBULANCE
- ◆ AIRPORT GROUND EQUIPMENT
- ◆ CIVIL DEFENCE
- ◆ MUNICIPAL BUS LINES
- ◆ HAZARDOUS MATERIALS HANDLING

Consumers

- ◆ CARS
- ◆ BOATS
- ◆ RVs

SatSting™

SATELLITE-BASED VEHICLE TRACKING SYSTEM



VARTEK

Distributed by:



19 Donegani # 402
Pointe-Claire, Qc.
H9R 2V6

514-695-0222
Tel# 514-694-0127
Fax# 514-694-7892

Fiberlight

FIBER OPTIC COMMUNICATIONS

A DIVISION OF PREFORMED LINE PRODUCTS

November 23, 1994

Mr. Cliff Oldridge
Industry Canada
RM 635A
235 Queen Street
Ottawa, Ontario
K1A OH5

Dear Cliff.

We have enclosed a package of our latest products. After your review if you have any questions please give us a call.

Regards,

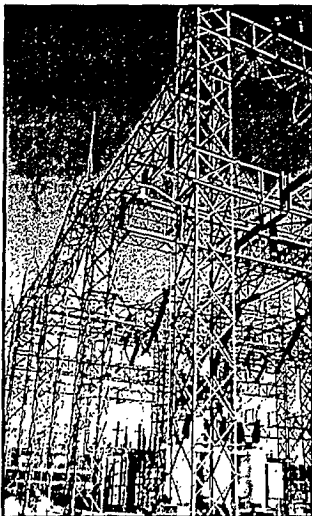
FS

Frank Stickle
Contract Administration

enclosures: TelePath, Corp Profile, PLP Catalogue, MS-2

FIBERLIGN DELIVERS FIBER OPTIC SOLUTIONS...

Fault tolerance and redundancy capability were the factors that influenced Iowa's Midwest Power Systems to choose Fiberlign's FMS-6400 fiber optic based multiplexer to create a communications loop for monitoring substations within a 30-mile circumference. Dual transceiver modules and automatic switching systems use available optical redundancy to reconfigure a network around problems.



Thanks to Fiberlign's frequency- and time-division multiplexing technology, only two optical fibers are needed to transmit the video, voice and data communications that feed 30 major exchanges on North America's first fully integrated FTMS highway, Ontario's "401" through Toronto.



PHOTO: MINISTRY OF TRANSPORTATION

Fiberlign's highly reliable, "self-diagnosing" components ensure uninterrupted service throughout the vast, often remote networks that typify the defense radar and satellite tracking systems of Fiberlign's clients in the military and aerospace industries.

Fiberlign supplies:

- **America's busiest highways**, from California to Virginia to Ontario, with fiber optic communications equipment that controls Freeway Traffic Management Systems (FTMS) and Intelligent Vehicle Highway Systems (IVHS).
- **The military and aerospace sectors** with the fiber optic multiplexers and modems on which their reconnaissance radar and satellite tracking systems depend.

A REPUTATION FOR ...

Experience:

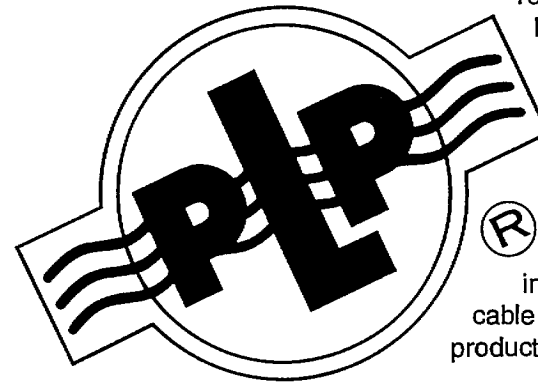
We've been in fiber optic communications since its infancy in the 1970s, working alongside Canadian fiber optic pioneers like Northern Telecom and Bell Canada. Not only were we helping design electronic systems for military operations, we were chosen by Bell Canada to design and supply the electro-optics for their landmark fiber-to-the-home experiment in Yorkville, Ontario, in 1978.

Back then, we were known as *Foundation Instruments*, the company that captured the attention of world markets with our fiber optic fusion splicing equipment. From there, we went on to become *Fiberlign*, a major developer of fiber optic communications systems, and a major supplier of electro-optics to the Transportation industry. Today, as we complete our third generation of fiber optic products, we are again leading the industry with innovative enhancements that anticipate our customers' evolving needs.



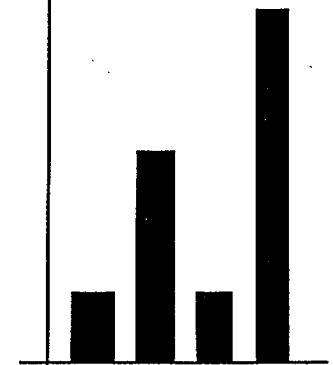
Stability:

Our clients know that, even in the tumultuous high-tech business environment, we'll be here over the long term. We're a division of Preformed Line Products (PLP), of Cleveland, Ohio, a relationship that began with PLP's initial investment in Fiberlign in 1983.



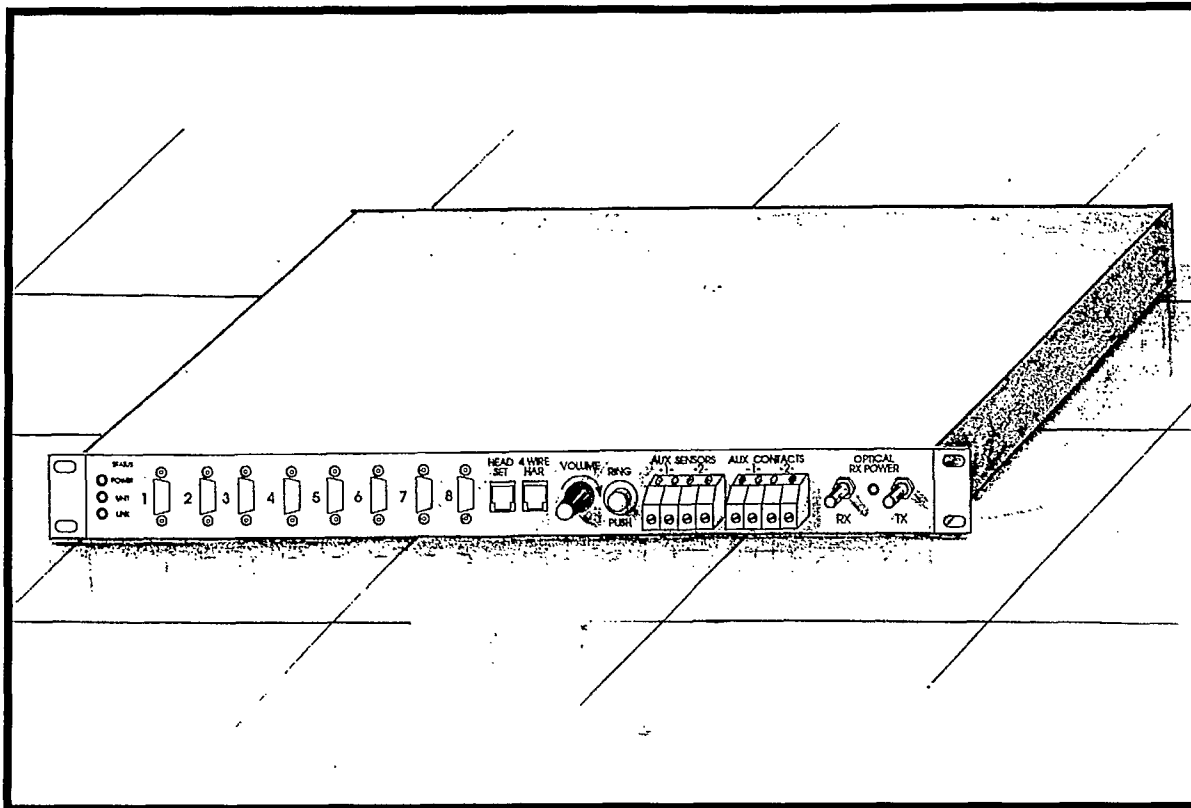
PLP's business reputation, financial stability and marketing reach are built on over 40 years of accomplishments in the fields of communication cable and power cable support products.

Global Markets



- Canada
- Europe
- Pacific Rim
- United States

NEW PRODUCT



Fiberlign® TelePath™ FO/FT1 Fiber Optic Fractional T 1 Multiplexer

Designed for point-to-point applications or on multi-location networks, the TelePath FO/FT1 is a low cost 10 Channel (8 data/2 voice) fractional T 1 multiplexer operating at 1.544Mb/s over multimode or singlemode optical fiber.

Versatility and flexibility are the main attributes of the TelePath FO/FT1. It is capable of operating as a terminal and/or a drop and insert multiplexer, and can be integrated in a variety of configurations with other members of the TelePath family of multiplexers.

The TeleVue Network Management System provides detailed monitoring and diagnostics to the channel level through the FDM & TDM multiplexers. TelePath FO/FT1 is the ideal solution for those segments of your network

that don't warrant the additional costs associated with a fully loaded T 1 system.

Range of Applications

- Traffic Management & Transit Monitoring
 - Campus Environments
 - Industrial Process Control
 - Utilities - SCADA
 - Security - Alarm & Access Control
- Critical Communication Links**
With TeleVue Management System, confidence level testing is built into data interfaces. TeleVue detects, locates and reports failures on any board in the system.
- Harsh Environments**
Built with high-grade components for temperatures of -20° to +70° Celsius.

Features

- Range of Data**
Supports RS 232, RS 422 (RS 530), or RS 485.
- Voice Channels**
Service Voice Link for headset with VOX control. 4 wire link for Highway

Advisory Radio (HAR).

Alarms

Two external dry contacts and sensors monitored and controlled remotely by TeleVue.

Universal Power Supply

90 Vac to 240 Vac, 129 Vdc.

Compact

Rack mountable in 19" or optionally 23 EIA.

Requires a maximum height of 1 RU (1.75")

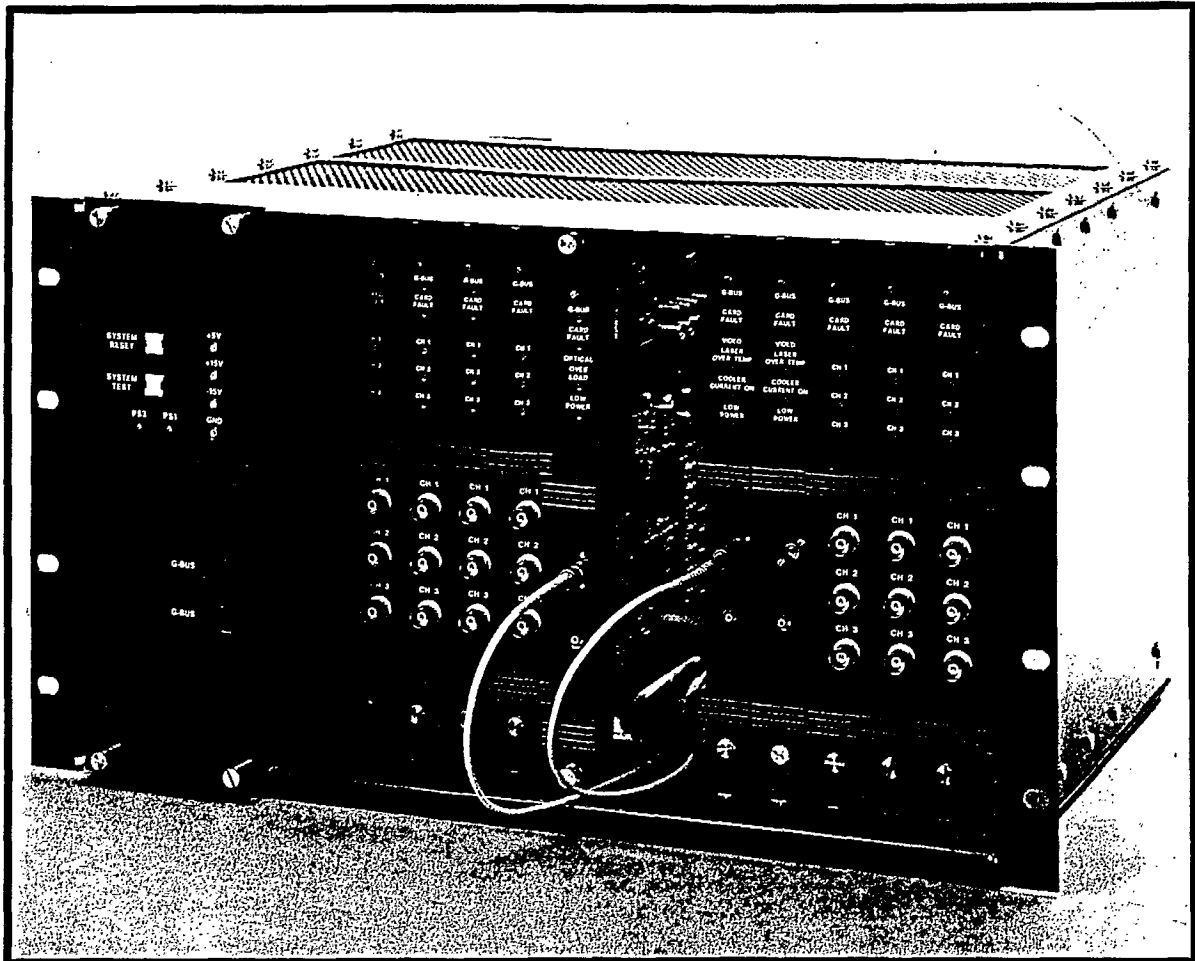
Find out more

Outside the U.S.:
FIBERLIGN, A Division of
Preformed Line Products
24 Colonnade Road
Ottawa, Ontario, K2E 7J6
(613) 226-4000

In the U.S.:
Preformed Line Products
P.O. Box 91129
Cleveland, Ohio 44101
(216) 461-5200

Fiberlign

A DIVISION OF PREFORMED LINE PRODUCTS



Fiberlign[®] TelePath[™] FDM

Fiber Optic Broadband Multiplexer

The Fiberlign TelePath FDM represents true innovation in Broadband Multiplexing. A microprocessor controlled unit, the TelePath FDM will support all of your video, voice and data communication needs well into the 21st century.

When used as a video multiplexer, the TelePath FDM is capable of transmitting up to 24 channels of EIA 250 C quality video over a single optical fiber. For even greater capacity, our optional Fiberlign WDM (wavelength division multiplexer) can be added to provide up to 48 channels. Our standard singlemode system is able to cover up to 40 km without a repeater.

The FIBERLIGN[®] TelePath FDM Series of bi-directional multiplexers is designed for applications demanding integrated Video, Voice & Data.

A Range of Applications

TelePath FDM applications include:

- Traffic Management & Transit Monitoring
- Campus Conference & Distance Learning
- CATV & CCTV
- Industrial Process Control

Traffic monitoring and teleconferencing are particularly well served by the modularity of the multiplexer.

Description

TelePath FDM series multiplexers are fully compatible with TelePath TDM multiplexers for simple integration of Voice & Data. Modular design assures simple field configuration to meet various system requirements.

Frequency Agility allows for simple changes of channel assignments. Local or Remote computer monitoring is available.

EIA-250 C Medium Haul performance is standard over the entire optical link.

Competitive Advantage

TelePath FDM products are particularly adaptable to harsh environments. Operation in temperatures ranging from +14F to +120F (-10C to +50C).

Compact size means that the TelePath FDM is simple to install and well suited for multi-point applications. Installation and field reconfiguration is further simplified by Local selection or optional Remote computer control.

Find out more

Outside the U.S.:
FIBERLIGN, A Division of
Preformed Line Products
24 Colonnade Road
Ottawa, Ontario, K2E 7J6
(613) 226-4000

In the U.S.:
Preformed Line Products
P.O. Box 91129
Cleveland, Ohio 44101
(216) 461-5200

A DIVISION OF PREFORMED LINE PRODUCTS



INTERNATIONAL ROAD DYNAMICS INC.

CORPORATE OFFICE: 702 - 43rd Street East Saskatoon, Saskatchewan CANADA S7K 3T9
Telephone: (306) 653-6600 Facsimile: (306) 242-5599

October 27, 1994

File: 132M/Ont

Mr. Cliff Aldridge
Industry Canada
235 Queen Street
Room 635A
Ottawa, Ontario
K1A 0H5

Tel: (613) 954-3326
Fax: (613) 991-9469

Dear Mr. Aldridge:


RE: IRD Corporate and Product Information

Further to your request, please find enclosed corporate and product information for IRD (International Road Dynamics Inc.). We are primarily a transportation systems and engineering company. We have been a weigh-in-motion (wim) industry leader since 1980, and have more systems in operation in North America than any other vendor. We are the only Canadian company in this specialized area. IRD also participates in the toll, automatic vehicle location, and other specialized market areas.

I have also enclosed Roy Parsons's business card, our International Manager, whose office is located in Ottawa.

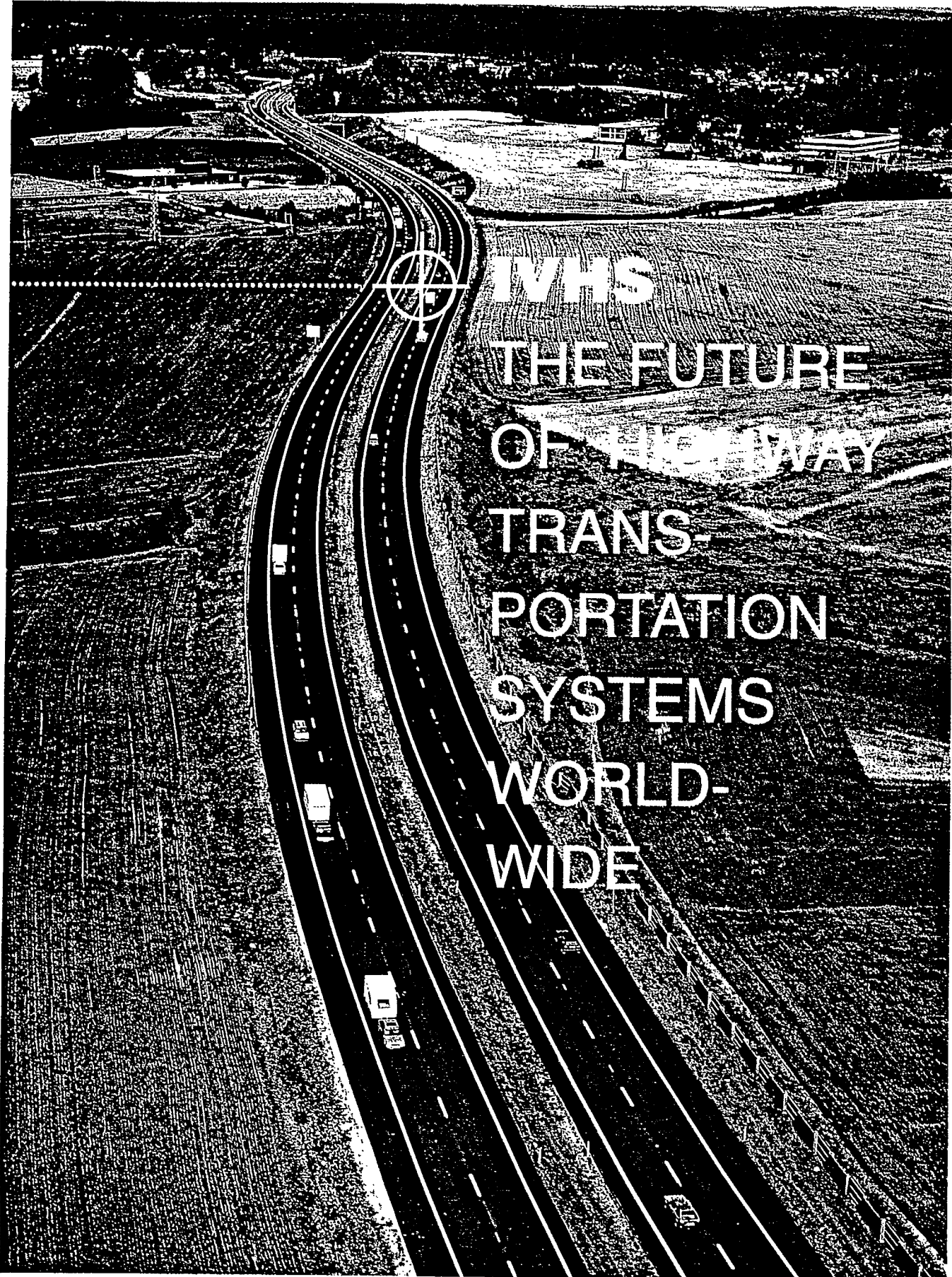
Please review the enclosures. If you have any questions or require further information, please contact either Roy or myself.

Best regards,


Rod Klashinsky
Marketing/Sales Mgr.

cc: Roy Parsons

IVHS SPECIALISTS
(Intelligent Vehicle Highway Systems)
WEIGH-IN-MOTION AND DATA COLLECTION SYSTEMS
U.S. CORPORATE OFFICE: Denver, Colorado Telephone: (303) 355-5788
Quality-in-Motion...



IVHS
THE FUTURE
OF HIGHWAY
TRANS-
PORTATION
SYSTEMS
WORLD-
WIDE

ird™ NEWS

INTERNATIONAL ROAD DYNAMICS INC.

Specializing in the Development, Manufacturing, Marketing, Installation and Service of
TRANSPORTATION MONITORING EQUIPMENT AND SYSTEMS

IVHS SPECIALISTS
(IRD is a member of ITS America)

IRD TOLL, TURNPIKE AND BRIDGE TRAFFIC AND WEIGHT MEASUREMENT SYSTEMS

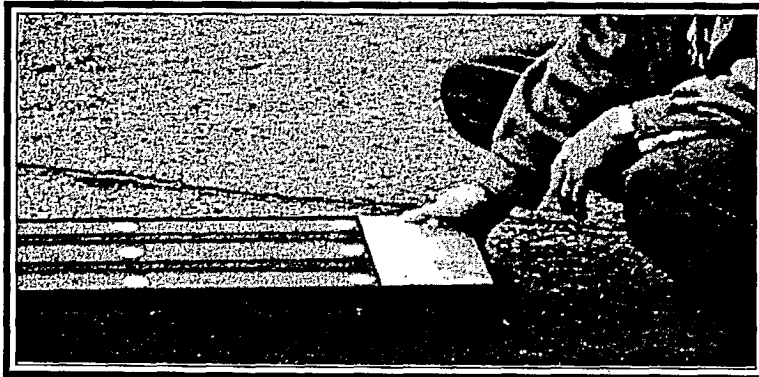
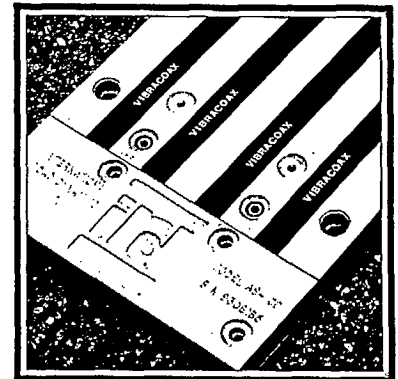


IRD INTRODUCES NEW TREADLE

IRD and Philips Electronic Instruments Company are proud to announce the introduction of a new treadle, which utilizes the time proven **Vibracoax Piezoelectric Axle Sensor** and IRD's quality treadle hardware. This new treadle was developed jointly by the two companies and is expected to receive a good reception from toll, turnpike, and bridge treadle users. The Vibracoax Piezoelectric Sensor has gained an enviable worldwide reputation for reliability and consistent performance for vehicle axle sensing.



The Vibracoax Sensor has been modified to fit directly into IRD's full line of treadle inserts and frames. The new Piezoelectric Treadle provides the capability to accurately detect several million axles and surpasses traditional "contact" closure treadles through its extended life.



NEW UNI-CONSTRUCTION MODELS

The new IRD Uni-Construction treadle is easier to install and require minimal road excavation. IRD has introduced new treadle models with a unified frame and clamp bar design, thereby eliminating the requirement for a treadle frame and treadle insert as separate components. These innovative treadles feature **shallow depth installation** and are offered in single, two, three and four sensor models.

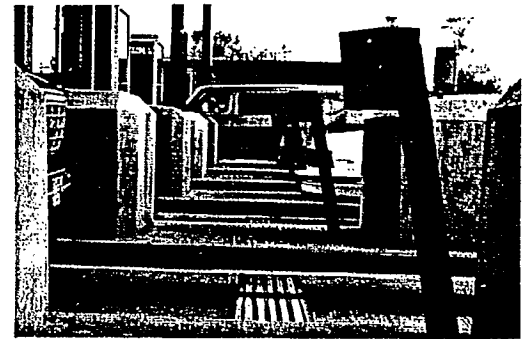
PROTECT YOUR HIGHWAY INVESTMENT

Billions of dollars in damage is done each year to roadways and bridges by overloaded trucks. **IRD Weigh-In-Motion (WIM) Scales** reduce this **devastating damage** by identifying suspected overweight vehicles. IRD WIM Scales weigh vehicles in motion and are placed upstream of a toll collection booth or bridge. The vehicle's axle weights, gross vehicle weights, and classification are recorded and communicated to the toll booth operator. This information can be utilized by the toll operator to direct the truck for further weighing and inspection, and/or to restrict an overloaded vehicle from traveling on the toll road or bridge.





Weigh-In-Motion (WIM)

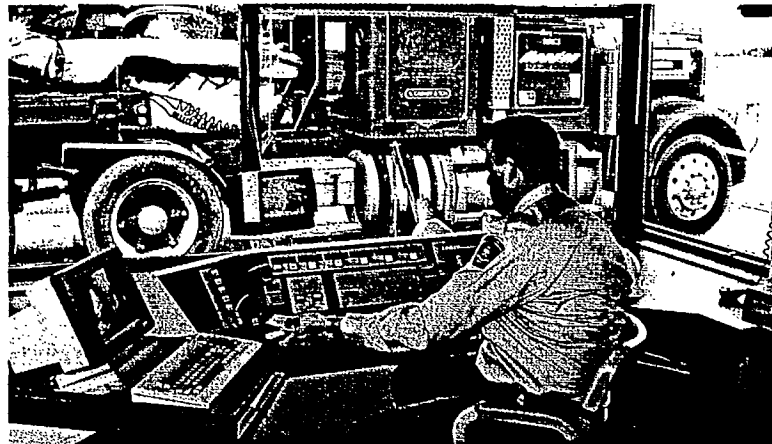


Toll Road Systems

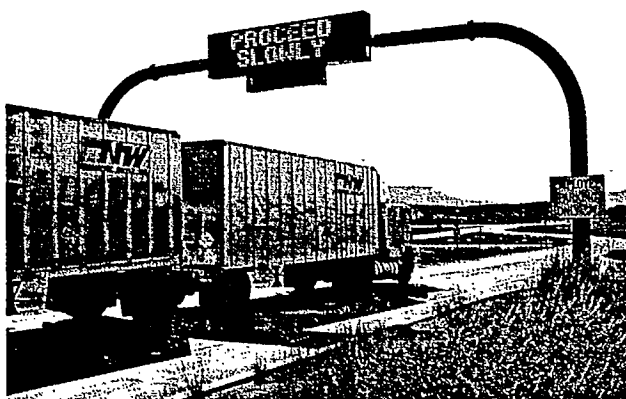
INNOVATIVE TECHNOLOGIES AND PRODUCTS TO MEET THE DEMANDS OF IVHS



Vehicle and Axle Detection Technology



Automated Truck Weigh Stations



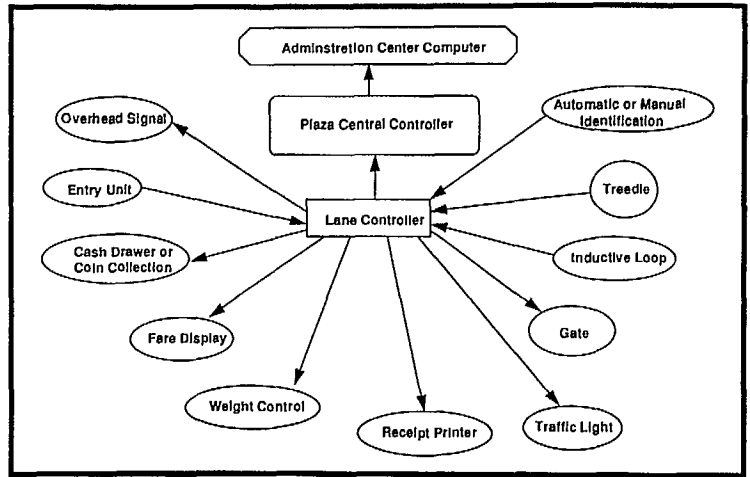
Traffic Advisory



Traffic Data Collection

IRD Lane Control and Collection Systems

IRD can provide **complete lane control, vehicle classification, and collection systems** for non-automated toll and bridge lanes. Our Engineers and Software Programmers excel in systems integration, merging the lane control and classification sub-systems with the central controller and computer. IRD Engineers work in harmony with the client to design and implement a system which will serve the client's requirements not only today, but into the future.



IRD TOLL SPECIALISTS



Mr. Rod Klashinsky
 Manager, Marketing & Sales
 Saskatoon, Canada
 (306) 653-6610



Mr. Roy Parsons
 Manager, International Markets
 Ottawa, Canada
 (613) 730-0210



Mr. Jae Lee
 Systems Specialist
 Houston, Texas
 (713) 550-3574

Contact Rod, Roy or Jae If You Have Any Questions Regarding IRD'S Toll Equipment & Systems



Customer Service Commitment

IRD's team of transportation engineering professionals and experts are committed to "Total Quality" in all areas of expertise, from design and development to manufacturing and installation, to long-term service. IRD's "Total Quality Commitment" focuses on the customer, striving to exceed customers' requirements. Installation supervision and service support are provided by IRD's expert technical staff anywhere in the world. IRD is known worldwide for providing user defined products and systems to meet each customer's needs.



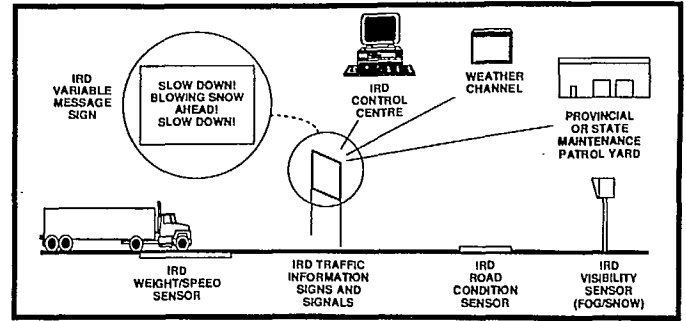
Local IRD Representative

CORPORATE OFFICES

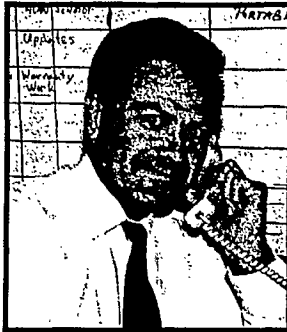
| | | | |
|--|--|--|--|
| 702 43rd Street E, Saskatoon, SK, CANADA S7K 3T9 Tel: (306) 653-6600 Fax: (306) 242-5599 | B1- 5660 McAdam Road, Mississauga, ON, CANADA L4Z1T2 Tel: (416) 890-2167 Fax: (416) 890-2166 | 7373 East Doubletree Ranch Road, Scottsdale, Arizona, USA 85258 Tel: (602) 443-4711 Fax: (602) 991-6606 | #305 - 1006 West 104th Avenue Northglenn, Colorado USA 80234 Tel: (303) 355-5788 Fax: (303) 443-4027 |
|--|--|--|--|

IRD Environmental Monitoring and Advisory Systems

IRD Environmental Monitoring and Advisory Systems forewarn traffic and trucks of potentially dangerous highway conditions. The system monitors visibility, ice and traffic conditions and forewarns traffic via message signs. In addition, the central weather station and highway services can be alerted.



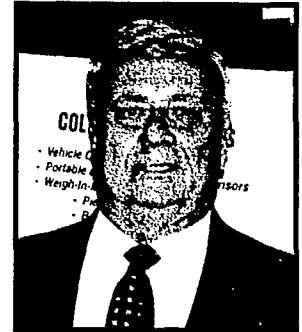
New Appointments at IRD



Mr. David Heath
VP Operations and Business Development
David directs IRD's engineering, manufacturing, support and service activities.
Call David at (306) 653-6607



Mr. Brian Beranek
Manager of IRD Colorado
IRD's manufacturing, service and sales hub.
Call Brian in Boulder at (303) 443-0567



Mr. Joe Madek
Business Development Officer
Director of Sales
After a brief leave of absence Joe has returned to IRD.
Welcome back Joe!
Call Joe in Arizona at (602) 443-4711



Customer Service Commitment

NEW APPOINTMENT

IRD's team of transportation engineering professionals and experts are committed to "Total Quality" in all areas of expertise, from design and development to manufacturing and installation, to long-term service. IRD's "Total Quality Commitment" focuses on the customer, striving to exceed customers' requirements. Installation supervision and service support is provided by IRD's expert technical staff anywhere in the world. IRD is known worldwide for providing user defined products and systems to meet each customer's needs.



Andrew Pratt
IRD's Engineering Support and Service Manager
7 years of service at IRD



Local IRD Representative

CORPORATE OFFICES

702 43rd Street E,
Saskatoon, SK,
CANADA S7K 3T9
Tel: (306) 653-6600
Fax: (306) 242-5599

B1- 5660 McAdam Road,
Mississauga, ON,
CANADA L4Z1T2
Tel: (416) 890-2167
Fax: (416) 890-2166

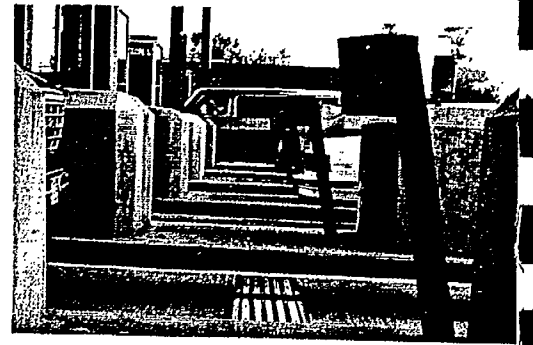
7373 East Doubletree
Ranch Road,
Scottsdale, Arizona,
USA 85258
Tel: (602) 443-4711
Fax: (602) 991-6606

#305 - 1006 West 104th Avenue
Northglenn, Colorado
USA 80234
Tel: (303) 355-5788
Fax: (303) 443-4027

IRD IS AN "EQUAL OPPORTUNITIES EMPLOYER"



Weigh-In-Motion (WIM)

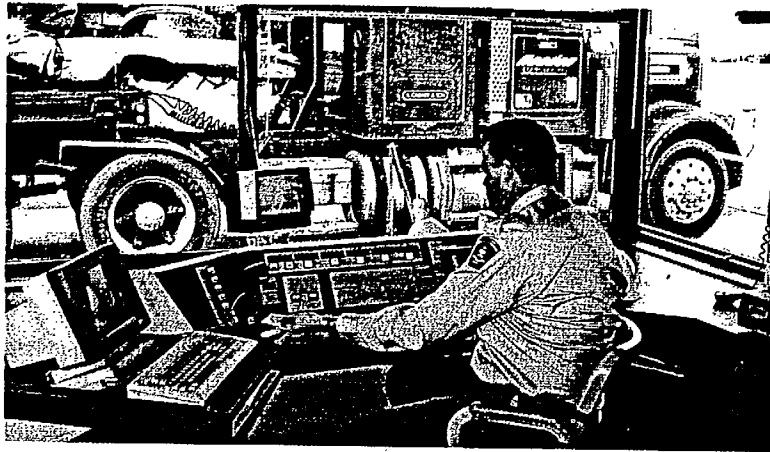


Toll Road Systems

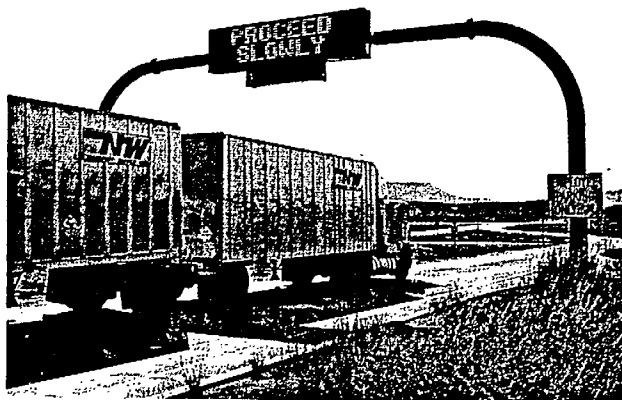
**INNOVATIVE TECHNOLOGIES AND PRODUCTS
MEET THE DEMANDS OF IVHS**



Vehicle and Axle Detection
Technology



Automated Truck Weigh Stations



Traffic Data Collection

TRANSMISSION

FAX

IBI
GROUP
BIA

230 Richmond Street West, 5th Floor, Toronto, Ontario, M5V 1V6
Tel: (416) 596-1930 Fax: (416) 596-0644

DATE: December 22, 1994 PROJECT NO: TO-9999

TO: Cliff Oldridge

FAX NO: 613-991-9469

FROM: Kevin Bebenek

SENT BY: Sharon DaCosta EXT. NO. 231

NO. OF PAGES: Face + 3

COMMENTS:

PLEASE ADVISE IF NOT RECEIVED CLEARLY OR IF ANY PAGES ARE MISSING

IBI is a group of companies practising professional consulting and is affiliated with BIA Beinhaker/Irwin Associates, Architects, Engineers, Planners



December 22, 1994

Mr. Cliff Oldridge
Industry Canada
Ottawa, Ontario
Fax: (613) 991-9469

Dear Mr. Oldridge:

Thank you for your letter dated November 4, 1994 regarding the Transportation Electronics Directory. My apologies for the delay in responding.

IBI Group is a multi-disciplinary consulting organization based in Toronto. Our transportation engineering practice incorporates specialized expertise in the area of Intelligent Transportation Systems. Attached you will find a profile of this area of the firm's activities.

Your quite correct in your understanding that IBI Group is primarily a professional services organization, yet the firm does provide products in the form of computer system solutions for ITS applications.

Thank you for the opportunity to participate in the Transportation Electronics Directory. Do not hesitate to contact me if you require any further information on IBI Group.

Sincerely,

IBI GROUP

Kevin L. Bebenek, P. Eng.
Associate

KB/sd
Encl.

IBI Group

230 Richmond Street West, 5th Floor
Toronto, Ontario
M5V 1V6

Tel: (416) 596-1930
Fax: (416) 596-0644

Contact:

Kevin Bebenek, Associate

Company Profile

IBI Group is a multi-disciplinary consulting firm providing expertise in the areas of Planning, Transportation/Systems, and Design. With a total staff in excess of 230 people, IBI Group provides services from offices throughout North America, and overseas.

The Intelligent Transportation Systems (ITS) practice of IBI Group has been active for 15 years. The principals and senior professionals in this practise bring a collective experience of over 250 years to ITS applications.

ITS Services

Full planning, design, and integration services, and turnkey solutions for all ITS functional areas, including:

- **Master Planning**
- **Design and Tender Documentation**
- **Computer System Hardware and Software**
- **Implementation, Integration and Operations**

ITS Products

- **Simulation software for ITS planning and analysis**
- **Traffic and Road Information System, PC-based Advanced Traveller Information System which accommodates a wide variety of information sources and dissemination technologies**
- **Advanced Traffic Management System Central System, incorporating features such as incident and route management, GUI, GIS, and CCTV interface**
- **Advanced Traffic Management System Local Field Controller, multi-functional with features such as local incident detection and response, and advanced ramp metering**

Company Profile

ITS Technologies Deployed

- Video Image and Side-Fire Microwave vehicle detection
- Color CCD CCTV with advanced display media
- Fibre optic and LED variable message signs
- Communication systems employing fibre optics, RF, infra-red, microwave, and spread-spectrum
- Real time information systems in VAX/VMS, UNIX, Windows NT, OS-9, QNX;
- High resolution interactive graphic user interfaces
- Voice information delivery systems
- Automatic Fare Collection
- Type III AVI Transponders

ITS Project Participation

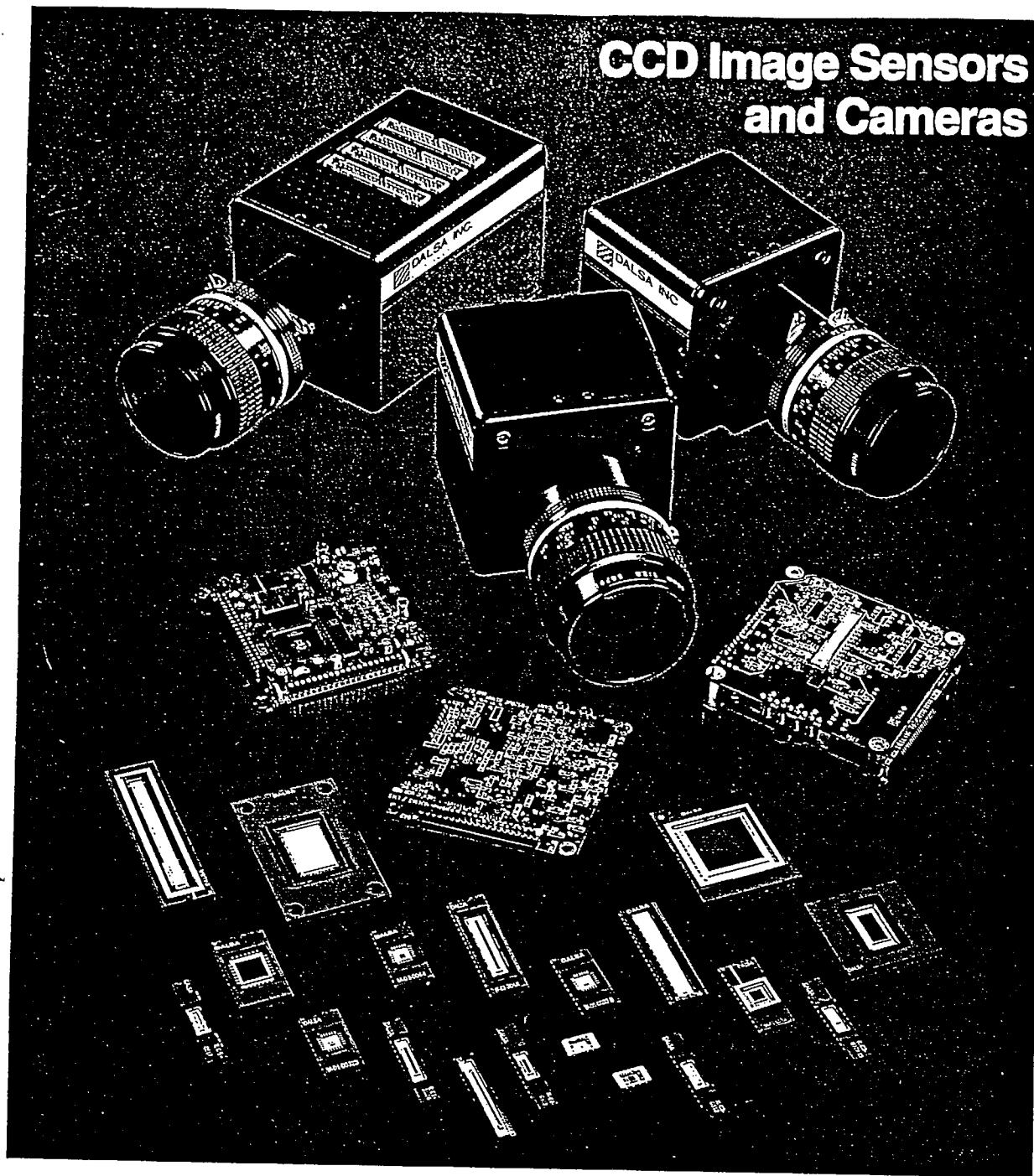
- Boston Central Artery/Tunnel Surveillance and Control System
- ADVANCE ITS Demonstration Project, Chicago
- Traffic Management Systems and Operations Study, Irvine
- I-4 Surveillance and Motorist Information System, Orlando
- Caltrans CCTV and Communications Systems, Los Angeles County
- Freeway Traffic Management System, Columbus
- Regionwide Traffic Management Systems and Operations Study, Portland
- Massachusetts Bay Transportation Authority Train Control System Implementation Review
- Triborough Bridge Emergency Motorist Information System, New York
- Caltrans INRAD (Talking Loops) Project, Los Angeles County
- Energy Efficient Traffic Signal Project, Anaheim
- ITS Corridor Study and Communications Plan, Seattle to Portland
- SMART Corridor Demonstration Project, Los Angeles
- I-5/SR55 Congestion Relief Projects, Santa Ana
- I-880/SR-17 Smart Corridor, Santa Clara County
- Gardiner-Lake Shore Corridor Traffic Management System, Toronto
- Variable Message Signs, Manchester
- CITRAC Motorway Control System, Glasgow
- Compass Freeway Traffic Management System, Toronto
- Arriyadh Smart Corridor Demonstration Project, Saudi Arabia
- Truck Control Revenue Management Demonstration System, Toronto
- National Driver Information Project, Scotland
- Airport Vehicle Monitoring and Control System, Toronto
- Transit Smartcard Fare Integration, Toronto

ITS Staff

IBI Group maintains a total ITS staff complement of over 50 professionals. This multi-disciplinary staff includes:

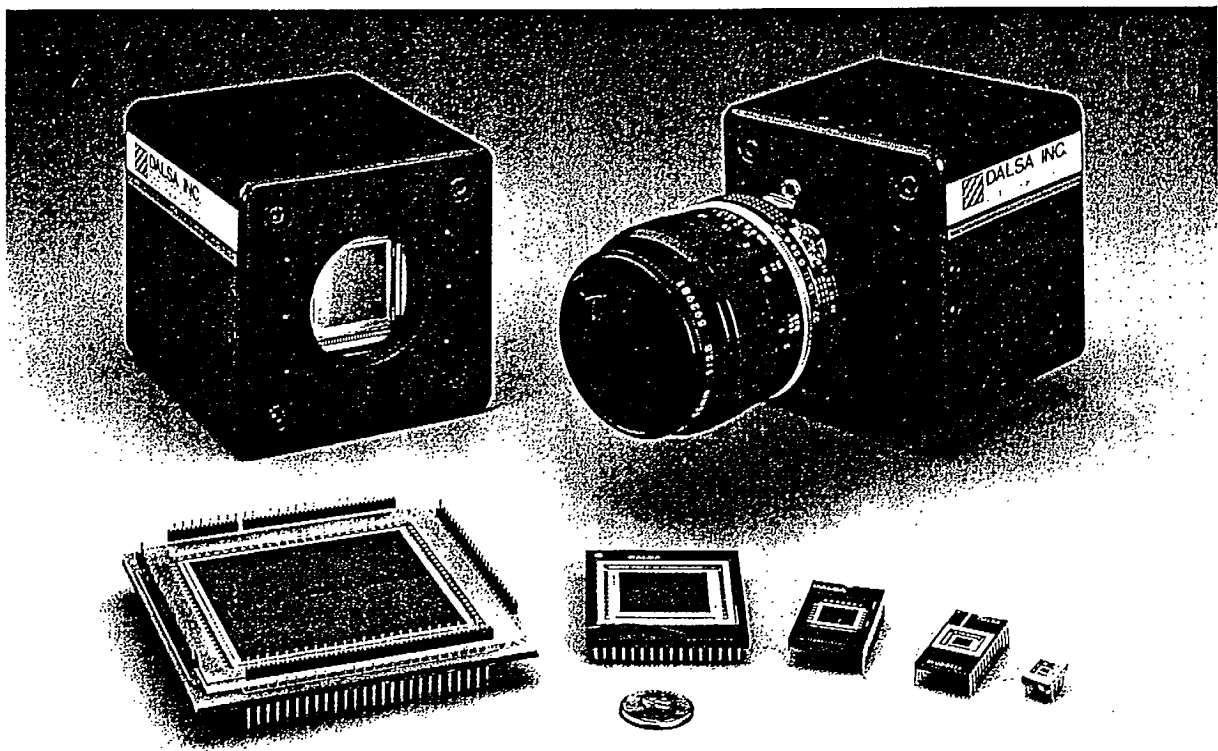
- Transportation Planners and Traffic Engineers
- Electrical/Electronics Engineers
- Communications Engineers
- Systems Engineers and Programmers

CCD Image Sensors and Cameras



DALSA INC.

CCD Image Sensors



High Speed Line Scan†

| CCD Sensor | Camera Product | Number of Photoelements | Photoelement Size | Sensor Data Rate | Camera Line Rate | Features |
|------------|----------------|------------------------------|-------------------|------------------|------------------|------------------------------|
| IL-C3 | CL-C3 | 128,256,512,1024, 1728, 2048 | 14µm x 14µm | 60 MHz | 230 kHz | High Speed, Exposure Control |
| IL-C6 | CL-C6 | 2048 | 13µm x 500µm | 20 MHz | 5 kHz | High Sensitivity, 38:1 ratio |
| IL-C7 | CL-C7 | 2048,3456,4096 | 7µm x 7µm | 60 MHz | 14 kHz | High Speed, Exposure Control |
| IL-C8 | CL-C8‡ | 6000 | 10µm x 10µm | 60 MHz | 5 kHz | High Resolution |
| IL-C9 | CL-C9 | 512 | 14µm x 42µm | 60 MHz | 57 kHz | 3:1 Ratio, Exposure Control |
| IT-C5 | CT-C5 | 2048,4096 | 10µm x 10µm | 120 MHz | 29 kHz | High Speed, Multiple Taps |
| | CL-G1 | 2098 | 14µm x 14µm | 30 MHz | 4 kHz | Tri-linear color |

Time Delay & Integration (TDI) Line Scan†

| CCD Sensor | Camera Product | Number of Photoelements | Photoelement Size | Sensor Data Rate | Camera Line Rate | Features |
|------------|----------------|-------------------------|-------------------|------------------|------------------|---------------------------|
| IL-E1 | CL-E1 | 512,1024,2048 | 13µm x 13µm | 15 MHz | 25 kHz | 80 X Sensitivity Increase |
| IL-F2 | CL-F2 | 512,1024,2048 | 13µm x 13µm | 15 MHz | 25 kHz | Bi-directional IL-E1 |
| IT-E1 | CT-E1 | 2048 | 13µm x 13µm | 120 MHz | 45 kHz | 80 X Sensitivity Increase |
| IT-F2 | CT-F2 | 2048 | 13µm x 13µm | 120 MHz | 45 kHz | Bi-directional IT-E1 |

High Frame Rate Area Scan†

| CCD Sensor | Camera Product | Number of Photoelements | Photoelement Size | Sensor Data Rate | Camera Frame Rate | Features |
|------------|----------------|------------------------------|-------------------|------------------|-------------------|----------------------|
| IA-D1 | CA-D1 | 32x32,64x64,128x128, 256x256 | 16µm x 16µm | 16 MHz | 12000 fr/sec | Frame Buffer on Chip |

High Resolution Area Scan†

| CCD Sensor | Camera Product | Number of Photoelements | Photoelement Size | Sensor Data Rate | Camera Frame Rate | Features |
|------------|----------------|--------------------------------|-------------------|------------------|-------------------|---------------------------|
| IA-D2 | CA-D2 | 512x512,1024x1024 | 10µm x 10µm | 16 MHz | 37 fr/sec | Full Frame Transfer |
| IA-D9 | CA-D9 | 1024x1024,2048x2048, 5000x5000 | 12µm x 12µm | 60 MHz | 28 fr/sec | Multiple Taps, High Speed |

† This table is a representative list of DALSA's standard products and does not include all standard products available from DALSA. DALSA also offers custom design services for designed-in products or modifications to standard products. Camera Line Rates and Frame Rates are maximum values. Values for individual sensors and cameras will vary. For more information on products and specifications please contact DALSA.

‡ These products are under development.



605 McMurray Road
Waterloo, Ontario
CANADA N2V 2E9

Phone: (519) 886-6000
Fax: (519) 886-8023

EUROPE: Phone: +49-089/54 55 82 65

JAPAN: Phone: (81)-3-3419-9190
Fax: (81)-3-3419-9239

Company Profile

Nature of Business

DALSA specializes in the manufacture, design, research and development of high performance, solid-state CCD image sensors and modular expandable cameras, which provide the highest spatial resolution at the highest data transfer speed of any known products in the industry. DALSA's CCD image sensors and cameras are used worldwide in document scanning, image capture, surveillance, process monitoring and manufacturing inspection. DALSA also develops customized products for specific customers and applications.

Major Achievements

- developed and marketed CCD MEGASENSOR™ large format sensor and camera technology, ideal for machine vision, document capture, medical and scientific imaging;
- developed, patented and marketed over 75 different models of modular expandable cameras which incorporate the TURBOSENSOR™ and QUIETSENSOR™ technology developed by DALSA;
- developed and marketed CCD TURBOSENSOR™ line scan and area scan technology. TURBOSENSOR™ technology uses an advanced CCD shift register profiled for high speed operation. TURBOSENSOR™ technology is ideal for high speed inspection and document scanning;
- developed and marketed CCD QUIETSENSOR™ Time Delay and Integration (TDI) line scan technology for high sensitivity and low noise operation under low light level conditions. QUIETSENSOR™ technology provides 80 times greater sensitivity than comparable line scan sensors. It is ideal for scanning and inspection applications requiring high spatial resolution at a high data transfer speed under low light conditions;
- developed, patented and marketed CCD DYNASENSOR™ technology with a dynamic range of more than 1,000,000:1. This device is suitable for applications requiring wide optical dynamic range such as welding vision and space applications.

Company Profile

DALSA sales volume has been increasing by 40% per annum with a present split of 80% standard product sales and 20% custom design products.

DALSA employs more than 70 full time employees at its Waterloo, Ontario plant. This consists of a high level engineering group as well as a manufacturing staff. DALSA has approximately 80 sales representatives in 40 sales offices worldwide.

Standard products have been recognized by such industry leaders as KODAK, DUPONT, QUAD GRAPHICS, IBM, NCR, NEC, PHILIPS and others. DALSA also offers custom design services for designed-in products or modifications to DALSA's standard products.

Company Background

DALSA was established in 1980 by Dr. Savvas Chamberlain in Waterloo, Canada to pursue advanced CCD design. Capitalized in 1984, DALSA now has a product line of over 100 image sensors and modular expandable cameras. DALSA designs and manufactures its products in 25,000 sq. ft. custom design facility situated in Waterloo, Ontario, Canada. The facility, entirely owned and operated by DALSA, is equipped with specialized anti-static class 100 clean rooms to assist in the design and manufacture of DALSA's state of the art technology. DALSA also leases additional space adjacent to the DALSA facility.

Current Marketing Activities

Sales and export of custom and standard products worldwide are done through an agent network. A strong emphasis is placed on demonstrations at numerous trade shows throughout the world.

Strategic Alliances

DALSA has various alliances at the present time in specialized markets. DALSA seeks strategic partners with an ambition to co-develop new technologies or enhance present day products.

06/15/93



Sensors and Cameras Selection Guide

High Speed Line Scan†

| CCD Sensor | Camera Product | Number of Photoelements | Photoelement Size | Sensor Data Rate | Camera Line Rate | Features |
|------------|----------------|-----------------------------|-------------------|------------------|------------------|------------------------------|
| IL-C3 | CL-C3 | 128,256,512,1024,1728, 2048 | 14µm x 14µm | 60 MHz | 230 kHz | High Speed, Exposure Control |
| IL-C6 | CL-C6 | 2048 | 13µm x 500µm | 20 MHz | 5 kHz | High Sensitivity, 38:1 ratio |
| IL-C7 | CL-C7 | 2048,3456,4096 | 7µm x 7µm | 60 MHz | 14 kHz | High Speed, Exposure Control |
| IL-C8 | CL-C8‡ | 6000 | 10µm x 10µm | 60 MHz | 5 kHz | High Resolution |
| IL-C9 | CL-C9 | 512 | 14µm x 42µm | 60 MHz | 57 kHz | 3:1 Ratio, Exposure Control |
| IT-C5 | CT-C5 | 2048,4096 | 10µm x 10µm | 120 MHz | 29 kHz | High Speed, Multiple Taps |
| | CL-G1 | 2098 | 14µm x 14µm | 30 MHz | 4 kHz | Tri-linear color |

Time Delay & Integration (TDI) Line Scan†

| CCD Sensor | Camera Product | Number of Photoelements | Photoelement Size | Sensor Data Rate | Camera Line Rate | Features |
|------------|----------------|-------------------------|-------------------|------------------|------------------|---------------------------|
| IL-E1 | CL-E1 | 512,1024,2048 | 13µm x 13µm | 15 MHz | 25 kHz | 80 X Sensitivity Increase |
| IL-F2 | CL-F2 | 512,1024,2048 | 13µm x 13µm | 15 MHz | 25 kHz | Bi-directional IL-E1 |
| IT-E1 | CT-E1 | 2048 | 13µm x 13µm | 120 MHz | 45 kHz | 80 X Sensitivity Increase |
| IT-F2 | CT-F2 | 2048 | 13µm x 13µm | 120 MHz | 45 kHz | Bi-directional IT-E1 |

High Frame Rate Area Scan†

| CCD Sensor | Camera Product | Number of Photoelements | Photoelement Size | Sensor Data Rate | Camera Frame Rate | Features |
|------------|----------------|-----------------------------|-------------------|------------------|-------------------|----------------------|
| IA-D1 | CA-D1 | 32x32,64x64,128x128,256x256 | 16µm x 16µm | 16 MHz | 12000 fr/sec | Frame Buffer on Chip |

High Resolution Area Scan†

| CCD Sensor | Camera Product | Number of Photoelements | Photoelement Size | Sensor Data Rate | Camera Frame Rate | Features |
|------------|----------------|-------------------------------|-------------------|------------------|-------------------|---------------------------|
| IA-D2 | CA-D2 | 512x512,1024x1024 | 10µm x 10µm | 16 MHz | 37 fr/sec | Full Frame Transfer |
| IA-D9 | CA-D9 | 1024x1024,2048x2048,5000x5000 | 12µm x 12µm | 60 MHz | 28 fr/sec | Multiple Taps, High Speed |

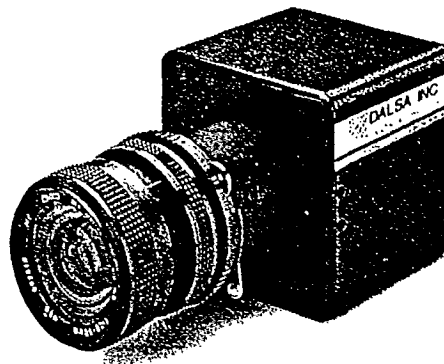
† This table is a representative list of DALSA's standard products and does not include all standard products available from DALSA. DALSA also offers custom design services for designed-in products or modifications to standard products. Camera Line Rates and Frame Rates are maximum values. Values for individual sensors and cameras will vary. For more information on products and specifications please contact DALSA.

‡ These products are under development.

CA-D1 High Frame Rate Area Scan Cameras

FEATURES

- 9,500 Frames / second (max.)
- Frame Transfer Architecture
- 32x32, 64x64, 128x128, or 256x256
PELs in a Square Matrix
- TURBOSENSOR™ Technology
- Medium Resolution Image Capture
within Standard Optics
- Output Processing Modules
- Easy Interface (DUBS™)



DESCRIPTION

DALSA's CA-D1 series cameras are high speed, medium resolution area scan cameras which use TURBOSENSOR™ technology in a frame transfer architecture. Data is provided at a 16 MHz data rate on a single output. The CA-D1 TURBOSENSOR camera is available in four different resolutions: 32 x 32, 64 x 64, 128 x 128 or 256 x 256. Pixels are 16µm by 16µm on a 16µm pitch in a square matrix. The CA-D1 camera can scan data at frame rates up to 9,500 frames per second. The smaller the array size, the faster the frame rate of the camera.

Image Sensor characteristics are the major factor affecting the performance of CCD cameras. DALSA designs and manufactures its own image sensors and this is one of the reasons for the superior performance of the CA-D1 cameras.

The CA-D1 cameras are also available with an 8 bit digital board module (S244) or a sample and hold board module (A143) which provides video with gain and offset correction that is compatible with most variable scan frame grabbers.

INTERFACES

The CA-D1 series cameras utilize DALSA's User Bus Standard (DUBS™) for easy interface to several frame grabber/image processing boards and to other systems. Refer to the INTERFACE Sec-

tion of the 1994 DALSA Databook for a chart of available interfaces.

APPLICATIONS

DALSA's CA-D1 area scan cameras are used in the applications such as:

- **Machine Vision**
The CA-D1 cameras can achieve stop actions of 100 µs without a high speed shutter or high speed strobe light. This corresponds to a frame rate of 9,500 frames per second.
- **Position Detection**
The CA-D1 cameras offer higher frame rates than RS170. This allows greater accuracy when determining position due to the enhanced stop action.
- **Instrumentation**
The CA-D1 cameras can be used to provide information about objects shape or size.
- **Motion Tracking**
The CA-D1 can be used to track the movement of an object. With the CA-D1-0064, objects moving at 300 ms across the selected aperture can be captured in stop action. The smaller the array size, the faster the frame rate of the camera.

Table 1. CA-D1 Camera Configurations

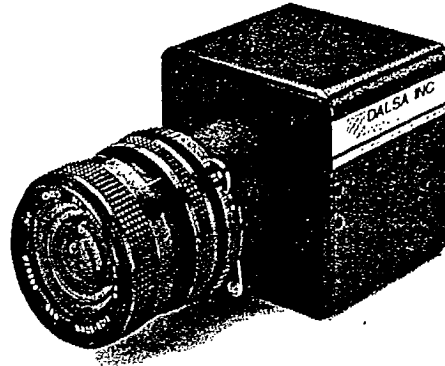
| Camera | Sensor | Number of PELs | Pitch (µm) | Aperture | Data Rate | Frame Rate |
|------------|------------|----------------|------------|------------------|-----------|----------------|
| CA-D1-0032 | IA-D1-0032 | 32x32 | 16 | 0.512 x 0.512 mm | 16 MHz | 9,500 / second |
| CA-D1-0064 | IA-D1-0064 | 64x64 | 16 | 1.024 x 1.024 mm | 16 MHz | 2,900 / second |
| CA-D1-0128 | IA-D1-0128 | 128x128 | 16 | 2.048 x 2.048 mm | 16 MHz | 840 / second |
| CA-D1-0256 | IA-D1-0256 | 256x256 | 16 | 4.096 x 4.096 mm | 16 MHz | 220 / second |



CA-D2-0512 -1024 Variable Scan Cameras

FEATURES

- 50 Frames / second (CA-D2-0512)
- Full Frame Transfer
- 512 x 512 PELs and 1024x1024 PELs in a Square Matrix
- Digital Output
- 15 MHz Free-Run Video on a Single Output
- Optional Output Processing Modules
- External Synchronization
- TURBOSENSOR™ Technology
- Easy Interface (DUBS™)



DESCRIPTION

DALSA's CA-D2 series cameras are variable frame rate, high resolution area scan cameras which use TURBOSENSOR™ (CA-D2-0512), MEGASENSOR™ (CA-D2-1024) Technology in a full frame architecture. Data is provided at a maximum 15 MHz data rate on a single output in free-run video format. The CA-D2 camera is currently available with the IA-D2-0512 TURBOSENSOR or the IA-D2-1024 MEGASENSOR™. The sensor features 512 x 512 or 1024 x 1024 active PELs with a 10µm pitch in a square matrix. The CA-D2-0512 camera can capture images at a maximum frame rate of 50 frames per second. **Note:** This frame time does allow for integration time, which will be determined by the users strobe pulse width or mechanical shutter speed.

Image Sensor characteristics are the major factor affecting the performance of CCD cameras. DALSA designs and manufactures its own image sensors and this is one of the reasons for the superior performance of the CA-D2 cameras.

The CA-D2 camera is also available with an 8 bit digital board module (S244), and a sample and hold board module (A143) which provides video with gain and offset correction that is compatible with most variable scan frame grabbers.

Note: The (A143) option is not available for the CA-D2-1024 camera.

A summary of features of the CA-D2 camera is provided in Table 1.

APPLICATIONS

DALSA's CA-D2 area scan cameras is used in applications such as:

• **Machine Vision**

The CA-D2 camera offers 100% fill factor pixels in a 1:1 aspect ratio. The square pixels and square matrix make this camera ideal for machine vision processing.

• **Medical Imaging**

The full frame architecture is ideal for medical applications requiring long integration times and high resolution. Extended integration times can be achieved by cooling the front plate of the camera.

Customer support for DALSA's sensors, boards and cameras is available from DALSA's applications engineers.

The information in this data sheet refers mainly to the CA-D2-0512 camera. For more detailed information on the CA-D2-1024 please contact DALSA.

Table 1. CA-D2 Camera Configuration

| Camera | Sensor | Number of PELs | Pitch (µm) | Aperture | Data Rate | Frame Rate |
|------------|------------|----------------|------------|------------------|-----------|--------------|
| CA-D2-0512 | IA-D2-0512 | 512 x 512 | 10 | 5.12 x 5.12 mm | 15 MHz | 50 fr / sec. |
| CA-D2-1024 | IA-D2-1024 | 1024 x 1024 | 10 | 10.24 x 10.24 mm | 15 MHz | 13 fr / sec. |



Automatic Vehicle Location Systems Ltd.

FAX / MEMO

190, 7330 Fisher St. S.E., Calgary, Alberta, Canada, T2H 2H8

Fax : (403) 253-1985

Bus. : (403) 253-6112

253-1485

To: Industry Canada
Ottawa, Ontario
Attn.: Mr. Cliff Oldridge
FAX No.: 1-613-991-9469

Date: 28 October 1994
Page: 1 of
From: Tom Lockhart *TL*
File: IVHS

Re : AVL Automatic Vehicle Location Systems Ltd.

Further to your telephone call on the 25th, please consider this fax as a brief introduction to our company. We would be pleased if you would include any of this information in the "catalog" of firms with an IVHS interest which you mentioned.

AVL Systems Ltd. is a systems integrator. We design and implement AVL systems for a variety of applications. A diagram is attached which illustrates the many options which are available. For the most part, we pursue business opportunities related to dispatch operations for small fleets.

The design and implementation steps are normally as follows;

1. Determine the user's requirements, in detail.
2. Determine what mobile radio communications system is currently being used, and assess its suitability to carry digital location, and other, data.
3. Submit a proposal or cost budget.
4. Select hardware components to meet the user's requirements. The main components are as follows, for each vehicle:
 - GPS receiver,
 - modem
 - radio
 - mobile data terminal, in some cases

In addition, the dispatch base station will require;

- base station radio and modem
 - base station PC
5. Select software. Our approach is to use PC based GIS software in conjunction with software which we write for the client's specific AVL application.
 6. System testing.

DIRECTOR DIRECTEUR
DEDIR 495
NOV 1 1994

7. Full system implementation.
8. Training.
9. Ongoing support.

Our particular interest in IVHS is that AVL can also be used for traffic management applications. AVL dispatch systems report vehicle position, speed, heading, and an identification number, at selectable intervals or on polling. This same information can be used to model traffic flows in an urban area. There is considerable scope for research in this area, and we are interested in participating in projects of this nature.

Attached please find some system diagrams taken from various proposals and reports in the past 18 months. These provide something of the flavour of what we do. Some of these are from our affiliated company Challenger Surveys & Services Ltd.

We appreciate your interest in our firm. Please call me with any questions or comments on any of this material.

DISPATCH AVL SYSTEM

Attributes:

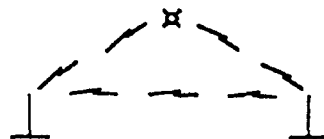
Location

Communication

Analysis

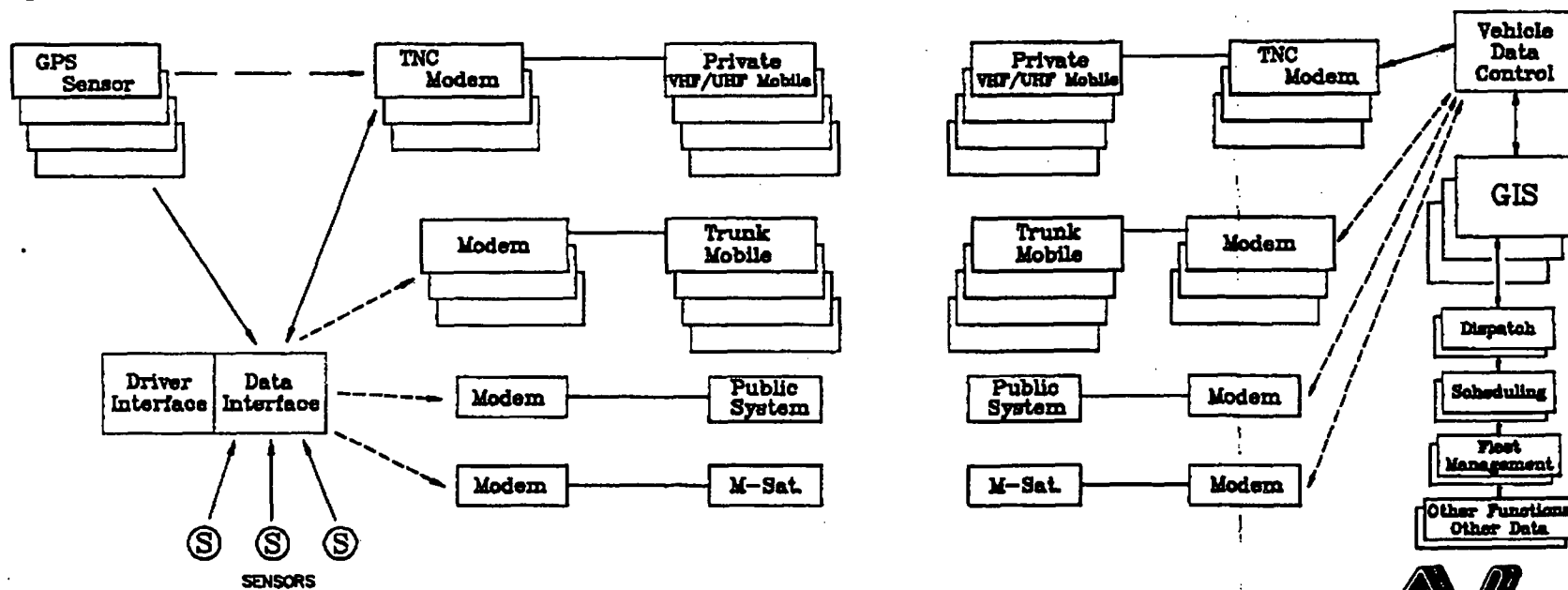
Location:

Vehicle



Base Station

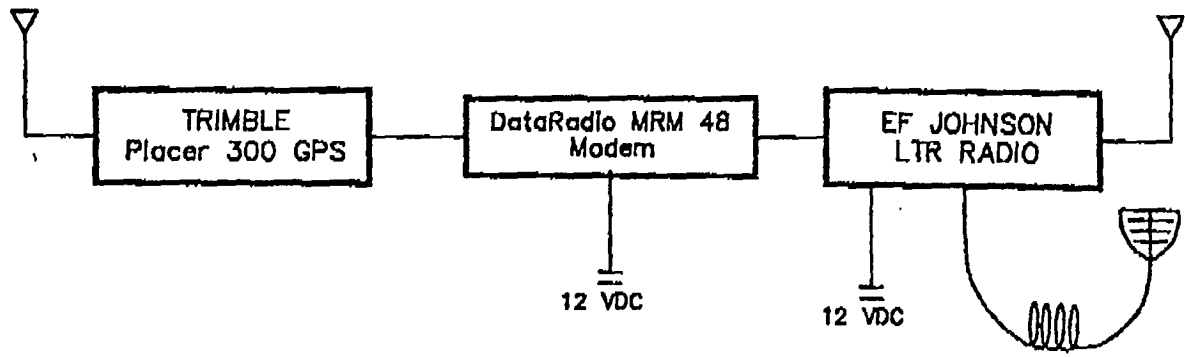
Components:



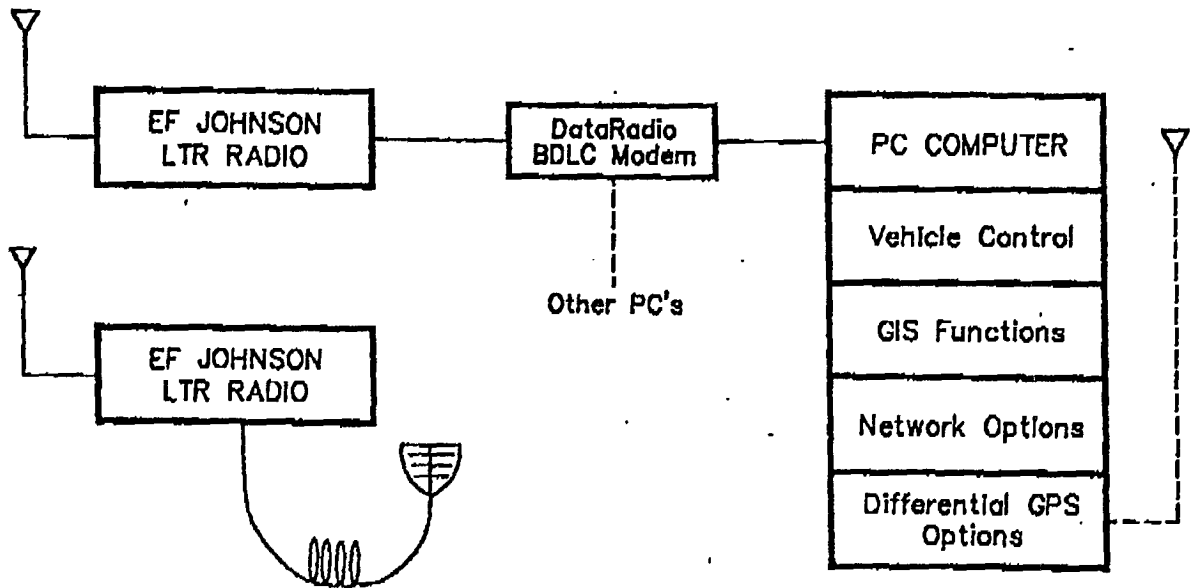
AL

AVS

RESOURCES - AVL MOBILE SYSTEM



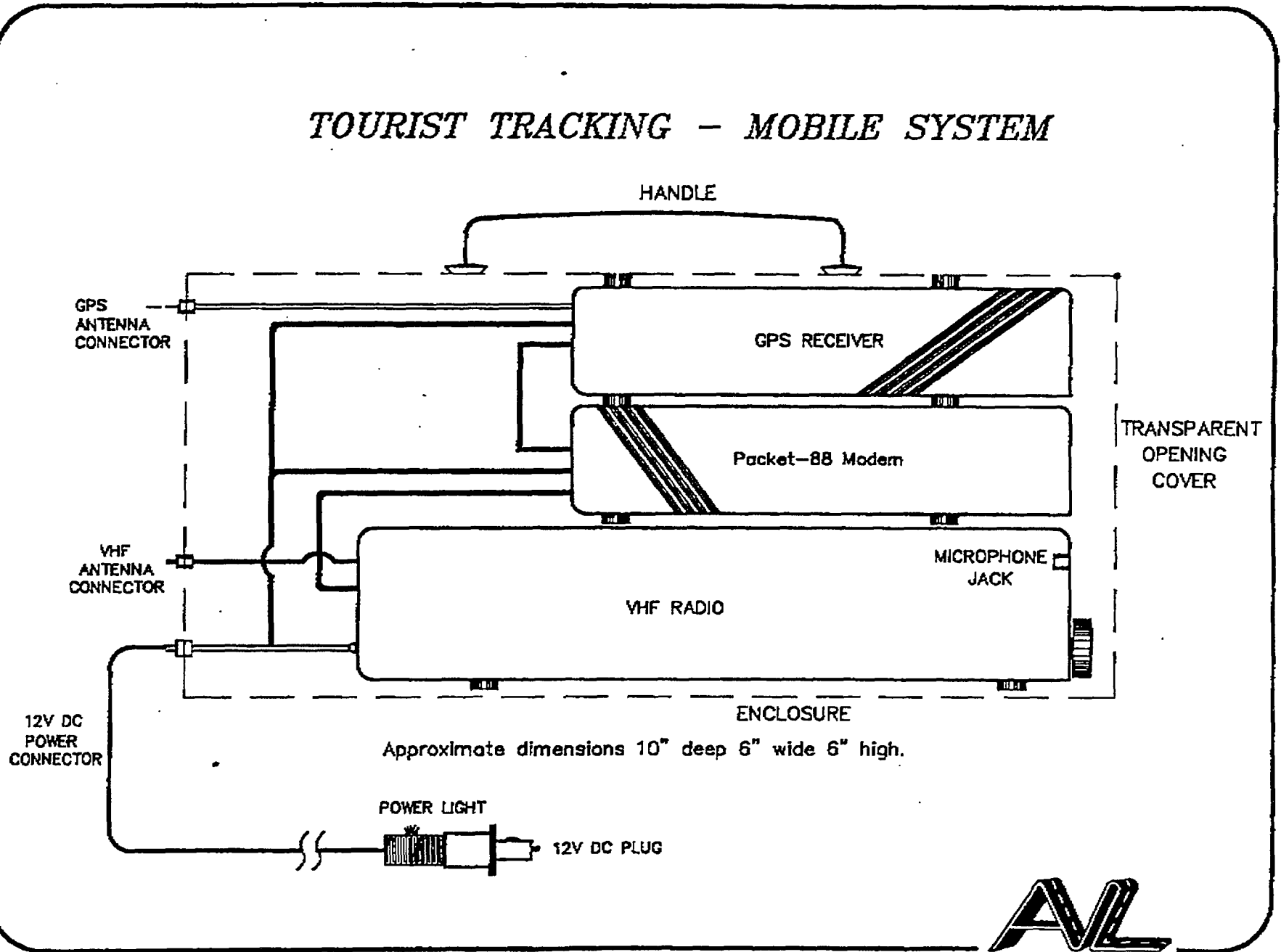
TRACKING BASE STATION



AVL-40



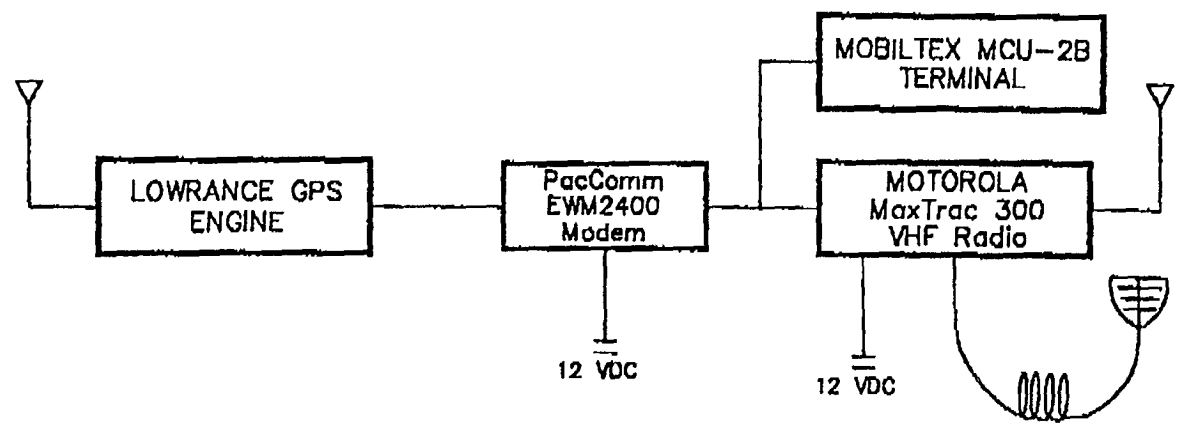
TOURIST TRACKING - MOBILE SYSTEM



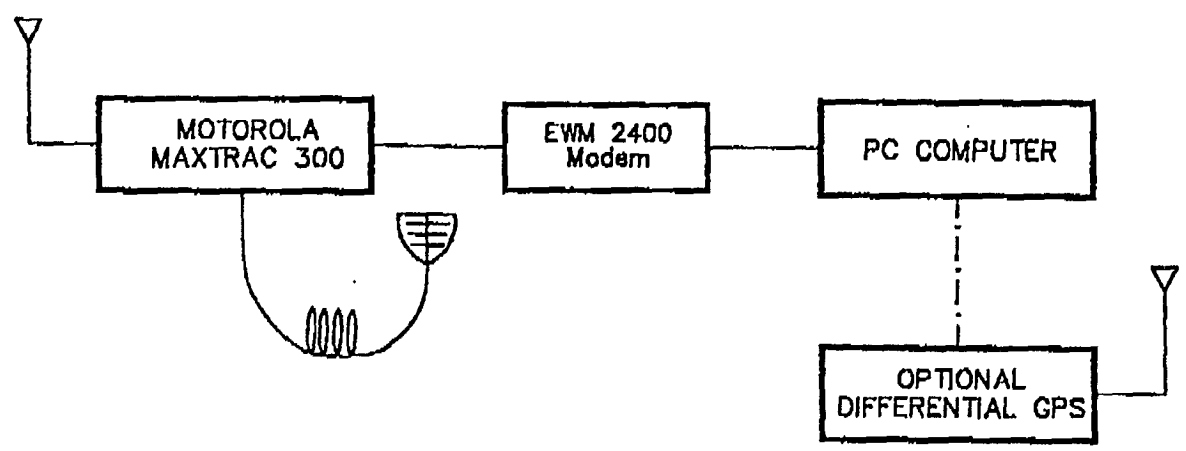
AVL-03-2



MOBILE SYSTEM



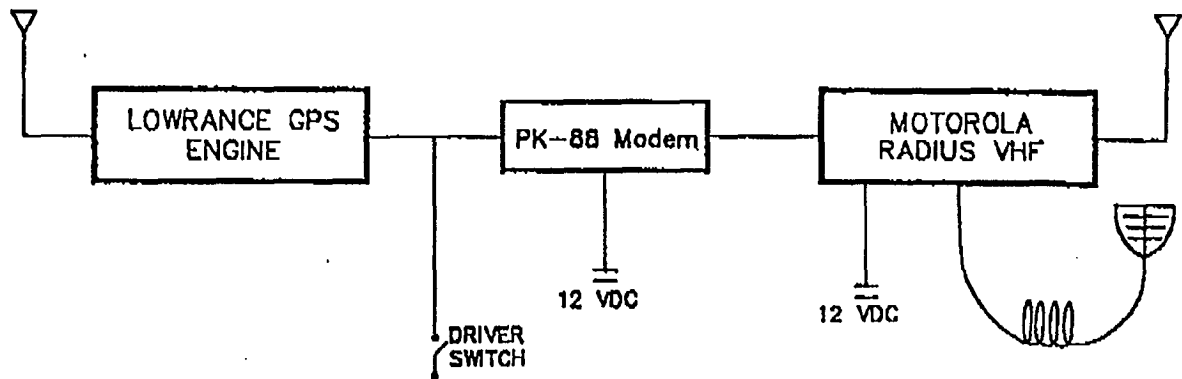
BASE STATION



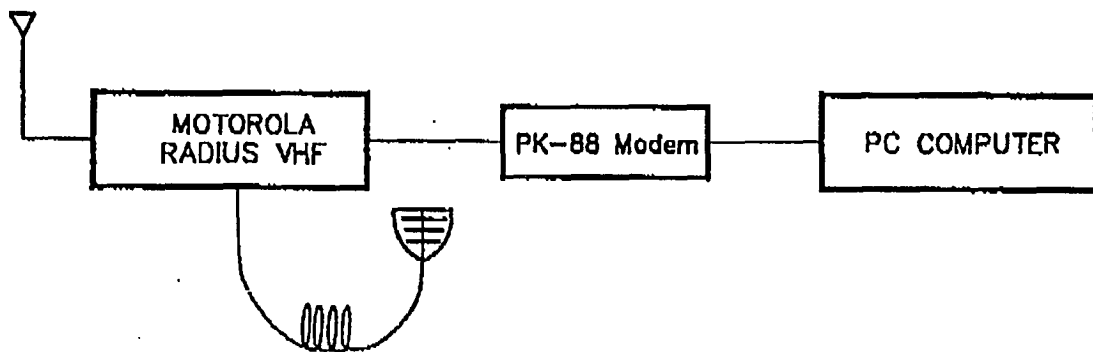
AVL-27A



TAXI TRACKING MOBILE SYSTEM



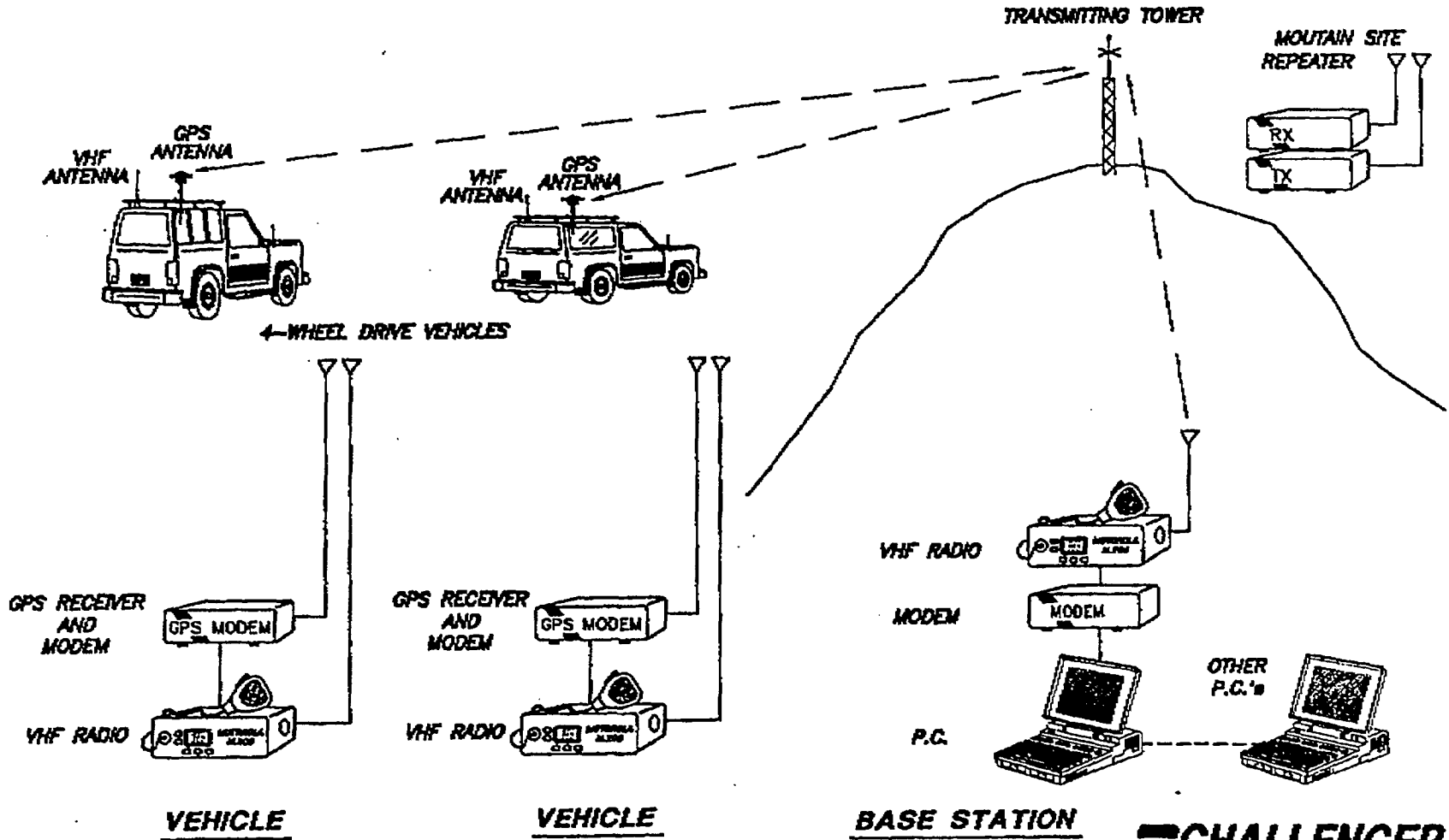
TAXI TRACKING BASE STATION



AVL-27



AVL SYSTEM DEMONSTRATION

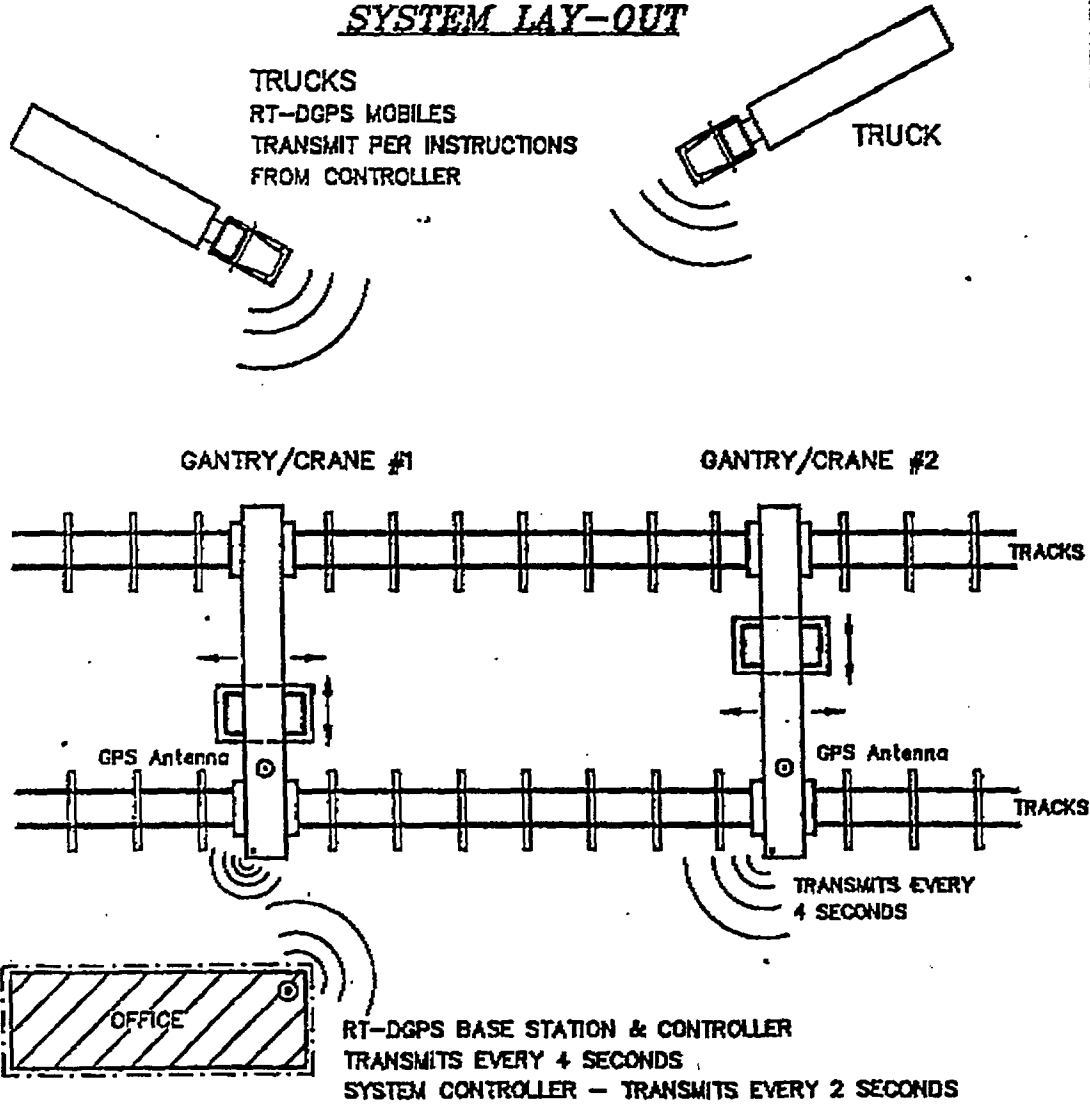


DWG. / AVL.DWG

CHALLENGER
SURVEYS & SERVICES LTD.

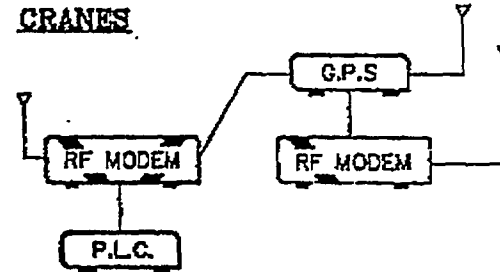
CRANE & VEHICLE POSITION MONITORING SYSTEM

SYSTEM LAY-OUT

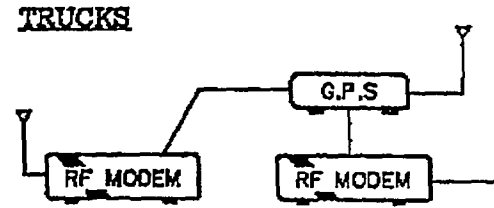


SYSTEM COMPONENTS

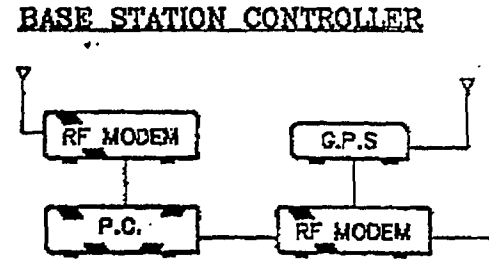
CRANES



TRUCKS



BASE STATION CONTROLLER



CHALLENGER
SURVEYS & SERVICES LTD

AV-95-9

**PULSEARCH**
NAVIGATION SYSTEMS INC.

October 25, 1994

Industry Canada
Fax #(613) 991-9469

Attention: Cliff Oldridge

Dear Mr. Oldridge:

Thank you for your call today regarding information on Pulsearch with respect to the "*Capability Directory*" being compiled by Industry Canada. I trust the following information is sufficient to include Pulsearch in the directory.

Pulsearch Navigation Systems Inc. is a geomatics engineering company specializing in assessing and developing Global Positioning System (GPS) based mobile information and navigation systems. Pulsearch was established in 1988 as a Canadian based company serving the national and international markets.

Pulsearch personnel are specialists in positioning and navigation systems, mathematical modelling, filtering technology, quality control and software development.

Pulsearch designs, develops and manufactures customized positioning and navigation systems involving the integration of GPS with:

Data Acquisition

- Seismic survey systems
- GIS attribute collection and mapping
- Communication signal strength monitoring
- Time and coordinate tagging video data collection

Dead Reckoning Devices Integration

- Digital barometry
- Odometers
- Rate gyros and compasses

Communications Technology

- Radio data systems
- Wide area DGPS satellite system
- Vehicle tracking (AVL)

BAY E, 6815 40th STREET S.E., CALGARY, ALBERTA, CANADA T2C 2W7
TELEPHONE (403) 720 0277 FACSIMILE (403) 720 0044

Map Databases

- Single line road networks
- 3D seismic survey data management

Software Development

- Client specific application software
- GPS post processing
- Real time survey and navigation
- Quality control and analysis

Pulsesearch has completed a number of projects, some of the highlights include:

- Provided 3-D seismic layout and data management in an environmentally sensitive wildlife reserve.
- Developed and implemented a WADGPS system.
- Designed and fabricated a slope monitoring system for open pit mines.
- Customized a data acquisition system for signal strength surveys for communications system coupled with video data collection.
- Integrated a navigation system for high altitude aerial photography.
- Researched and prototyped positioning and attitude systems for unmanned vehicles in military ordnance detection.
- Created a real time vehicle tracking and asset management system.
- Developed and implemented a windows based offshore buoy tracking system.
- Comprehensively tested and analyzed comparative GPS boards for major manufacturers and clients.
- Tailored training courses for client applications.
- Engineered a GPS based system for golf cart navigation.

Pulsesearch products include:

NavSEIS - Seismic Survey System

A portable real time seismic survey system using a variety of GPS receivers integrated with digital barometers, temperature probes and communications system. **Applications include:** Land Seismic Surveys, Heli-Portable Drilling, Forest Inventory Surveys, Environmental Surveys.

NavTrax - Vehicle Tracking Fleet Management System

A real time vehicle location and tracking system using GPS. **Applications include:** Public Safety Sector, Utility Companies, Trucking Industry, Energy Sector.

NavAIR - Aircraft Navigation System

A real time aircraft navigation and data acquisition survey and mapping system. **Applications include:** Aerial Photography, Crop Spraying, Environmental Assessment, Corridor Assessment, Forest Fire Burn, Mapping, Inspection Surveys.

NavARC - GPS Survey and Mapping System

A portable real time field survey and mapping system. **Applications include:** GIS Data Collection, Signal Strength Surveys, Spraying Operations, Environmental Surveys, Mapping Applications, Control Surveys.

JUPITER - GPS Post Processing Software

Differential and stand alone GPS processing with filtering and robust statistics. Uploads and downloads data from NavARC and NavSEIS. Processes Magnavox, Trimble, NovAtel, Motorola and RINEX raw data. **Applications include:** Seismic Surveying, GIS Data Collection, Data Acquisition.

R-CODE - Differential Correction Generation Software

Software for generating real time RTCM SC-104 pseudorange and range rate corrections. **Applications include:** Seismic Surveying, GIS Data Collection, Signal Strength Surveys, Spraying Operations, Environmental Surveys.

MicroSAT - GPS Navigation and Survey Software

A menu driven software program for static and kinematic GPS positioning applications. **Applications include:** GIS Surveys, Control Surveys, Environmental Surveys, Integrity Monitoring, Seismic Surveys, Data Acquisition Systems, Mapping Applications.

Key contacts for Pulsesearch are:

Mr. Paul Kowalenko - President

Mr. James McLellan - Vice President & General Manager

Office addresses are:**Head Office**

Bay E, 6815 40th Street S.E.

Calgary, Alberta T2C 2W7

Phone: (403) 720-0277

Fax: (403) 720-0044

USA Office

3000 Hayes Road

Houston, Texas, USA 77082-2699

Phone: (713) 584-0458

Fax: (713) 584-9090

If you require any further information or clarification please do not hesitate to contact me at anytime.

Thank you.

Yours truly,

PULSESEARCH NAVIGATION SYSTEMS INC.

Per: *CO'Dell*

Corinne O'Dell

Administration

/cod



FAX COVER SHEET

SEL Division
Alcatel Canada Inc.
1235 Ormont Drive
Weston, Ontario M9L 2W6
Tel.: (416) 742-3900
Fax: (416) 742-1136

Please deliver the following 4 pages (including this cover sheet) to:

NAME: R. SAXENA

CC: INDUSTRY CANADA (OTTAWA)

COMPANY: _____

FAX NUMBER: (613) 954-4246

FROM: MARK HALINATY

DATE: SEPTEMBER 21, 1994

SUBJECT: ALCATEL PROFILE - SEL DIVISION

IF YOU EXPERIENCE ANY PROBLEM WITH THIS TRANSMISSION, PLEASE CONTACT US AT (416) 742-3900.

As per your conversation with Mark Halinaty, please find attached Alcatel's Company Profile sent to you as per your request.

If copies are not clear, please advise and we will send you the original.

JoAnne Sandelands
(for M. Halinaty)



PROFILE

SEL Division

BACKGROUND:

SEL Division was established in 1974 initially as SEL Canada, an operating unit of ITT Industries of Canada Ltd. With the creation of the Alcatel n.v. joint venture in January 1987, SEL Canada became SEL Division of Alcatel Canada Inc., incorporated under the laws of Canada, and a wholly owned subsidiary of Alcatel n.v.

The Alcatel n.v. joint venture brought about the merging of the worldwide communications/computer operations, activities and capabilities of Compagnie Generale d'Electricite (CGE) of France (now Alcatel-Alsthom) and the ITT Corporation of the United States of America.

By virtue of our unique North American/European heritage, SEL Division is strategically oriented to meet the needs of the signalling and train control industry.

SEL Division's business mission is to develop, manufacture, install and maintain high technology railway signalling systems as well as individual products for transit and mainline railroad applications.

With the support of the massive technological and financial resources of our \$20 billion (1990) parent company, SEL Division is dedicated to innovation and high quality products. This commitment, to professional and product excellence, is paying off in sales and in worldwide recognition of our industrial leadership.

Research, development and manufacturing is located at SEL Division's head office in Don

Mills, in Metropolitan Toronto – the work centre for most of our highly skilled employees. SEL Division also maintains a West Coast sales/design and product centre in Burnaby, British Columbia, to serve the west coast of North America. Our office in London, England, is responsible for European projects such as the Docklands Light Railway re-signalling project.

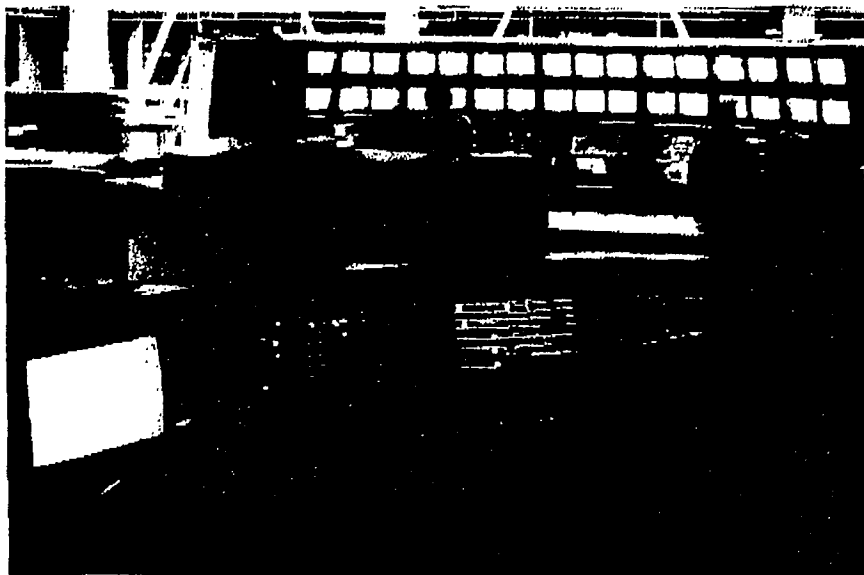
Over the years SEL Division has introduced a number of innovative computer-based railway signalling components and systems. The initial focus on urban transit applications has been broadened to include train control systems for mainline railways, people movers, monorails and other forms of automated, guided transport.

SEL Division's reputation is founded on such innovative products as the SELTRAC Train Control System, a breakthrough in train control technology that has forever altered the business of making trains run safely and on time.

The solid record of performance compiled by three sophisticated SELTRAC Train Control System applications in Vancouver, Detroit and Toronto – through all types of weather – have conclusively demonstrated the SELTRAC system's practicality, versatility and reliability in the demanding real-world environment of big city public transit.

In Vancouver, throughout EXPO 86, the safety and versatility of SELTRAC Train Control System impressed transit industry leaders from around the world. The computerized train control system deftly slotted nonstop trains, shuttling visitors between EXPO sites, in between the regular mainline trains on the same tracks.

Ridership on the Vancouver Sky Train, B.C. Transit's showcase system, has since reached 120,000 a day, thus demonstrating the high performance standards of a fully automatic transit system.

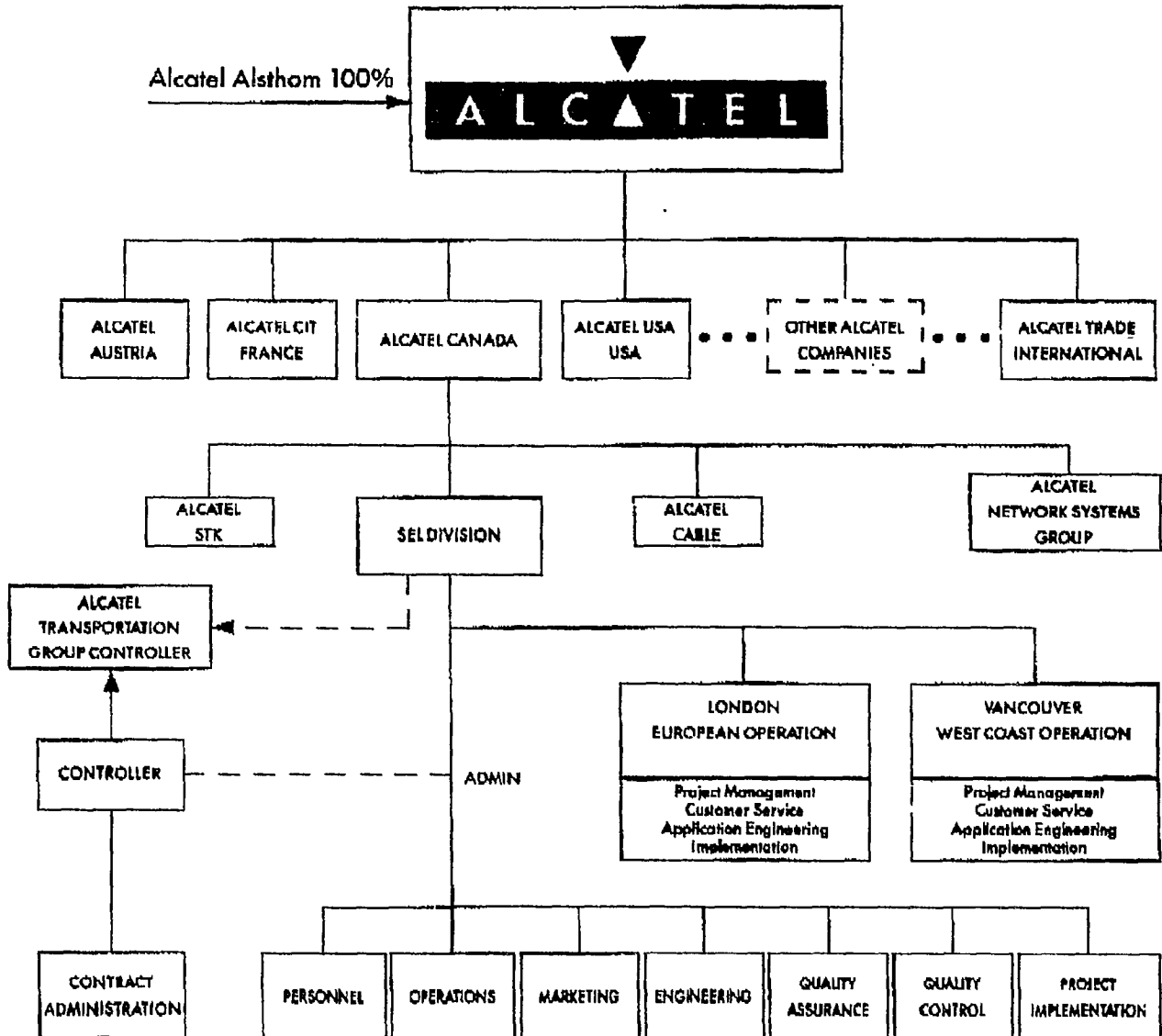


With a success-proven base of technological advancements conceived during the development of the SELTRAC Train Control System, SEL Division has expanded into additional product areas. Today, SEL Division continues to advance the state-of-the-art in signalling and train control with systems such as Advanced Train Control (ATCS), a distributed, discontinuous signal-

ling technology for mainline railroads; inductive Data Transmission Systems (IDTS) for train describer applications and train information management; Low Density Control Systems (LDCS), a cost-effective automated train control for people mover and LRT applications; and a family of Integrated Signalling and Information Systems (ISIS), designed to eliminate railway pole/

code line systems, upgrade relay-based interlockings to computer based interlockings and integrate CTC systems into broader dispatching and operating information systems.

SEL Division works jointly with its customers to provide optimized solutions for rail operating problems.





Head Office Toronto:
Vancouver:
United Kingdom:

1235 Ormont Drive, Weston, Ontario M9L 2W6 Tel.: (416) 742-3900 Fax: (416) 742-1136
5172 Kingway, Suite 270, Burnaby, B.C. V5H 2E8 Tel.: (604) 434-2455 Fax: (604) 434-7699
Unit A), Lanterns Court, Millharbour, Isle of Dogs, London E14 9TU Tel.: (071) 538-1020 Fax: (071) 538-0180

CENTRODYNE INC.
ST. LAURENT (MONTREAL), QUEBEC

Electronic trip recorders

Fuel Tax Logger

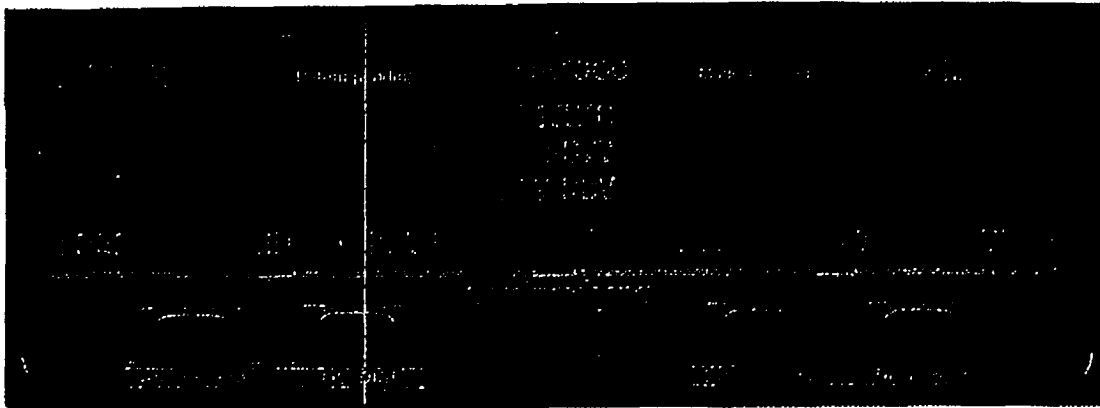
Serial Data Link Pulse Converter (speed/r.p.m./fuel

Network of 100 distributors to some 30 countries worldwide

presenting...

the **"SILENT 1000"**®

**ELECTRONIC TRIP RECORDER
WITH INTEGRAL ELECTRONIC LOG BOOK**



(ACTUAL SIZE)

AND LINEAR TACHOGRAPH CAPABILITY

THE SYSTEM — In addition to its primary function of recording and displaying trip data, the "Silent 1000" also features an integral electronic log book and linear "tachograph" capability, enabling both visual displays of "hours of service" as well as the generation of hard copy logs and linear tachograph reports. Data acquired by the Vehicle Mounted Unit (VMU) may be transferred directly by Data Link, or via a portable Data Transfer Unit (DTU), to an off-line computer. Centrodyne's TRIP/CONVERT software enables the operator to summarize and analyse trip data on-screen and produce hard copy. The VMU may be configured with or without displays and push buttons, allowing for both active and passive system installations.

THE BENEFITS — Aside from the obvious benefits of electronic over mechanical systems, such as accuracy, reliability, ease of maintenance, light weight, etc., the "Silent 1000" provides digital displays and alarms when pre-set company limits of speed and rpm are exceeded, as well as protected areas of memory for recording event data and driver input. The integral log book feature meets all U.S. and Canadian DOT hours of service requirements. In addition to encouraging safe driving, the potential cost savings in fuel, maintenance, and vehicle/driver utilization made feasible by the "Silent 1000" ensure a rapid pay-back of the initial investment.

IN CANADA & ELSEWHERE:

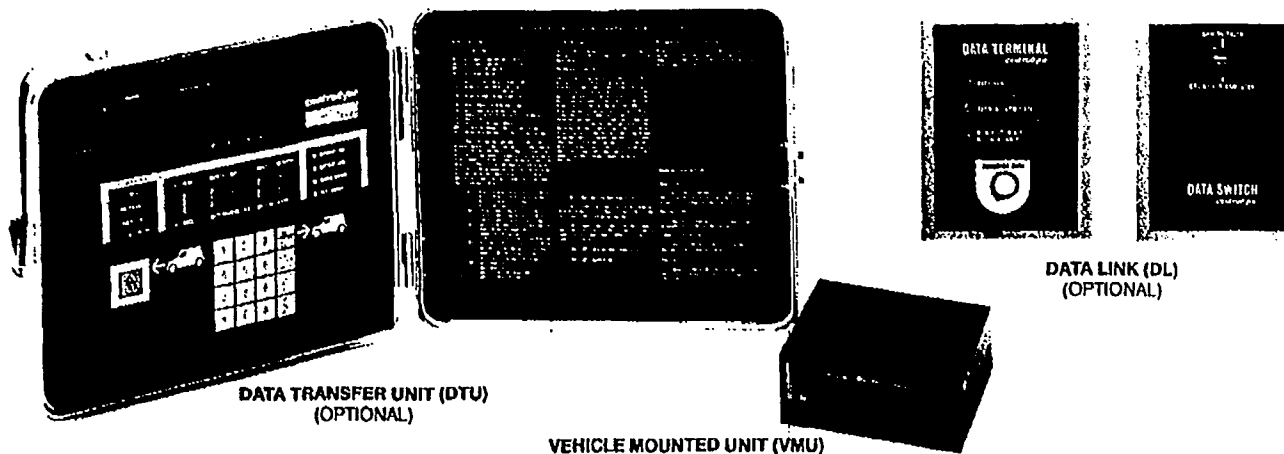
Centrodyne Inc.

3485 THIMENS BLVD., ST. LAURENT
MONTREAL, QUE., CANADA H4R 1V5
TEL.: (514) 331-8760
FAX: (514) 339-1078

IN THE U.S.A.:

Centrodyne Corp. of America

276 EAST ALLEN STREET
WINDOOSKI, VT 05404
TEL.: (802) 655-4582
FAX: (802) 655-4588

DATA TRANSFER UNIT (DTU)
(OPTIONAL)

VEHICLE MOUNTED UNIT (VMU)

DATA LINK (DL)
(OPTIONAL)

"SILENT 1000" — SYSTEM COMPONENTS (EXCLUDING OFF-LINE COMPUTER)

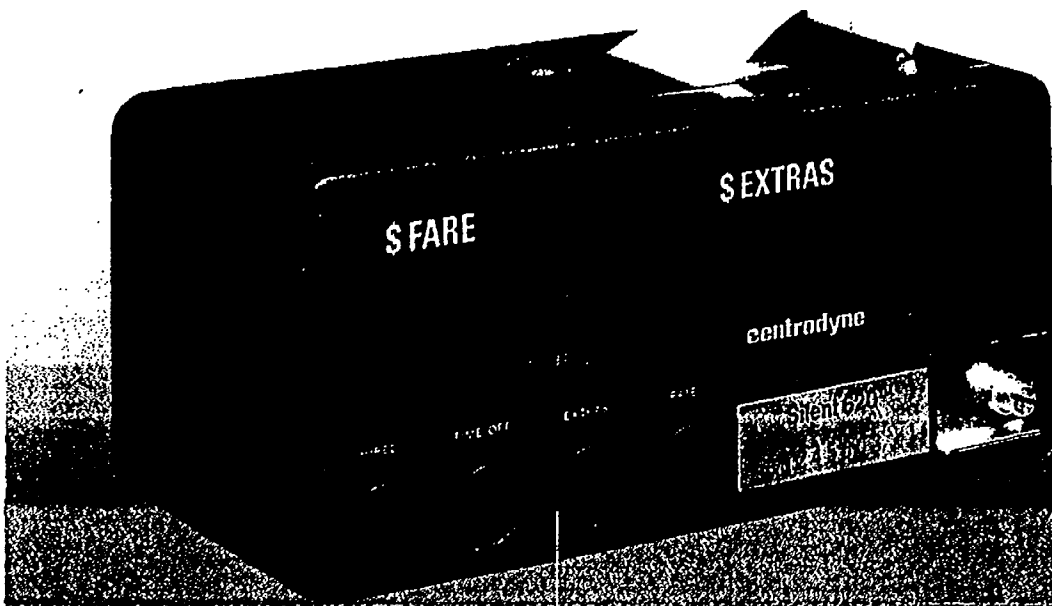
| ALARMS — | THRESHOLD — | TYPE — |
|----------------------------------|---|-------------------------|
| — Engine Overspeed | — Programmable-Customer Supplied Figure | — Flashing Light/Buzzer |
| — Vehicle Overspeed | — Programmable-Customer Supplied Figure | — Flashing Light/Buzzer |
| — Miscellaneous | — Open Door, Etc. 12 Volt Relay input | — Customer Supplied (2) |
| TRANSDUCERS | RANGE | — RESOLUTION |
| — SPEED | 0 — 119 mph (191 kph) | — 1 mph/kph |
| — RPM | 0 — 9,999 rpm | — 5 rpm |
| — FUEL | 0 — 40 mpg (L/100 km) | — 0.1 mpg (L/100 km) |
| RPM AND SPEEDOMETER CALIBRATION: | 1-281 pulses per engine revolution 1,200 — 614,400 pulses/mile (km) COMPATIBLE WITH ELECTRONIC SENSORS. | |
| VMU DIMENSIONS: W x H x L | 6.125" (15.56 cm) x 2.25" (5.71 cm) x 5.875" (14.92 cm) | |
| WEIGHT: | 2.2 lbs (1.0 Kg) | |
| DISPLAYS: | 8 seven-segment LED's — digit size 0.56" (14 mm) | |
| SEALS: | 2 unit seals and 1 mounting seal—either locking screw or 9 mm lead seals. | |
| MOUNTING: | In/On/Against dash | |
| TEMPERATURE: | Operating -30°C to 70°C (-22°F to 158°F) Non-operating -40°C to 85°C (-40°F to 185°F) | |
| POWER: | 9 — 16 V DC (Nominal) 20 V DC max. (short term) — 0.5 AMP Nominal - Internal standby battery. | |

IN CANADA & ELSEWHERE:

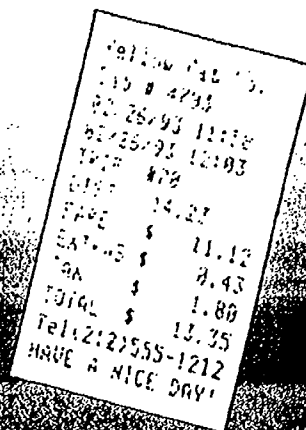
Centrodyne Inc.
3485 THIMENS BLVD., ST. LAURENT
MONTREAL, QUE., CANADA H4R 1V5
TEL: (514) 331-8760
FAX: (514) 339-1078

IN THE U.S.A.:

Centrodyne Corp. of America
276 EAST ALLEN STREET
WINOOSKI, VT 05404
TEL: (802) 655-4582
FAX: (802) 655-4588



"SILENT 620"



centrodyne

In business since 1968 designing and building taximeters known around the world as the most versatile, reliable, fully featured meters available.

| Specifications | SILENT 610 | SILENT 620 |
|----------------|--|--|
| Dimensions: | 6.22" x 2.86" x 1.44" 158 x 71.55 x 36.5mm | 6.22" x 3.01" x 2.82" 158 x 76.5 x 71.55mm |
| Weight: | 0.90 Lbs. (410 gr.) | 1.49 Lbs. (675 gr.) |
| Mounting: | On/Against dash | On/Against dash |
| Temperature: | Operating: -30°C to +70°C Non operating: -40°C to +85°C | Operating: -30°C to +70°C Non operating: -40°C to +85°C |
| Power: | 8 - 16 VDC (Nominal) 20 VDC max. (Short term) | 8 - 16 VDC (Nominal) 20 VDC max. (Short term) |

To find out more about our

"SILENT 600"

ELECTRONIC TAXIMETER SERIES

contact your local distributor,

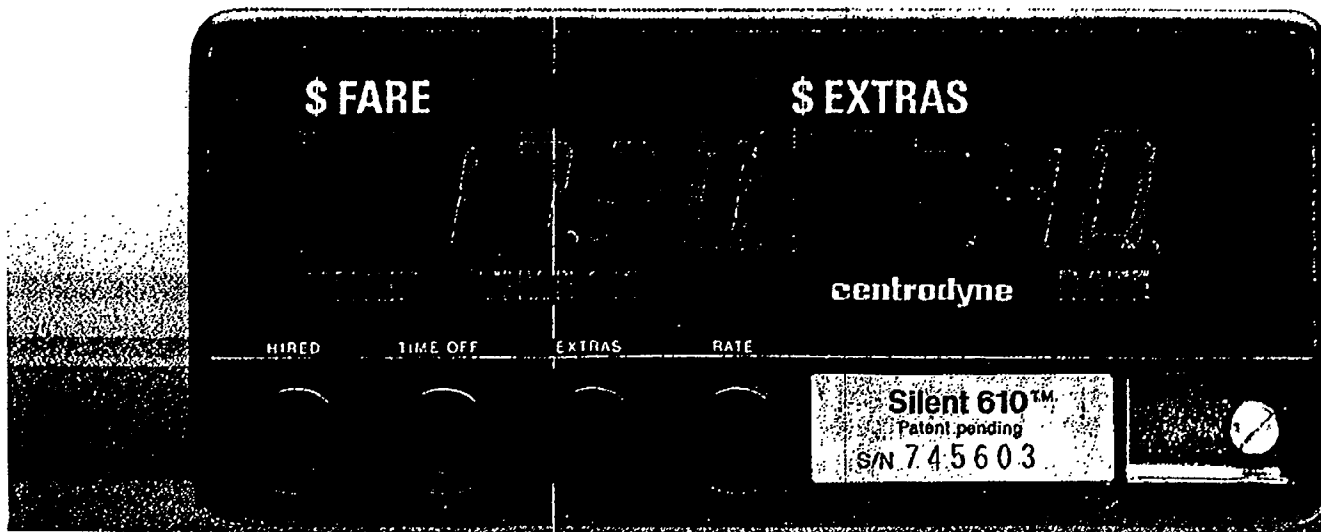
or call / write:

In the U.S.A.:
CENTRODYNE CORP.
 OF AMERICA
 276 East Allen Street
 Winooski, Vermont 05404
 TEL: (802) 655-4582
 FAX: (802) 655-4588

In Canada & Elsewhere:
CENTRODYNE INC.
 3485 Thimens Blvd., St. Laurent
 Montreal, Que., Canada H4R 1V5
 TEL: (514) 331-8760
 FAX: (514) 339-1078

Printed in Canada

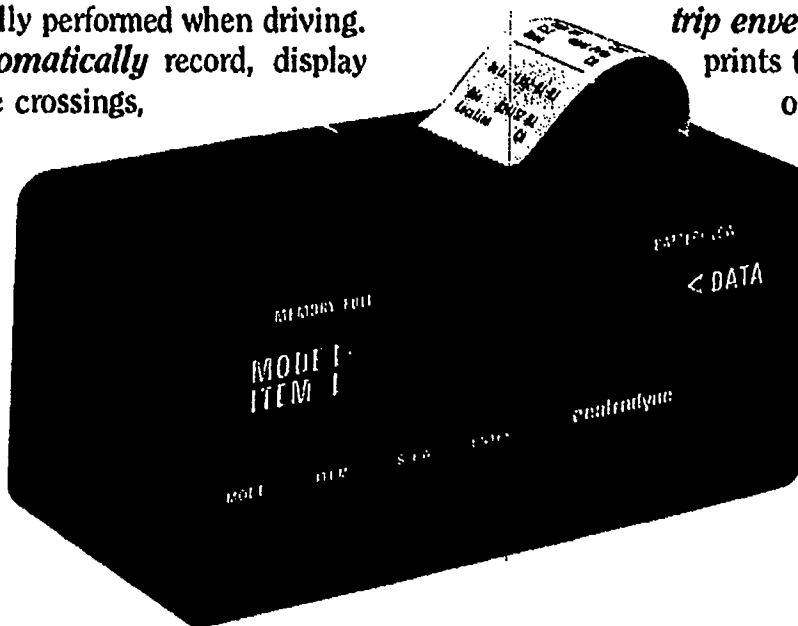
THE "SILENT 610" ELECTRONIC TAXIMETER



centrodyne

THE "SILENT 710" FUEL TAX LOGGER (FTL)

CONCEPT!!! The Fuel Tax Logger (FTL) has been designed to eliminate the manual recording of state line crossings, odometer readings, etc., usually performed when driving. The FTL will *automatically* record, display and print, state line crossings, beginning and ending odometer readings, highway numbers, and more.



PAPERWORK!!! If you want more quality time, let the FTL perform your time consuming tedious paperwork. In a typical *trip envelope format*, the FTL prints the states travelled in, odometer readings, toll roads, along with your fuel purchase information (price, gallons, invoice #, etc.)



FTL displays current state and odometer. Only surrounding states are displayed for selection.



FTL displays present highway number. Simple button combination selects next highway number.



FTL View Data mode allows a review of all recorded state lines crossing, odometer readings, fuel purchases, etc.

FUEL TAX LOGGER SAMPLE PRINT OUT

| | | |
|--------|------------|-----------------------------------|
| Start: | | |
| 10:41 | 1993-06-02 | Time and Date of trip start. |
| Odom | 101220 MI | Vehicle odometer at trip start. |
| DRV ID | J1440 | Driver identification number. |
| VEH ID | F2402Z | Vehicle identification number. |
| Cal | 4000 P/MI | FTL distance calibration. |
| Home | VT | Home state. |
| Date | 1993-06-02 | Date and time of first entry |
| Odom | 101220 MI | Odometer (first entry) |
| Loc | MA | State line crossing (first entry) |
| Road | I 90 | Highway number (first entry) |
| Odom | 101295 MI | Odometer reading (next entry) |
| Loc | CT | State line crossing |
| Odom | 101376 MI | Odometer reading (next entry) |
| Fuel | 50 G | Gallons of fuel purchased |
| Fuel | \$58.50 | Price of fuel |
| Inv # | IR437205 | Fuel purchase invoice |

| Specifications | SILENT 710 |
|----------------|--|
| Dimensions: | 6.22" x 3.01" x 2.82" • 158 x 76.5 x 71.55 mm |
| Weight: | 1.49 Lbs. (675 gr.) |
| Mounting: | On/Against dash |
| Temperature: | Operating: -30°C to +70°C Non operating: -40°C to +85°C |
| Power: | 9 - 16 VDC (Nominal) 20 VDC max. (Short term) |
| Display: | Two lines by 20 characters LCD |

One year parts and labor warranty

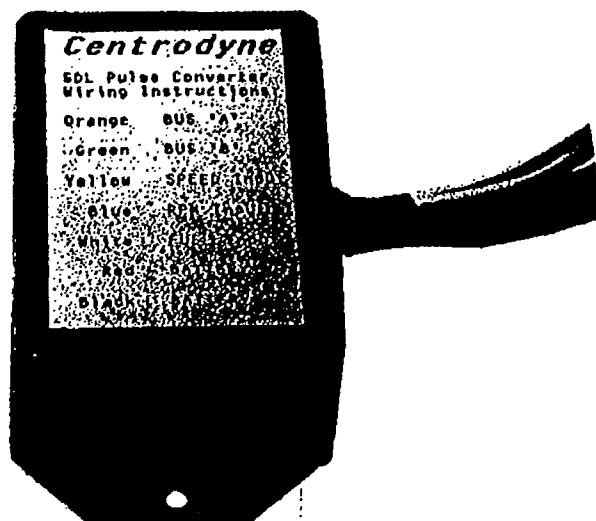
To find out more about our
"SILENT 710"
FUEL TAX LOGGER (FTL)
contact your local distributor, or call/write:

In the U.S.A.:
CENTRODYNE CORP.
OF AMERICA
276 East Allen Street
Winooski, Vermont 05404
Tel.: (802) 655-4582
Fax: (802) 655-4588

In Canada & Elsewhere:
CENTRODYNE INC.
3485 Thimens Blvd., St. Laurent
Montreal, Que., Canada H4R 1V5
Tel.: (514) 331-8760
Fax: (514) 339-1078

CENTRODYNE INC.

3485 Thimens Blvd., Montreal, QC H4R 1V5 * (514) 331-8760 * Fax: (514) 339-1078



Z032 SERIAL DATA LINK PULSE CONVERTER (SDL)

Centrodyne's Serial Data Link Pulse Converter takes advantage of the increasing number of electronic engines available, to provide a single source for vehicle instrumentation pulse requirements. The SDL Pulse Converter provides pulse outputs of speed, rpm, and fuel, without the need of additional sensors, and yields significant savings where real time fuel inputs are desired, by eliminating the cost of expensive mechanical fuel flow sensors.

The SDL is compatible with the SAE J1708 and J1587 standards and interfaces directly with the engine/vehicle serial data link, to provide suitable pulse outputs for trip recorders, tachographs, speedometers, tachometers, etc.

When connected to the vehicle/engine serial data link (refer to installation and wiring diagram overleaf), the SDL Pulse Converter, approximately 4" x 3" x 1.5", supplies the following standard outputs:

SPEED = 4000 pulses/mile (2485 pulses/kilometer)

RPM = 3 pulses/revolution

FUEL = 2801 pulses/gallon (740 pulses/liter)

CENTRODYNE CORP. OF AMERICA

276 East Allen Street, Winooski, VT 05404 * (802) 655-4582 * Fax: (802) 655-4588

THE COMPANY

Centrodyne, incorporated in July 1968, is North America's leading manufacturer of electronic taximeters with its' principal products, the "Silent 600"* Series of Electronic Taximeters, which supersedes the "Silent 500"* Series, and the "Silent 1000"* Series of Electronic Trip Recorders, all of which have been sold in over 30 countries worldwide.

R & D CAPABILITY

The company has seven full time employees devoted to R & D. All circuit, software, and basic mechanical design work is carried out in-house. Some mechanical and industrial design prototyping is sourced externally.

The company's primary area of expertise lies in the design and manufacture of digital electronic products for automotive applications. The company's corporate strategy is to select specialized market segments in which they can secure a dominant position through the introduction of cost-effective, high-technology products. To achieve this objective, Centrodyne has consistently re-invested a very large percentage of its operating funds into R & D, as well as receiving some assistance from government research and development grants.

WORLD MARKETING

The company's products are marketed via a network of over 100 distributors in North America and through agents in over 30 countries worldwide.

In 1974 the company established Centrodyne Corporation of America, a 100% owned subsidiary. All U.S. customers and distributors are supplied through the U.S. subsidiary in Burlington, Vermont.

All Canadian and Export markets are served through the Canadian Head Office via locally established distributors. Our export marketing activities involve identifying specific market requirements and locating and establishing distribution. Historically, upwards of 75% of the company's production is destined for export markets.

*Registered Trade Marks

THE PRODUCTS

The "Silent 1000" Electronic Trip Recorder

The "Silent 1000" has been designed as a universal "black box" vehicle monitoring device which can be user configured, by varying programmable parameters, to meet differing customer needs in any type of vehicle from passenger cars to class 8 tractors.

The primary function of the "Silent 1000" Vehicle Mounted Unit (VMU) is to record and display up to 200 operating hours of trip data, which can then be transferred to an offline computer where Centrodyne's TRIP/CONVERT Software enables the operator to summarize and analyze trip data on-screen and/or produce hard copy reports.

Subsidiary functions of the VMU are to provide: digital displays and alarms of speed and rpm when pre-set company limits are exceeded, displays of fuel consumption, time of day, trip statistics and log book data. The unit maintains protected areas of memory for recording event data and driver input. The "Silent 1000" features an Integral Electronic Log Book and Linear "Tachograph" capability, enabling both visual display of "hours of service" as well as the generation of hard copy logs and linear tachograph reports.

Alternatively, the VMU may be hardware configured without displays and driver input capability, allowing for a passive system installation.

The Overall system comprises the "Silent 1000" VMU, a portable Data Transfer Unit (DTU) or "fixed" Data Link for downloading data from the VMU to the offline PC, and an offline computer loaded with Centrodyne's TRIP/CONVERT software.

THE PRODUCTS (Continued)

The "Silent 600"* Series Electronic Taximeter

The "Silent 600" Series of Electronic Taximeters, have been designed to meet all of the requirements of tariff and vehicle calibration data as set out by the U.S. National Institute of Standards and Technology, in addition to those of numerous other countries.

The "Silent 610"* taximeter consists of a fully programmable/configurable "basic" taximeter which can easily upgrade to "Printing" ("Silent 620"*) and/or "Credit Card" ("Silent 630"*) versions via the addition of hardware and software options.

Some of the system selectable features include Self Programmable Fare Structure, Automatic Calibration, Rate Lock-out when Hired, Programmable Tax Rate, Fare and Tax Totals display, Fare Inhibit above Speed Threshold, Four (4) Rate capacity, Auto Rate Change based on fare, distance, and time of day, Additional Relay Drivers, Programmable Display Time-out, 7 Digit Statistics Display, Battery Back-up for Statistics, Password Protection, Lead & Wire Seal, in addition to others.

COMPANY CONTACT: Mr. Carlos Parente
Marketing Director

Centrodyne Inc.
3485 Thimens Blvd.
Montreal, Quebec, Canada
H4R 1V5

Tel: (514) 331-8760
Fax: (514) 339-1078

CANADIAN MARCONI COMPANY
Aerospace, Communications & Surface Transportation
Electronics Groups

New Products:

- High-end, certifiable, 12 channel airborne GPS navigation sensor systems and OEM modules.
- High-end, low cost, 12 channel GPS receiver OEM modules, providing superior positioning capabilities for embedded applications, ie: IVHS, General Aviation, Marine and Survey markets products.

Seeking Alliances in:

- GPS based, product "co-development" programs
- Commercial communications opportunities, ie: products and/or services



Our ALLSTAR*mobile* is a self-contained 12-channel, "all-in-view" GPS receiver packaged in a ruggedized enclosure. This user-configurable unit provides reliable GPS position solutions for automatic vehicle location (AVL) and monitoring systems, mobile GIS data acquisition and other applications where superior "all-in-view" GPS receiver performance, and possibly a "customized" GPS receiver solution are requirements.

CMC currently provides a variety of "off-the-shelf" customized options in the form of value-added firmware, all of which can be integrated into to the basic ALLSTAR*mobile* unit. This "custom tailoring" of the ALLSTAR*mobile* offers you premium system performance at substantially lower system costs. Our options include:

INTERFACE FIRMWARE

- Communications modules and hardware which control the operation of various integrated radio modems,
- Interface modules which drive external system display devices or monitor "on-board" sensors

INTEGRATED "VALUE-ADDED" HARDWARE

- Various power supply configurations
- FM data receiver for reception of DGPS correction data via commercial radio data broadcast services
- Dual-channel differential beacon receiver, compatible with both North American and European radio beacon frequencies providing fully automatic differential GPS positioning capabilities

The ALLSTAR*mobile*'s configuration flexibility combined with superior operational reliability offered from its 12-channel "all-in-view" GPS receiver, provides tomorrows mobile product designs with the latest GPS solutions available today. For more information or a demonstration of the ALLSTAR*mobile* GPS receiver contact a Canadian Marconi Company representative today.

The logo for Canadian Marconi Company, featuring the letters 'CMC' in a stylized, italicized font with a horizontal line through the middle.

CANADIAN MARCONI COMPANY
SURFACE TRANSPORTATION ELECTRONICS

CMT-1216 ALLSTAR*mobile*

Specifications

GPS RECEIVER

ALLSTAR OR ALLSTAR*plus*, 12-CHANNEL "ALL-IN-VIEW" GPS RECEIVER

| | |
|-----------------------|--|
| Prime Power | 10 to 36 VDC (12 VDC @ 250 mA) |
| Dimensions | 4.05" W x 6.02" L x 1.5" H (103 x 153 x 38 mm) |
| Weight | 1.3 lb (0.6kg) |
| Operating Temperature | -20 to +60°C (standard) -40 to +85°C (optional) |
| Storage Temperature | -55 to +90°C |
| Humidity | 5% to 95% Relative Humidity, Non-condensing to +60°C |
| Altitude | 60,000 feet |
| Vibration | SAE 51455, 5 to 2,000 Hz |
| Connectors | Power/Data I/O: DB-15 male RF: OSX or MCX female |

ALLSTAR GPS RECEIVERS 12 PARALLEL TRACKING CHANNELS, "ALL-IN-VIEW" GPS SENSOR MODULE

| | |
|--------------------|---|
| L1 Frequency | 1,575.42 MHz |
| Coarse Acquisition | C/A code (1.023 MHz chip rate) Code & carrier phase tracking |
| Sensitivity | -124 to -130 dBm (antenna input level) |
| DGPS Software | Standard |

FM BROADCAST DATA RECEIVER

| | |
|---------------------|-----------------|
| Frequency Range | 87.5 to 108 MHz |
| Modulation Formats | MBS, RDS & RBDS |
| Initial Tuning Time | 10 sec |

PERFORMANCE

| | |
|--------------------|--|
| Dynamics | Velocity: 1800 km/h (500 m/sec) Acceleration: 4 g (39.2 m/sec ²) Jerk: 2 m/sec ³ |
| Position Accuracy | 2 m circular error probability (CEP), DGPS 30 m, 2D rms, without SA imposed, 95% confidence 100 m, 2D rms, with SA imposed, 95% confidence |
| Acquisition Time | 30 sec typical TTFF (with current almanac, position, time & ephemeris) 60 sec typical TTFF (with current almanac, position, time) |
| Reacquisition Time | 3 sec typical to re-acquire (30-sec obscuration) 10 sec typical to re-acquire (60-minute obscuration) |

INTERFACES

| | |
|---------------------------------------|--|
| "Keep-Alive" Power | 3.0 to 5.25 VDC external input, < 1 mA or 3.0 VDC battery on-board, (optional configuration) |
| Serial Communications | 2 x RS-232 asynchronous data ports; TX1-RX1, TX2-RX2 19,200 Baud Rate Standard (user selectable from 300 to 76,800 baud) |
| Input Messages | |
| Rx 1: NMEA/CMC Binary | Set altitude, position, date & time selectable output messages & rates |
| Rx 2: RTCM SC-104 | Message types 1, 2, 5, 6, 7, 9, 16 |
| Output Messages | |
| Tx 1: NMEA 0183 v2.0 or CMC Binary | GGA, GSA, GSV, RMC, VTG, ZDA, plus proprietary messages All data available on NMEA message plus measurements, SV XYZ positions, channel assignments, self-test result (BIT), others |
| Tx 2: | Spare |
| Time Mark Output | 1 pulse/sec |



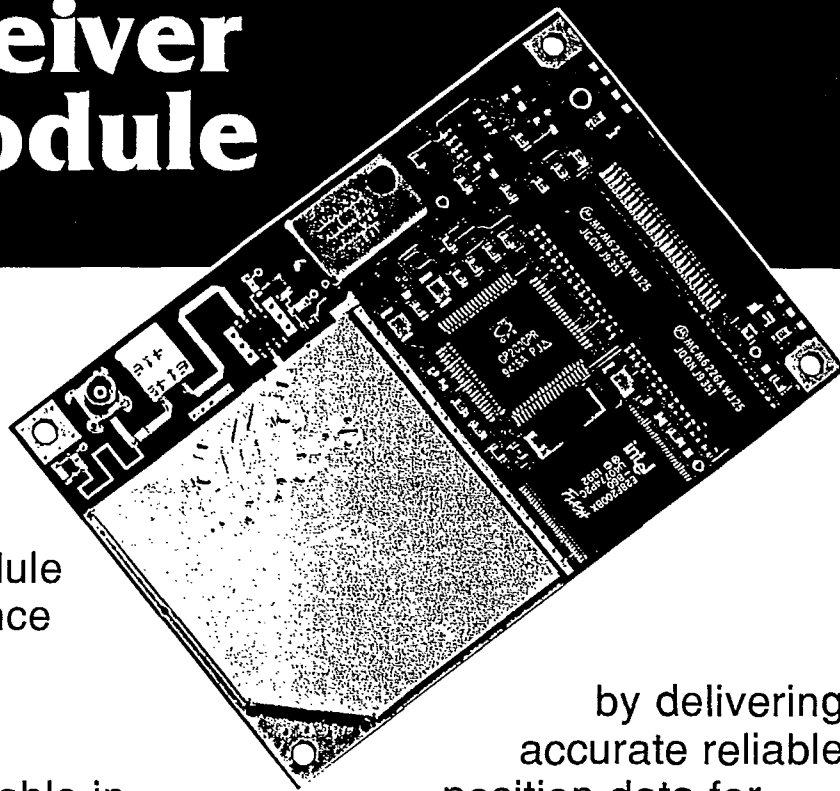
CANADIAN MARCONI COMPANY
SURFACE TRANSPORTATION ELECTRONICS

Box 18, 600 Dr. Frederik Philips Boulevard, Ville Saint-Laurent, Quebec, Canada H4M 2S9
Tel: (514) 748-3070 Fax: (514) 748-3055

ALLSTAR

CMT-1200

12-Channel GPS Receiver OEM Module



Canadian Marconi Company's 12-channel "all-in-view" receiver module offers superior performance and reliability at a highly competitive price.

The ALLSTAR is available in a variety of configurations to suit your integration requirements. It is the smallest 12-channel GPS receiver package available, measuring only 2.65"W x 4.00"L.

The ALLSTAR provides the extra performance capabilities of "all-in-view" receiver architecture

by delivering accurate reliable position data for demanding applications including automatic vehicle location (AVL), aviation and marine navigation systems.

Optional integrated features include an FM RDS/RDBS/MBS receiver, and self-contained power supply.



CANADIAN MARCONI COMPANY
SURFACE TRANSPORTATION ELECTRONICS

CMT-1200 ALLSTAR 12-Channel GPS Receiver OEM Module

Specifications

GENERAL

12 PARALLEL TRACKING CHANNELS, "ALL-IN-VIEW" RECEIVER MODULE

| | |
|--------------------|---|
| L1 Frequency | 1,575.42 MHz |
| Coarse Acquisition | C/A code (1.023 MHz chip rate) Code & carrier phase tracking |
| Sensitivity | -124 to -130 dBm (antenna input level) |
| DGPS Software | Standard |

PERFORMANCE

| | |
|---------------------|--|
| Velocity | 1800 km/h (500 m/sec) |
| Acceleration | 4 g (39.2 m/sec ²) Jerk: 2 m/sec ³ |
| Position Accuracy | < 5 m circular error probability (CEP), DGPS 30 m, 2D rms, without SA imposed, 95% confidence 100 m, 2D rms, with SA imposed, 95% confidence |
| Acquisition Time | 30 sec typical (with current almanac, position, time & ephemeris) 60 sec typical TTFF (with current almanac, position, & time) |
| Re-acquisition Time | < 3 sec typical to re-acquire (30-sec obscuration) 10 s typical to re-acquire (60-min obscuration) |

INTERFACES

| | |
|---------------------------------------|--|
| Prime Power | 5.0 ± 0.25 VDC input (50-mV p-p ripple maximum) 2.0 W at 5.0 VDC with passive antenna |
| "Keep-Alive" Power | 3.0 to 5.25 VDC external input, < 1 mA 3.0 VDC battery on-board (optional) |
| Serial Communications | 2 x RS-232 (TTL level) asynchronous data ports; TX1-RX1, TX2-RX2 19,200 baud standard (user-selectable from 300 to 76,800 baud) |
| Input Messages | |
| Rx 1: NMEA/CMC Binary | Set altitude, position, date & time selectable output messages & rates |
| Rx 2: RTCM SC-104 | Message types 1, 2, 5, 6, 7, 9, 16 |
| Output Messages | |
| Tx 1: NMEA 0183 v2.0 or CMC Binary | GGA, GSA, GSV, RMC, VTG, ZDA, plus proprietary messages All data available on NMEA message plus measurements, SV XYZ positions, channel assignments, self-test result (BIT), others |
| Tx 2: | Spare |
| Time Mark Output | 1 pulse/sec |

PHYSICAL

| | |
|-----------------------|--|
| Dimensions | 2.65" W x 4.00" L x 0.75" H ; (67 x 102 x 19 mm) |
| Weight | 0.20 lb (93 g) |
| Operating Temperature | -30 to +70°C (standard) -40 to +85°C (optional extended temperature-range components) |
| Storage Temperature | -55 to +90°C |
| Humidity | 5% to 95% relative humidity, non-condensing to +60°C |
| Altitude | 60,000 ft (18 km) |

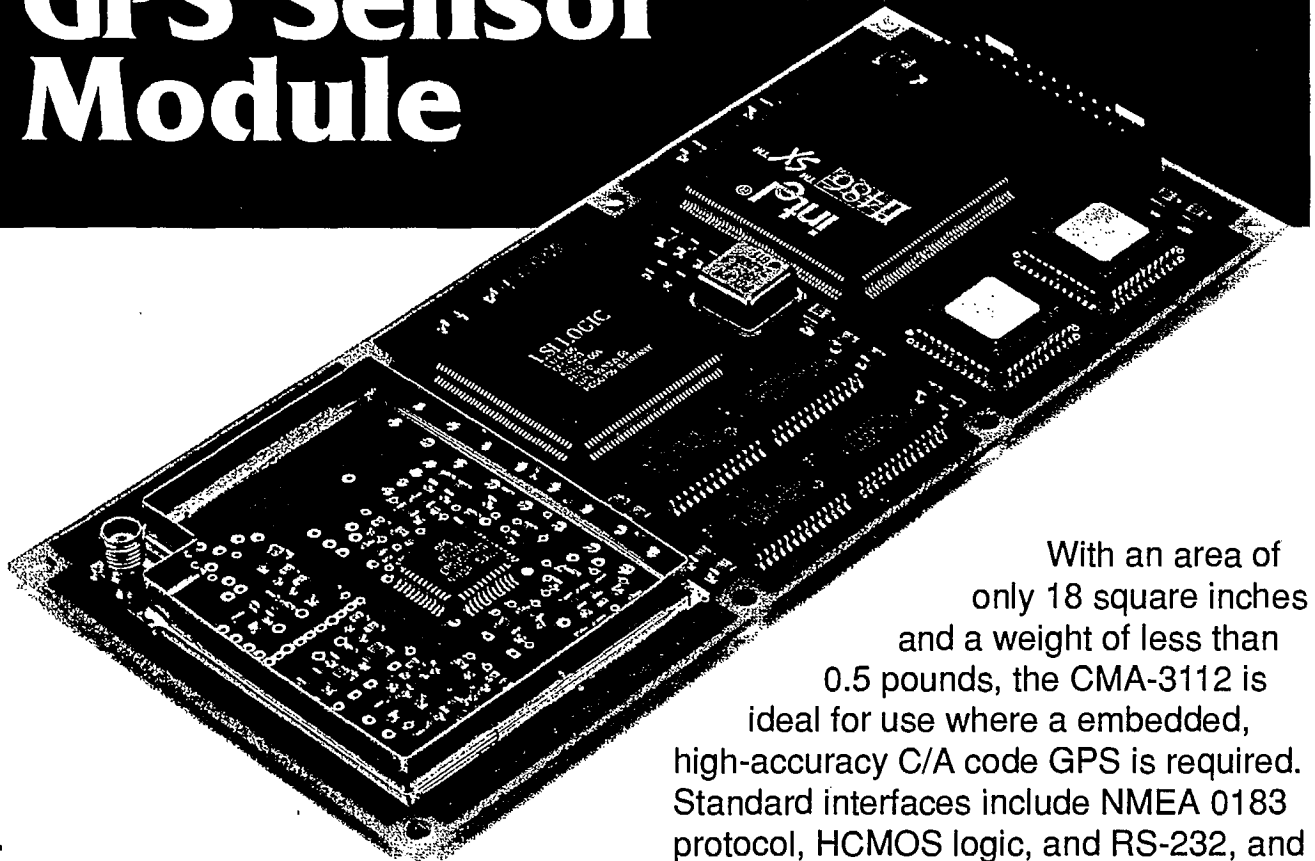


CANADIAN MARCONI COMPANY
SURFACE TRANSPORTATION ELECTRONICS

Box 18, 600 Dr. Frederik Philips Boulevard, Ville Saint-Laurent, Quebec, Canada H4M 2S9
Tel: (514) 748-3070 Fax: 514) 748-3055

CMA-3112

Airline-Standard GPS Sensor Module



The CMA-3112 from Canadian Marconi Company is a single-card 12-channel GPS "Engine" designed for the demanding requirements of airborne navigation and positioning. Derived from the CMA-3012 GPS Sensor Unit chosen for Airbus and Boeing 777 aircraft, the features of the CMA-3112 include high acquisition and tracking sensitivity, Carrier Phase Tracking, differential GPS input, and a horizontal position accuracy of 30 meters.

With an area of only 18 square inches and a weight of less than 0.5 pounds, the CMA-3112 is ideal for use where an embedded, high-accuracy C/A code GPS is required. Standard interfaces include NMEA 0183 protocol, HCMOS logic, and RS-232, and ARINC 429 input/output is optional.

Comprehensive end-to-end receiver built-in test (BITE), and extensive use of advanced circuit technologies and design result in an outstanding MTBF of over 50,000 hours.

The result of over 15 years of experience in the design and application of GPS products, the CMA-3112 is the best choice wherever an airline-quality GPS Sensor Module is called for.

CANADIAN MARCONI COMPANY
AVIONICS DIVISION

CMA-3112 GPS Sensor Module — Characteristics

GENERAL

| | | |
|------------|---|--------------------------------|
| Conformity | DO-160C ARINC 429-12 RTCM 104 | DO-208 DO-178A ARINC 743 |
| MTBF | 50,000 hours (calculated at +40° C) | |
| BITE | Continuous coverage, 90% fault coverage | |

RECEIVER CHARACTERISTICS

| | |
|-----------------------|---|
| Type | 12 channels, all-in-view |
| Frequency | L1, 1575.42 MHz, C/A code |
| Sensitivity | Acquisition: -121 dBm and C/N ₀ of 34 dB Hz |
| (at module i/p) | Tracking: -124 dBm and C/N ₀ of 34 dB Hz |
| Time to First Fix | 50 seconds |
| Time to Reacquisition | 5 seconds (@ 500 knots) |
| Accuracy | Horizontal Position: 30 meters, 95% S/A off Altitude: 40 meters, 95%, S/A off Velocity: 1.0 knot, 95% |
| Position Update | Differential: Less than 10 meters Once-per-second standard Three-times-per-second optional |

OTHER FEATURES

| | |
|-------------|---|
| Data Loader | On-aircraft software upload via an RS-232 Data Loader |
|-------------|---|

PHYSICAL CHARACTERISTICS

| | |
|-------------------|---|
| Size | 3.0" x 6.0" x 0.8" (7.6cm x 15.2cm x 2.0cm) |
| Weight | 0.5 lb |
| Input Power (Max) | 5 VDC @ 800 mA 7 to 15 VDC @ 150 mA |

ENVIRONMENTAL CHARACTERISTICS

| | |
|-----------------------|---|
| Operating Temperature | -40° C to +70° C standard performance -55° C to +85° C optional (heatsink required) |
| Altitude | -15,000 feet to +55,000 feet |
| Humidity | 95% R.H. condensing at +60° C |
| Vibration | 0.025g ² /Hz 10 Hz +3dB/octave 10 Hz - 40 Hz 0.04g ² /Hz 40 Hz - 100 Hz +3dB/octave 100 Hz - 200 Hz 0.08g ² /Hz 200Hz - 500 Hz -6dB/octave 500 Hz - 2000 Hz |
| Acceleration | 4g |

INTERFACE CHARACTERISTICS

| | |
|--------------------|---|
| Inputs | Host port, NMEA 0183 protocol, HCMOS logic or RS-232 Differential corrections port, RS-422 logic level Maintenance port, RS-232 logic level 2 ARINC 429 input ports (optional) |
| Outputs | Host port, NMEA 0183 protocol, HCMOS logic or RS-232 Maintenance port, RS-232 logic level Spare port, RS-422 logic level 1 ARINC 429 output port (optional) |
| 1 Pulse-per-Second | Rising edge is synchronized with the solution output on Port 1 or, optionally, synchronized to UTC. 0-5V logic level or open collector output level. 10mSec precision. |

SOFTWARE

| | |
|-----------|-----------------------|
| Language | ADA |
| Level | Critical design level |
| Processor | 32-bit 80486 |

ANTENNA

The CMA-3112 can operate with a 5V or a 12V standard active antenna.



CANADIAN MARCONI COMPANY
AVIONICS DIVISION

600 Dr. Frederik Philips Boulevard, Ville St-Laurent, Quebec, Canada H4M 2S9
Tel: (514) 748-3043 Fax: (514) 748-3055 Telex: 05-827822 SITA YULCMGR



ARRAY SYSTEMS COMPUTING INC.

Downsview, Ontario

Development and integration of software for system (CIS), an IBM - RT based real-time tracking system for Toronto Transit Commission (TTC).

The system is composed of central ethernet-based network of IBM RISC computers and some 3000 vehicle-based micro computers.

Vehicle micro computers accumulate trip data, vehicle health status, and load; these data are transmitted to central site every few minutes.

ARRAY SYSTEMS COMPUTING INC. CORPORATE PROFILE

SECTION 1: CORPORATE AND CONTACT DATA

Contact:

- Robert Bruce - Business Development Manager
Email bruce@array.ca

Locations:

- 401 Magnetic Drive, Suite 24, Downsview, Ontario M3J 3H9 CANADA
Fax (416) 736-4715 Tel (416) 736-0900 ext. 226
- 1000 Windmill Rd., Suite 10, Dartmouth, Nova Scotia B3B 1L7 CANADA
Fax (902) 468-8990 Tel (902) 468-8980

Year Established:

- Array Systems Computing Inc. was founded in 1981.

Ownership:

- Array is a privately-owned Canadian company.

Nature of Business:

Array Systems Computing Inc. has become a recognised international leader in scientific interdisciplinary solutions, specialising in sophisticated software development and systems integration. Array's continued success has been the result of superior capabilities in advanced computing, high-speed processing, and specialised system development.

Array's expert team of computer scientist and engineers has extensive experience with the company's varied product niches. Array's employees work with a variety of technologies and different data types, such as sonar, radar, x-ray, and satellite, to create state-of-the-art systems for Array's customers. With the combination of Array's scientific scholarship, flexible development strategies, innovative ideas, and economical solutions, the company has a competitive advantage in the industry.

Computer Aided X-ray Screening System (CAXSS)

CAXSS is an intelligent threat detection system that assists the operator in detecting concealed guns, knives, grenades, aerosol cans, and bombs by analysing x-ray images of passenger carry-on luggage. In less than 2.5 seconds, the processing results are displayed on the monitor as object outlined in red, yellow, or blue (the colour specifies the level of alarm). By pointing to the appropriate icons on the touch-sensitive monitor, the operator can rescale, zoom, or enhance, the area of interest.

D. TRAFFIC SYSTEMS

Array Systems has carried out several contracts for Metropolitan Toronto Transportation Control Centre (MTTCC) over the past 10 years. These have all included analysis or Fortran code.

Restructuring Of The Cell Task Software

The Cell Task is the program residing in each of the Cell computers responsible for controlling the traffic signals at 32 intersections. In a previous project Array Systems has made some changes to the Cell Task software and as part of our final report recommended that the restructuring of the code to make it maintainable was long overdue.

As a consequence, MTTCC gave Array Systems the contract to extensively revise the code by documenting the control structure embedded in the "spaghetti code" in terms of a subroutine hierarchy, replacing unstructured GOTOs with more modern control structures, removing embedded assembly language, and replacing "magic numbers" with meaningfully-named constants. The completed code, which originally ran only on an obsolete Perkin-Elmer 8/16 computer, was then ported to an IBM PC under DOS.

Communication Reconfiguration for Metro Transportation

Array Systems made extensive changes to the functionality of the Cell Software (i.e. TRAF29A) for the 8/16 Concurrent computers to handle communications with a central multiplexer.

Central Multiplexer Integration (CMI) for Metro Transportation

A port of the 8/16 Cell software to a QNX platform was carried out by Array Systems. The 8/16 Cell software was rewritten in C, various upgrades were implemented, and the new software was ported to the QNX platform, and integrated with the other components of the CMS system (i.e. the Systems Software and the Central Multiplexer Emulator). As part of the work, Array Systems generated specification and design documents, and developed a user interface to test the new software independently of the other components of the systems.

ARRAY SYSTEMS COMPUTING INC.

CORPORATE PROFILE

Communication and Information System (CIS)

Array Systems Computing was contracted by the Toronto Transit Commission in 1987 to develop the Central Application component of a modern Communication and Information System (CIS) for the TTC's surface fleet.

CIS is a modern complex system to provide direct voice and data communication with all the TTC surface vehicles and to allow inspectors to manage and reduce the schedule deviation problem of the commission. The new system is composed of a central Ethernet-based network of IBM RISC computers (15 machines) and some 3,000 vehicle-based microcomputers. The vehicle microcomputers continuously accumulate trip data such as distance travelled, vehicle health status and load. These data are transmitted to the central site in short bursts on a frequent basis (every few seconds), upon receiving a polling command from the central system. Ingested data are processed continuously in real-time by the distributed system to provide supervisors with route and vehicle status display and to allow them to promptly initiate intentional schedule deviation for improved public service.

Array was assigned the responsibility for developing and integrating the software system for the central computer network. This included the conversion of an old partial prototype (written in FORTRAN 66) to C, retargeting to real-time Unix and the development of the network management system (TCP/IP for the LAN, X.25 for the WAN).

CIS was an IBM-RT based Real Time tracking system for the buses belonging to the Toronto Transit Commission (TTC). The project goal was to develop a prototype real time system that would track and update the database of current positions of the TTC buses and respond to inquiries by the operator at the central computer facility. This work was carried out in AIX/C on IBM-RT.

**AVeL-TECH INC.
Laval, Quebec**

Automatic vehicle location system using GPS.

Space Reference Information System (SRIS) provides real-time tracking.

AVeL NET System can access your database, use SRIS tracking, and interleave with your computer-aided tracking system.

Radio communications: AVeL TECH's data compression techniques guarantee maximum use of various telecom networks.

Company has concluded strategic agreements with industry leaders in areas as varied as media-alert services, transportation, safety and marine management.

AVEL-TECH INC.

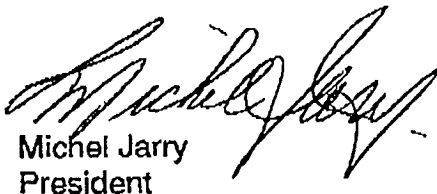
September 20th 1994

MR. Cliff Oldridge
Industry Canada
FAX.: (613)991-9469

Dear MR. Oldridge:

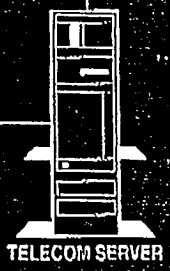
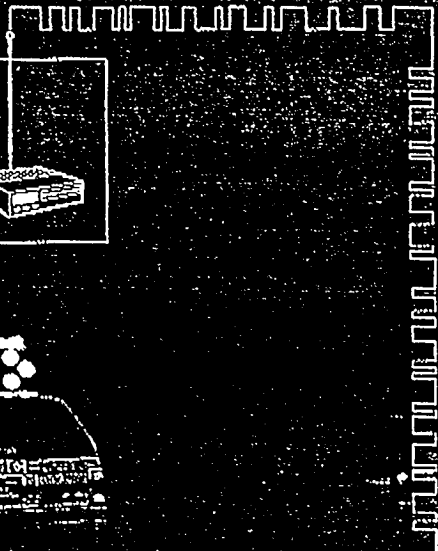
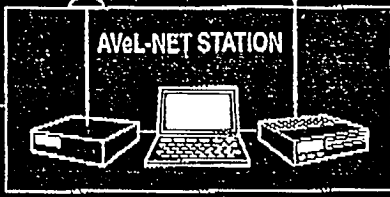
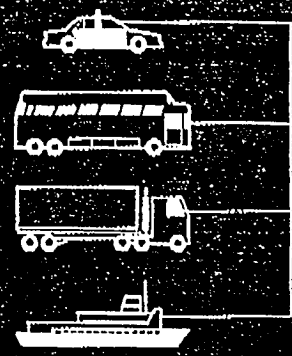
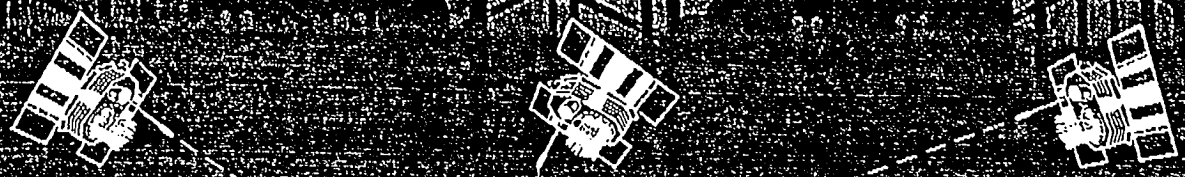
As promised, please find enclosed some documentation concerning our products and company.

Best regards



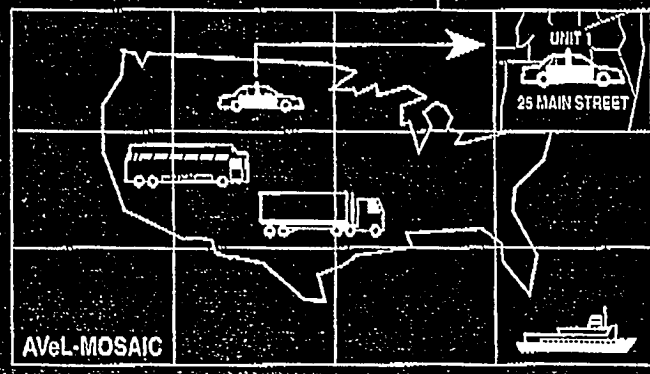
Michel Jarry
President

1685, rue Fleetwood, 5^e étage
Laval (Québec) Canada
H7N 4B2
Téléphone: (514) 668-AVEL
Télécopie: (514) 668-6644



AVeL-NET BASE

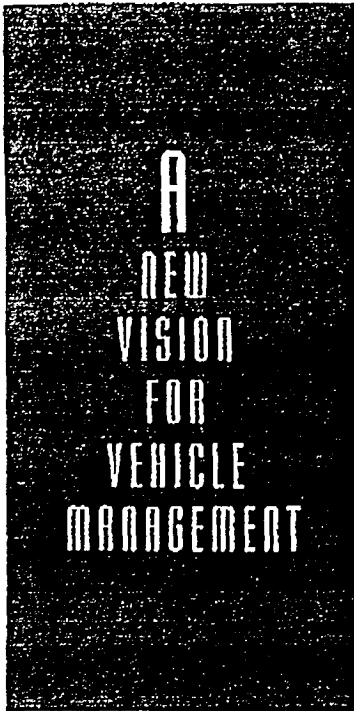
CONTROL CENTER



DISPATCH



THE AVeL-NET SYSTEM



AVeL-NET is an automatic vehicle location system that keeps you in permanent contact with each of your vehicles.

It lets you track your vehicles on screen, communicate with them, and follow their whereabouts anywhere in the world, either in real-time or in playback mode. This way, you can plan your schedules more easily, manage the use of each vehicle more accurately, and, in case of emergency or accident, react more effectively.

A new vision that will save you time and money regardless of the number or type of vehicles in your fleet.

process the geobase data with unequalled speed, allowing, for example, addresses to be displayed under the icon representing each vehicle as they move on screens.

- **SCREEN DISPLAY:** The modules of the AVeL-NET System can display the whereabouts of the vehicles on one or more work stations, or even distribute the information over a mosaic of high resolution giant screens as if it were a single screen. AVeL-NET will support any open architecture mosaic.

- **FLEXIBILITY:** The AVeL-NET System can access your databases, use your space reference information system, and interleave with your computer-aided dispatching system.

MULTIPLE APPLICATIONS

Every organisation and business with at least one vehicle can benefit from the AVeL-NET System.

Whether it's for dispatching emergency vehicles (ambulances, patrol-cars) or for operating a fleet of trucks, busses or boats... the AVeL-NET System will let you work more efficiently, more economically and more safely.

ADVANCED TECHNOLOGIES

- **TRACKING BY SATELLITE:** AVeL-NET positions the vehicles using the GPS (Global Positioning System) navigational satellites of the U.S. Army. The independence of AVeL-NET regarding the vehicle equipments allows AVeL-TECH Inc. to select the best GPS receivers for your specific needs, while staying within budget.

- **RADIOCOMMUNICATIONS:** The radiocommunications system provides the data transfers between your dispatch centre and your vehicles. There also, thanks to its flexibility, the AVeL-NET System can take advantage of most wireless transmission networks. AVeL-TECH's own data compression techniques will guarantee maximum use of the telecommunication networks.

- **SPACE REFERENCE INFORMATION SYSTEM (SRIS):** AVeL-NET's integrated SRIS has been specifically designed for real-time vehicle tracking. Its exclusive search algorithm can

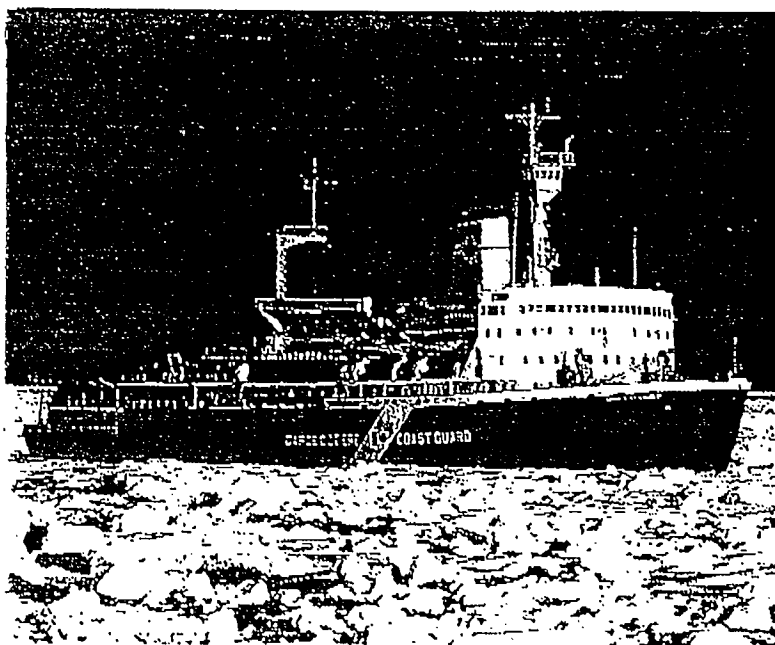
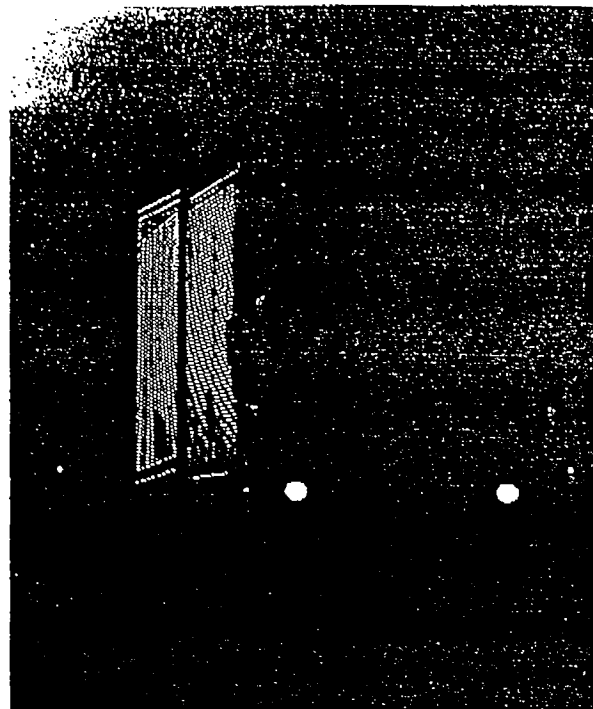
| THE EACH VEHICLE | |
|---|--------------------|
| Hardware | Software |
| GPS antenna and receiver | AVeL-NET Station |
| Radio system | AVeL-NET Station |
| Processing unit (PC or controller) | AVeL-NET Station |
| AT THE CONTROL BASE | |
| Hardware | Software |
| Communications system | AVeL-NET Station |
| LAN and WAN | Geographic systems |
| Work stations, multi-screens, terminals | AVeL-NET Station |

A BUSINESS THAT'S GETTING AHEAD

The performance of the programs developed by AVEL-TECH Inc. has earned it to be selected by some of the biggest manufacturers of communications hardware and GPS receivers as well as by the most highly reputed system integrators in the world.

AVEL-TECH Inc. has further concluded strategic agreements with the industry leaders to realize projects in areas as varied as medic-alert services, transportation, safety and marine management.

Furthermore, whether it's to integrate radiocommunications systems or existing display modules, or to adapt AVEL-NET to your own requirements, AVEL-TECH Inc. has the necessary resources and experience.



OUR COMMITMENT

AVEL-TECH Inc. is committed to reinforce its leader's position in the industry, by continuing to develop the best AVI. systems on the market.

THE EYE IN THE SKY...
a new vision for vehicle management.

AVEL-TECH INC.

507, place d'Armes, bureau 1400
Montréal (Québec), Canada H2Y 2W8

Tel. : 1-(514) 844-3200

Fax : 1-(514) 282-6382

AVeL-NET SYSTEM - Product Specification

| ITEMS | FEATURES |
|---|--|
| AVeL-NET BASE | AVeL-NET BASE is the main user software program from which all base operations are controlled |
| Operating System | MS Windows 3.1, MS Windows NT |
| Minimal Computer system recommended for a single base operator: | 80486 33 mhz or faster 8 Mb RAM 160 Mb Hard drive (depending on mapping required) VGA colour display 1 Mouse 1 Serial port (RS-232) |
| Computer networks supported | Novell Netware, Banyan Vines, DEC Pathworks, Pc Lan, Ethernet and most NETBIOS compatible networks |
| Databases | Bybase for Client/Server implementations Code Base (DBASE/Clipper/Foxbase compatible) for non Client/Server implementations (Network operation supported). |
| Number of concurrent vehicles tracked by one system | Limited by Radio Communication capacity |
| Tracking | Real time mode (with or without automatic mapping display) Playback mode (with or without automatic mapping display) In relation to dispatches |
| Interaction with the fleet | Multidirectional messaging Computer aided dispatch to addresses, intersections and coordinates with computer aided vehicle selection based on vehicle type, status and proximity to the dispatch point |
| Profile and Control | GPS positions transmission rate configuration by time and or displacement intervals with number of positions saved on board that are transmitted all at once at transmission time Get position now Get radio link status Save/Stop saving positions for later playback |
| Mapping | Raster maps and vector maps Zoom in/out (user-defined zoom areas for vector maps, limited to available map scales for raster maps) Panning Map segment and landmark information display |
| Geobase format | Published format. Most existing formats can be imported |
| Representation on maps | User selectable icons representing each vehicle User defined top label identifying each vehicle Choice of labels under each icon: <ul style="list-style-type: none"> - None - Address at which the vehicle is located as it moves - Vehicle speed - Date and time of related coordinates Choice of icon colours as per vehicular profile configuration or vehicle status Choice of vehicle labels colour as per vehicle profile or vehicle status |

| | |
|---|--|
| Maps Display Parameterisation | <p>By geographical sector</p> <p>By defining vehicle selection criteria</p> <p>By tracking selected vehicle(s) with automatic map selection, zooming and panning</p> <p>By asking the system to find and display any of the following:</p> <ul style="list-style-type: none"> - A vehicle - A street address - An intersection - A landmark - Coordinates <p>By selecting a dispatch: the required map and its scale are selected and displayed in order to include the dispatch point and the concerned vehicles converging toward it</p> |
| History file | <p>Data recorded:</p> <ul style="list-style-type: none"> Vehicle ID Date Time Longitude Latitude Speed Heading Vehicle status Address (when within 150 feet of a street address) |
| Printouts (on screen or printer) | <ul style="list-style-type: none"> Any map displayed on screen and its contents Vehicles list Vehicle groups list Classification codes list History file list Messages list Dispatches list |
| Utilities | <ul style="list-style-type: none"> History file archive and restore Messages file archive and restore Dispatches file archive and restore Form generator for the formatting of messages and dispatches Data files compaction and re-indexation |
| Help | <ul style="list-style-type: none"> Detailed user guide On-line context sensitive help system |
| AVeL-NET TELECOM | <p>AVeL-NET Telecom is the software gateway to the radio communication system(s) which links the Base Operator(s) with the fleet.</p> |
| Operating system | <p>MS Windows 3.1 and MS Windows NT</p> |
| Computer requirements | <p>May run in background on the same computer used to run AVeL-NET BASE if only a single works station is required.</p> <p>When implemented over a large fleet, the AVeL-NET system should be implemented over a Local Area Network (LAN) and a work station should be dedicated as the Telecommunication Server. The minimal configuration of this work station is:</p> <ul style="list-style-type: none"> 80486 33 mhz or faster 8 Mb RAM Hard drive (optional) VGA colour display 1 Mouse 1 Serial port (RS-232) <p>Other peripherals (X.25 card, multiplexer etc) may be required depending upon Radio implementation.</p> |

| | |
|---|--|
| <p>Radio communications supported</p> | <p>Ardis RAM/Mobitex Cellular Most trunking systems suitable for data transmission</p> |
| <p>Functionalities</p> | <p>Transparent Inter Network Routing (TINR) to allow the simultaneous operation of more than one type of radio communications system Reception of positional data and updating of central positional file(s) Transmission of dispatches Transmission and reception of messages Transmission of differential data from reference sight to vehicular GPS receivers (Radio system implementation specific) Reception of pre configured status, alarms and messages Transmission of specific Control base(s) requests Data compression before transmission Data expansion after reception Data integrity check High throughput address retrieval from positional data (60/sec)</p> |
| <p>Mode of operation</p> | <p>Unattended</p> |
| <p>AVeL-NET MOBILE</p> | <p>AVeL-NET Mobile is the vehicular software program. It can be used on several types of processors, ranging from full featured vehicular PCs down to vehicular processors without screen and display.</p> |
| <p>Features</p> | <p>Background processing of GPS output Background processing of Dead Reckoning device Background processing of radio transmissions Dispatch reception and management Multi-directional messaging (base and other vehicles) Pre-configured status, message and alarm transmission Background processing and reply to control base(s) requests Map display (VGA screen required) Real-time display of the vehicle location on map (VGA) Display of dispatched point and vehicle location on map (VGA) Display of linear distance separating vehicle to dispatched point Display of speed, position, number of satellites involved in fix and number of transmitted coordinates packets to Control Base. Local storage of positions for periodic manual retrieval Data integrity check Data compression before transmission Data expansion after reception</p> |
| <p>Interaction with Base and fleet</p> | <p>Messages to and from base Messages to and from other vehicles even if on a different Radio Communication system via TINR Dispatch reception and management with disposition levels Transmission to base of pre configured messages</p> |

MOBILE COMPUTING CORPORATIONS

Toronto, Ontario

Products/Capabilities

Computer-aided dispatch system

Vehicle mechanical monitoring

Driver monitoring and activity recording

On-board invoice or work order printing

Electronic transfer of info to/from truck

Market applications include:

- Automatic load weighing using proprietary on-board sensors (waste market)**
- Automatic liquid metering (fuel oil and propane)**
- Automatic pricing and invoice extension.**

Customers: North America and Europe.

MOBILE COMPUTING CORPORATION

CORPORATE PROFILE

Mobile Computing Corporation ("MCC") is an information systems company engaged in the development, manufacturing, selling and servicing of on board computing, dispatch, and fleet information systems in three major vertical markets: commercial solid waste disposal, field service, and metered liquid product delivery. In addition, the company is currently developing products for the newspaper distribution and municipal garbage disposal markets. The company's world class technology has been adopted by North America's largest waste and fuel oil and propane companies who are realizing enormous cost savings from using the system and experiencing 12 month paybacks. As a result, MCC has experienced compounded growth in revenue in excess of 100% over the past three years.



The Company

Mobile Computing Corporation is a Toronto based, full-service wireless communications company that is focused on providing on-board hardware systems, application and communication software, components and related integration and implementation services which specifically address the growing needs of its customers. MCC has developed systems that enable companies, who manage fleets of trucks, to communicate and monitor the activities of their fleet.

Through the use of wireless messaging systems on board each of the trucks and a "smart" work station at the dispatch office, multiple users (fleet managers, operations managers, dispatchers, etc.) can monitor the location and activities of their trucks and drivers, quickly respond to customers' demands, and have detailed statistical and accounting reports available on a "real time" basis. The MCC system allows users to track the efficiency and cost-effectiveness of each delivery (fuel), service call or pick-up (waste). On board the trucks, drivers can eliminate time-consuming and error-prone paper logging of activities and can automate the generation of on-site customer documentation. MCC has undertaken extensive research and development into improvements of its product lines and has developed innovative hardware and software technology that is highly valued by its customers.

Since a reorganization in 1989, MCC has focused on developing vertical market applications primarily for the waste management, field service and fuel delivery industries. The company's software can be integrated with communication devices and computer technologies developed by third party vendors. MCC's ability to add value to these systems is enhanced by its on-going product development efforts that are geared toward making its products user friendly while providing maximum performance and substantial cost savings for the end-users.

Nov. 1993



The Market

A study by the Waters Group on the mobile data communications industry estimates the growth rate for this sector to exceed 50% annually over the foreseeable future. According to a 1993 industry report by Pemberton & Associates, an association of independent consultants that research the mobile communications industry, the worldwide market for wireless data services is poised to grow from \$4.6 billion in 1992 to \$17 billion in 1997 which represents a 30% compound annual growth rate in five years. MCC is a formidable competitor well positioned to capitalize on this growth opportunity.

MCC has developed a strong position in the mobile computing market as one of the only providers of turnkey mobile solutions to its target niche markets. In particular the refined fuel delivery and waste transportation markets represent \$600 million and \$950 million markets in North America respectively. The latter is especially attractive in that MCC has established itself with all of the five largest waste haulers who together represent in excess of 25% of the total market. Each of these waste haulers are now beginning their MCC fleet installation "roll-out". MCC has only just begun to capitalize on this enormous market opportunity and still has a long way to go before reaching saturation.

Most recently, MCC has expanded into Europe with the largest waste hauling company, Waste Management International Inc., which operates some 10,000 trucks throughout Western Europe and Asia. This company alone represents a \$100+ million market opportunity and provides MCC with an excellent European market entry.

MCC's solutions for point to multi-point truck fleets answer a pressing need on behalf of businesses to control and monitor costs of field operations in real-time and provide enhanced customer service. The actual documented payback provided to customers who adopt MCC's applications is as short as 6 months.

Having incurred the development costs to bring these applications to market, MCC is now well-positioned to continue expanding. In addition, attractive vertical market opportunities are presenting themselves to MCC which have similar needs to its base market. These new markets: the newspaper distribution and user-pay residential garbage markets are very large and have no entrenched competitors. In the newspaper application, a large newspaper chain is funding the development of the system and the first systems are now installed and being tested. The user-pay residential garbage application will allow municipalities to charge individual households for garbage pick up on a variable rate basis. The City of Victoria is the first user-pay pilot project and will be a world wide showcase installation for MCC.



The Product

Once a salesman leaves an office, a delivery truck leaves the plant, or a service technician heads out in his van for the day, management loses contact. The mobile communications market is driven by the needs of businesses to stay in touch with these critical parts of their operation. In some simple business applications, cellular telephone and paging systems are acceptable solutions. However, there are many applications where the volume and urgency of data required by management is too much for these simple systems to handle. MCC uses the technology of wide area mobile communications to meet the requirements of these applications.

MCC's product is a mobile communications system that combines rugged, on board hardware with proprietary software to provide a data acquisition system for applications which are computationally intensive in nature. The MCC system then links this data collection to a home base ("host") system using public or private data, radio networks. MCC provides application software on the host system which allows management to analyze and track important variables in their operation.

MCC has developed turnkey mobile solutions targeted for its three target markets. In each market, MCC integrates its proprietary software applications and hardware with market specific needs and peripherals. The standard applications and options common to all its markets include:

- Computer aided dispatch using data over radio
- Vehicle mechanical monitoring
- Driver monitoring and activity recording
- On-board invoice or work order printing
- Electronic transfer of information for a paperless truck

Market specific applications include the following:

- Automatic load weighing (waste market)
- Automatic liquid metering (fuel oil and propane)
- Automatic pricing and invoice extension (fuel oil, propane, and field service)

By designing a modular system which can be adapted to specific user needs, MCC can now leverage its past investment in R&D to penetrate new vertical market opportunities.

The Customers

In the waste hauling and fuel delivery markets MCC has established accounts with the industry's largest companies including;

Waste Companies

Waste Management Inc.
Browning Ferris Industries
Laidlaw

Fuel Companies

Imperial Oil
Shell Oil
Petro Canada

MOBILE COMPUTING CORPORATION



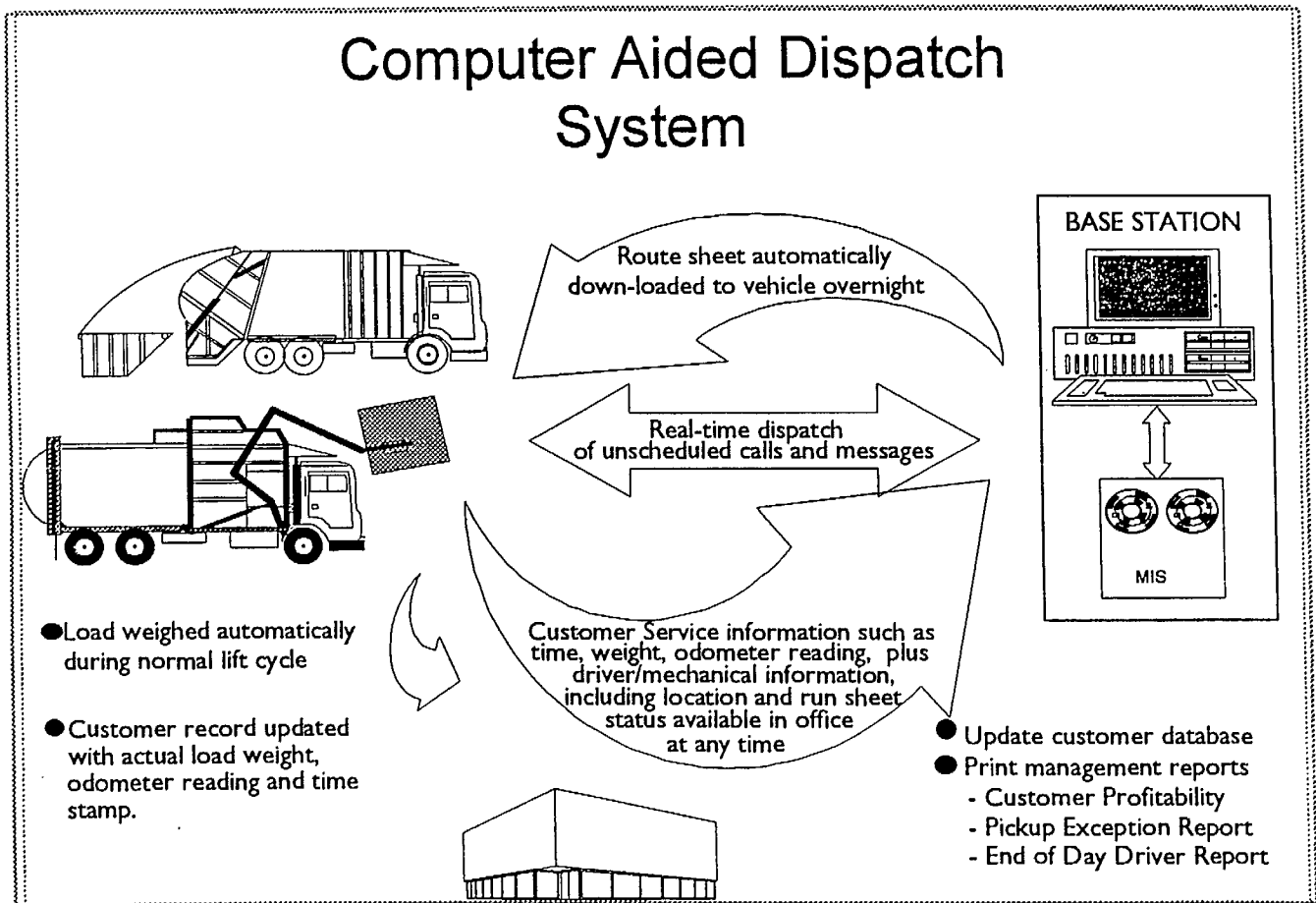
COMPUTER AIDED DISPATCH SYSTEM

Mobile Computing's Computer Aided Dispatch System is the most efficient and technologically advanced load weighing solution available today. Throughout the day, vital business information is transmitted between vehicle computers and the base station by data over radio. The system is totally automatic, eliminating driver paperwork, manually collected cards, and other time consuming operating procedures. The data over radio network offers unlimited potential for integration with automatic bin identification and other advanced functions.

The Computer Aided Dispatch system includes three subsystems:

On-Board System

Each vehicle is fitted with an on-board computer and high precision load weighing sensors. An electronic version of the daily run sheet is automatically transmitted to each vehicle computer from the base station by data over radio. Drivers perform their work with no change to normal operational procedures. The on-board system calculates refuse weights and automatically transmits load weight and up-to-the-minute activity data to the base station together with other pertinent business information.



MOBILE COMPUTING CORPORATION



Model 5400-3 On-Board Computer

Mobile Computing's 5400-3 On-Board Computer was designed with three primary features:

- **Ease of Use**

Designed and improved with driver input, Mobile Computing is proud of how quickly drivers adapt to the MCC System on their vehicles. The system is menu driven and requires very few keystrokes to complete any task.

- **Rugged**

Initially developed and installed on equipment in deep underground mines, Mobile Computing's computers are built to handle temperature extremes, moisture, grime and rough rides far better than any comparable system.

- **Expandable**

Once installed, the 5400-3 is ready to have mechanical monitoring equipment, bin identification systems, axle weight scales, printers, etc. plugged in, if and when they are needed.

FUNCTIONAL CHARACTERISTICS

| | |
|------------------------|---|
| Microprocessor: | 2 80C88 processors |
| Memory: | 128 K bytes for EPROM 128 K bytes for Flash EPROM(expandable to 256K) 356 K bytes for Non-volatile RAM (expandable to 512K for data storage) |
| Standard I/O: | 6 Analog inputs with software selectable gain 5 Opto isolated digital inputs 2 Counter/Timer inputs 1 Opto isolated digital output 2 Open collector drivers 2 Precision voltage references |
| Expandable to: | 12 Analog Inputs 7 Digital Inputs 6 Counter/Timer inputs 4 Opto isolated digital power drivers(2@10A, 2@2A) 2 Opto isolated digital power drivers (2A) 3 Digital outputs 4 Precision Current sources 2 Thermocouple conditioner inputs |
| Audio Alert: | Audible beeper activated under application software control Display line may be used as legend Numeric Keyboard with Alpha capacity |

MOBILE COMPUTING CORPORATION



Model 5400-3 On-Board Computer

Mobile Computing's 5400-3 On-Board Computer was designed with three primary features:

- **Ease of Use**

Designed and improved with driver input, Mobile Computing is proud of how quickly drivers adapt to the MCC System on their vehicles. The system is menu driven and requires very few keystrokes to complete any task.

- **Rugged**

Initially developed and installed on equipment in deep underground mines, Mobile Computing's computers are built to handle temperature extremes, moisture, grime and rough rides far better than any comparable system.

- **Expandable**

Once installed, the 5400-3 is ready to have mechanical monitoring equipment, bin identification systems, axle weight scales, printers, etc. plugged in, if and when they are needed.

FUNCTIONAL CHARACTERISTICS

| | |
|------------------------|--|
| Microprocessor: | 2 80C88 processors |
| Memory: | 128 K bytes for EPROM 128 K bytes for Flash EPROM (expandable to 256K) 356 K bytes for Non-volatile RAM (expandable to 512K for data storage) |
| Standard I/O: | 6 Analog inputs with software selectable gain 5 Opto isolated digital inputs 2 Counter/Timer inputs 1 Opto isolated digital output 2 Open collector drivers 2 Precision voltage references |
| Expandable to: | 12 Analog Inputs 7 Digital Inputs 6 Counter/Timer inputs 4 Opto isolated digital power drivers (2@10A, 2@2A) 2 Opto isolated digital power drivers (2A) 3 Digital outputs 4 Precision Current sources 2 Thermocouple conditioner inputs |
| Audio Alert: | Audible beeper activated under application software control Display line may be used as legend Numeric Keyboard with Alpha capacity |

Keyboard Sealed membrane, backlit keypad
Software programmable function keys

Display: 20 Character x 4 line display
Vacuum tube fluoresescent display
Configurable brightness control

Operating System: AMX multi-tasking executive system running
Microsoft code

COMMUNICATIONS

Radio Control: Channel ready, channel sense, push to talk, audio muting

Configurable for:

Private Radio Networks

SMR Networks:

Cantel MOBITEX/RAM/ARDIS:

Memory Card:

Spread Spectrum Modem

Ports:

Internal 1200 BPS modem

MASC Protocol

Memory card slot (256 x 8K - credit card size)

4 RS-232 serial ports

1 SMR compatible modem port

1 RS-485 Serial Port

PHYSICAL CHARACTERISTICS

Dimensions:

13" x 3.5" x 9.5" (D x H x W)

Weight:

8 Lbs

ELECTRICAL SPECIFICATIONS

Supply requirements: 12 Vdc nominal, 2A

Reverse polarity protected

Overvoltage protection to 100v

Onboard 24v 1A DC Supply for invoice printer

ENVIRONMENTAL CONDITIONS

Operating temperature range:

-104F to 185F

Storage temperature range:

-104F to 212F

Humidity:

0 to 95% condensing

Altitude:

up to 10,000 Feet above sea level

DATA SECURITY

Non-volatile RAM:

Protects data when device is OFF or vehicle power removed

Data communications:

Compressed and encrypted

Static shock protection:

Protected against electrostatic discharge up to 20,000 volts

Shielding:

Conforms to FCC Part 15 for Class A computing devices

Self diagnostics:

Event logs transferred to dispatch system for remote analysis

MOBILE COMPUTING CORPORATION



Front End Load Weighing Technology

Mobile Computing Corporation offers the most accurate, advanced on-board load weighing system available for the waste transportation industry. Our unique and patented design eliminates the calibration problems normally associated with hydraulic systems.

Incorporating a strain gage scale system it provides accuracy to within plus or minus 1% of the full scale range while weighing in motion, and even greater accuracy in static mode. This feature allows drivers to complete their lifts at their normal speed without significantly affecting the accuracy of the weight data.

Some features of this exceptional technology are highlighted below:

Strain Gage Sensors

We apply a patented system of strain gages to the vehicle arm mechanism. These sensors measure arm deflection, which is proportional to the lifted weight. The sensors carry no load and, therefore, do not degrade the strength of the arms, the hydraulics, or the arm/hydraulic joints. The sensors accurately and repeatedly measure the deflection of the arms when carrying a load.

Put simply, the gages measure how much the arms bend when a container is lifted (full) and how much the arms bend when the container is set back down (empty). The difference between the two measurements is the weight of the waste dumped into the truck.

Unlike inaccurate hydraulic based systems, strain gages are not affected by fluid viscosity, hydraulic cylinder seal friction (which varies with the load carried), pump characteristics, engine RPM, rate of lifting, and a host of other unmeasurable and uncontrollable factors that occur in hydraulic systems.

Center of Gravity

Our patented load weighing technology computes the unknown center of gravity of a load (which varies according to bin size, load placement in the bin, opened or closed lids etc.) and then computes the load weight.

This automatic center of gravity compensation is unique in the industry and enables us to achieve repeatable accurate weights under all container loading conditions. For instance, a bin could be heavily loaded at the front, and be lifted on the ends of the forks. Without a center of gravity compensation, this load would appear to weigh substantially more than it does.

Other simple, single sensor systems cannot compensate for the unknown center of gravity and may have errors greater than 18% due to this factor alone.

Multiple Measurements

When a load is weighed in motion, our system obtains hundreds of weight readings during the lift cycle and statistically computes the weight. The system does not sense, and is therefore not subject to, errors caused by hydraulic seal frictions, hydraulic surges and other exception conditions that frequently occur in hydraulic systems.

Multiple calculations allow the system to ignore load bouncing, load tumbling and load shifting during the lift or return cycle.

Auto Calibration

Our system has an integrated auto-calibration function that allows the driver to calibrate the unit in less than three minutes. This procedure needs only be performed four times a year to satisfy drivers and managers that the system is functioning properly.

Auto-calibration is an important feature that permits managers and salespersons to guarantee the accuracy of load weight data to their customers.

Redundancy and Self Diagnostics

The sensor system is applied to both arms. If, for any reason (such as a driver bending an arm), one side deviates from the other, a diagnostic message is automatically generated to warn of possible errors.

Mobile Computing Corporation

Municipal Waste System

Managing the waste stream is becoming an ever larger part of municipal government. Authorities need to:

- Check on Collection System Performance,
- Encourage Waste Stream Reduction, and
- Manage in an Environment of Ever Declining Budgets.

Additionally, legislation and environmental policy making requires an ever increasing analysis of individual waste disposal habits. Municipalities require better information and more sophisticated analytical tools to address these increasing requirements.

Mobile Computing provides three systems for municipal waste collection:

1. **Volume - Based Audit System:** uses Radio Frequency (RF) Tag to identify and time stamp every pickup by household/resident & by cart type;
2. **Weight - Based Audit System:** adds a standard scale to the audit system to document the weight of waste by user and by material type; and,
3. **User Pay By Weight System:** adds a semi automatic or automatic lifter specially outfitted with a government approved scale for direct billing by weight.

These systems allow municipal waste collection to be:

- **Audited:** insuring that pickups occurred as scheduled, and that the source of the waste collected and disposed of is documented;
- **Analysed and Controlled:** so that waste stream diversion and individual disposal trends can be understood, and
- **Billed on a Usage Basis Rather than Flat Fee or Tax Basis:** to encourage the adoption of *Reduce Reuse Recycle* practices.

The overall objective of these systems is to reduce the overall cost of waste disposal.

Mobile Computing Municipal Waste Systems include:

- On Board Computer
- RF Tag Identification Reader
- Scale, Standard or Certified (Option)
- Odometer & Engine Hour Sensors (Option)
- Radio Based Communications Options
- Base Station Database and Reporting System
- Interface to Existing MIS

Mobile Computing's Municipal Waste Systems provide the full compliment of operational and customer service advantages of the Commercial Waste System. The system provides:

- Route Productivity Reports,
- Driver & Vehicle Monitoring and Reporting,
- Computer Aided Dispatch,
- Manager/Supervisor Efficiencies,
- Driver Report Elimination,
- Clerical and Customer Service Efficiencies,
- Database of Customer Service History,
- Overweight Fine Elimination, and
- Vehicle Maintenance Scheduling Data.

Mobile Computing provides a single source for vehicle/point of service information systems for the waste industry. These complete systems include all necessary hardware and software and communications integration, project management, installation, training and on going support services.

ALLIED-SIGNAL AEROSPACE CANADA

Etobicoke, Ontario

Electronic thermal management systems, electro-optics and aircraft engine controls.

Products sold to over 160 international OEMs.

Annual sales \$136 million (80% export).

Seeking alliances in:

- software development and system engineering**
- application of core technologies (e.g. temperature, load cell) to new markets.**

ALLIEDSIGNAL AEROSPACE CANADA

ALLIEDSIGNAL
AEROSPACE CANADA
240 Attwell Drive
Etobicoke, Ontario
M9W 6L7

Phone: (416) 675-1411
Fax: (416) 675-4021

President & CEO:
Ken Kivenko

V.P., Gov't Affairs &
Business Development:
Bill Coyle

V.P. Sales & Marketing:
Tom Mitchell

V.P. Engineering:
Bill Papaevangelou

AlliedSignal
Aérospatiale Canada Inc.
200 Laurentien Blvd.
Montreal, Quebec
H4L 4X8

Phone: (514) 744-2811
Fax: (514) 342-3795

President:
Elli Segev

V.P. Marketing:
R. Egery

ALLIEDSIGNAL AEROSPACE CANADA IS AN ACKNOWLEDGED leader in the specialized fields of electronic thermal management systems, electro-optics, aircraft engine controls/accessories and support services. The company provides full customer support for its own products, as well as on a contract basis, to the Government of Canada and worldwide aircraft operators, for the products of more than 160 international OEMs.

The company employs more than 1,700 Canadians and has annual sales of \$136 million, 80 per cent of which is for export markets.

AlliedSignal Aerospace Canada and its operating units are approved to NATO AQAP-1. The company is dedicated to Total Quality and has numerous awards for quality and service.

AlliedSignal Aerospace Canada is a Total Quality Company continuously improving all work processes to satisfy internal and external customers.

Electronic Thermal Management Control Systems

Electronic environmental control systems, the core of AlliedSignal Aerospace Canada's business for more than 40 years, are designed, developed, manufactured and supported for major airframe and defence systems manufacturers at our Etobicoke, Ontario based facility.

AlliedSignal Aerospace Canada (ASACa) has been selected by the Boeing Commercial Airplane Group to develop electronic bleed air control systems for the super high-bypass engines for its 777 aircraft program. This follows a series of successful development programs for this highly specialized technology, including the Boeing 767-300 and McDonnell Douglas MD-11 and C17 aircraft programs.

Through the company's continual process to enhance customer satisfaction, a Rapid Prototyping System (RPS) tool has been developed which allows ASACa engineers to construct representative models of closed-loop aircraft systems quickly. It is being used to speed the development and improve the quality of the initial development stages of our ECS product. The RPS is a combination of computer technology and software and has proven invaluable in saving time, reducing risk and improving quality. Current programs such as the 777, MD-90 and ICECS IV are using the RPS in their development processes, with dramatic results.

Electro-optic Systems

Our Montreal operation has established an international reputation for its expertise in the design, development, manufacture and support of sophisticated

electro-optical systems.

Thermal imaging products use infra-red technology to detect heat emissions. Working in the far infra-red spectrum, these devices are ideally suited for day or night surveillance, for search and rescue, drug interdiction and defence applications such as weapon sights and targeting systems. The units are light in weight, low cost and incorporate the latest technological advances in detectors, scanners and cryogenic coolers. Thermal imaging systems can be used in fog, smoke, at night or in daylight.

The Montreal facility is a leading supplier of night vision devices to the Canadian Armed Forces. Lightweight, low-cost night vision goggles permit users to accomplish routine tasks such as driving, patrolling, giving first aid or map reading in low ambient light conditions. The modular design adjusts to helmet or gas mask use and is NBC resistant.

Night vision driving periscopes (NVP) for armed vehicles in the M113 family, Lynx, Grizzly and Leopard 1 tanks, night vision image intensifying weapons sights (NVS) and weapons training simulators complete the electro-optical systems product family.

Aircraft Engine Control Systems and Accessories

During this unit's 60-year history in Montreal, it has established a lead role in aircraft engine fuel control systems for small gas turbine engines.

The company designs, develops and manufactures sophisticated engine control systems and related components for turboprop, turboshaft and turbofan aircraft engines for manufacturers, including Pratt & Whitney Canada.

Support Services

AlliedSignal Aerospace Canada's seven support service facilities throughout Canada have joined forces to combine talent, resources and technology to ensure customer satisfaction.

Dedicated to providing high-quality, cost-effective and responsive service, this business unit offers repair, overhaul and modification of a broad range of airborne equipment. Technologies supported include: gas turbines, auxiliary power units, propulsion engine accessories, aircraft hydraulics, pneumatic equipment and avionics. Strategically located in Toronto, Montreal, Vancouver and Summerside (PEI), each repair facility is a specialist in its technical expertise and its markets.

From custom designed facilities in Hawkesbury, Toronto and Winnipeg, the Metrology Services group provides responsive management, calibration and



repair of test and measuring equipment on behalf of military, aerospace and industrial customers across Canada.

Technical publications are prepared and produced in-house to a variety of military standards and airline industry specifications, such as ATA-100.

The advanced technologies of modern aerospace systems demand a high degree of training for both operators and maintenance personnel. AlliedSignal's instructional designers, instructors and experts in computer-based training are available to design and produce "turn-key" training programs.

Headquartered in Richmond, BC the aeromarine business unit is the authorized distributor and service centre for Furuno marine electronics, and offers specialized project management and delivery services, as well as supplying the aerospace and defence markets with a wide range of equipment and spare parts.

The operating divisions of AlliedSignal Aerospace Canada maintain highly skilled, dedicated field support teams. The company also has access to a worldwide network of more than 20 technical and support offices operated by AlliedSignal Aerospace.

Advanced Technology Initiatives

The company is pursuing ambitious new strategic technology ventures to assure continuous market development and growth. To augment our major product line of electronic environmental control and bleed air management systems, new initiatives are being developed. One of these new programs provides a unique ice protection system which will help eliminate the current environmentally hazardous and costly de-icing procedures. Others include: enhanced windshield heat controls suited for a wider range of aircraft applications and 'smart' actuators and sensors which will enable higher reliability, more rugged, smaller and lighter control electronics for future aircraft and space applications.

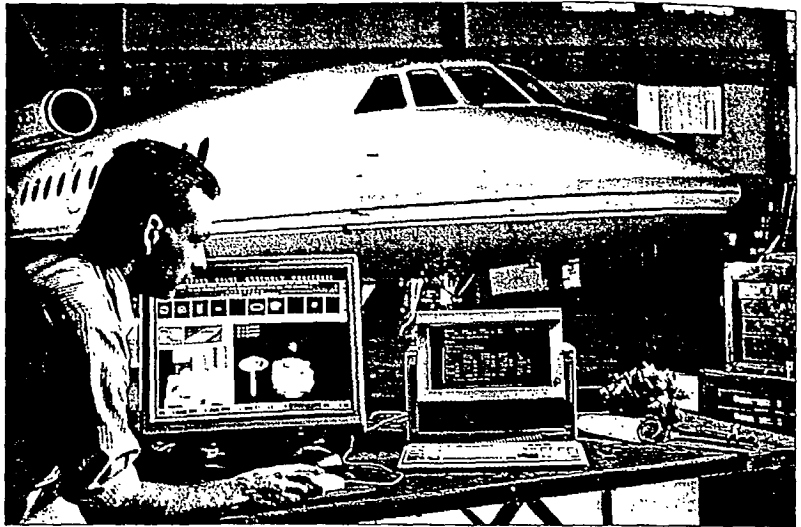
ASACa is currently involved in two new product initiatives, both in the ice-protection arena:

Electro-thermal Ice Protection Systems (ETIPS™)

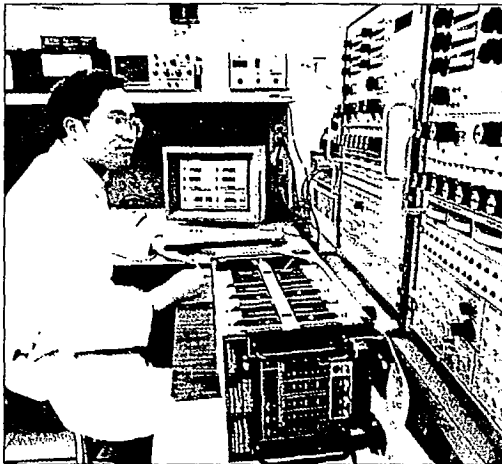
ETIPS™ is an engineered system to meet specific anti-icing or de-icing requirements. It can be customized to address specific areas of concern. The product consists of a unique AFH™ heater of conductive non-woven material, sensing and control circuitry and cockpit display functions. ETIPS™ provides a low-cost, light-weight solution for anti/de-icing needs.

Clean Wing Detection System

FAA 'clean wing' regulations prohibit an aircraft from taking off if the aerodynamic surfaces are contaminated by snow, ice, frost or any other substance. It is the aircraft captain's responsibility to ensure that



Above: AlliedSignal Aerospace Canada's extensive customer support programs — covering the products of more than 160 international OEMs, as well as its own — ensure fast and highly effective service.



At left: a substantial investment in Automated Test Equipment and other technologies places AlliedSignal Aerospace Canada at the forefront of time-saving, risk-reduction and quality enhancing an clients' behalf.

requirements are satisfied and the aircraft is safe for flight. Currently, there is no reliable automated system to assist the pilot in this vital decision. The clean wing detector system answers this critical flight safety need.

Development of technical capabilities in digital signal processing, circuit design and development complex software, shielding and EMC, COMSEC and TEMPEST at ASACa have led the company into areas that have built technological bases and skilled expertise.

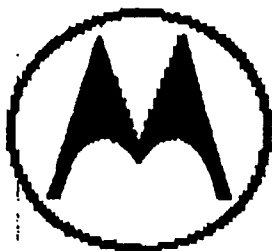
- In tactical missile actuation systems — the company is an experienced Canadian lead partner on multi-national defence programs in the areas of flight control actuation, power supplies, mission electronics and specialized test systems on programs such as: the 155mm Autonomous Precision Guided Munition (APGM), NATO Anti-Air Weapons System (NAAWS), the Advanced Short-Range Air-to-Air Missile (ASRAAM).

- In communications and airport equipment — the company's emergency locator transmitters, which work in conjunction with the international search and rescue satellite system, SRSAT/COSPAS, are carried aboard more than 90 per cent of the western world's commercial aircraft on transoceanic flights. The company is currently developing a 406 MHz emergency locator beacon.

MOTOROLA CANADA

North York, Ontario

- **Have worked with railroad industry and consultants to develop Advanced Train Control Specifications**
- **Several systems in revenue service**
- **Other uses for communication infrastructure have been developed and successfully implemented on ATCS Comms infrastructure**
- **Compliant communication subsystem includes:**
 - **Mobile communication package, base communication package, and front-end processor cluster controller.**
- **Operates in 900 MHz frequency band at 12.5 KHz channel spacing**
- **Company has participated in other voice/data applications for transportation industry to support features such as vehicle location, emergency communications system, voice dispatching and alarm reporting**



MOTOROLA CANADA LIMITED SYSTEM PRODUCTS

3125 Steeles Avenue East
North York, Ontario
Canada, M2H 2H6

23

FAX NUMBER: (416) 499-8130
PHONE NUMBER: (416) 756-5755

TO: CHIEF OLDRIDGE

LOCATION: OTTAWA

FAX NO: 613-991-9469

FROM: ED WHITEHEAD

PAGES TO FOLLOW: 1

DATE: SEPT 15, 1994

SPECIAL NOTES OR INSTRUCTIONS:

**MOTOROLA CANADA***Land Mobile Product Division*

TO: Cliff Oldridge
FROM: Ed Whitehead
SUBJECT: Rockwell Int - Transportation Electronics
DATE: 94-September-15

Motorola has jointly worked with the Railroad industry and consultants to develop the Advanced Train Control Specifications (ATCS) and several systems are currently in revenue service. The ATCS specifications were jointly developed to provide an operating system for the Railroads to improve safety. Although the systems have not been widely deployed as train control systems, other uses for the communication infrastructure such as work order reporting and code line replacement have been developed and successfully implemented on the ATCS communication infrastructure. Motorola has worked with the Railroads for over 10 years to jointly develop the specifications and the products for the communication sub system. We currently offer three products which form the specification compliant communication sub system, a Mobile Communication Package (MCP), a Base Communication Package (BCP), and a Front End Processor Cluster Controller (FEP/CC). The system operates in the 900 MHz frequency band at 12.5 KHz channel spacing.

Motorola has also participated in several other voice and data applications for the transportation industry to provide the wireless backbone to support such features as vehicle location, emergency communication systems, voice dispatching and alarm reporting. The coverage plus system developed by Motorola is an example of this type of system.

Please let me know if you would like any additional information and keep me informed as to progress on the system and application.

Regards,

Ed Whitehead, P.Eng.,
Product Manager,
Motorola Canada Ltd.

DISYS CORPORATION
Toronto, Ontario

Products:

RF Transponders and system engineering to identify and weigh in motion railroad cars. Projects in Europe and Mexico.

RF transponders and system engineering for industrial, medical and home security.

International client base

DISYS

DISYS INC

PROFILE

Disys specializes in designing solutions using Radio Frequency Communications.

A selected group of clients includes; NUMMI (Toyota/GM manufacturing plant), British Steel, Railweight, Post Offices (Denmark, Finland, Norway, Sweden, Ireland) and Royal Bank of Canada.

Solutions provided include;

- RF transponders and system engineering to identify and weigh in motion railroad cars and their contents. Projects in Europe and Mexico.
- RF transponders and system engineering to identify auto components in a manufacturing facility. Project in U.S.A.
- RF transponders and system engineering to provide an electronic throughput measurement system for Post Offices. Projects throughout Europe.
- RF based security system to provide home security. Over 5000 sold throughout North America.
- Designed 250K Bps direct sequence spread spectrum system for transmission of cardiogram data throughout health care facility. Project in North America.
- RF engineering and design to provide an RF based point of sale terminal and local area network for retail locations. Project in Canada.

DISYS INC.

711 Clayson Road, Toronto, Canada M9M 2H4

Tel: (416) 745-3200 Fax: (416) 745-3223

THE

T-90

COMPACT TAG

The T-90 Compact Tag is small, powerful and designed for general purpose applications. It is a miniature RF receiver and transmitter which is excited by signals transmitted by 90 Series Readers, and transmits stored identification data under control of a DISYS designed integrated circuit. The T-90 is powered by a long-life lithium cell.

DISYS
ELECTRONIC
IDENTIFICATION



- 256 bit data capacity
- Read/write
- Operation unaffected by environmental contaminants
- 1.5m interrogation range
- High speed reading
- Simultaneous identification of numerous Tags by one Reader
- Optional data encryption
- Functionally compatible with T-92 Personal Tag

IDENTIFICATION MATTERS

T-90 SPECIFICATIONS

Regulatory Compliance

| | |
|--------|-------------------|
| UK | MPTI340 & MPTI337 |
| USA | CFR47 Part 15 |
| Canada | TRC 51 |

Physical

| | |
|------------|----------------|
| Dimensions | 48 x 34 x 10mm |
| Weight | 22g |

Environmental

| | |
|-----------------------|--------------|
| Operating temperature | -20 to +70°C |
| Storage temperature | -20 to +40°C |
| Packaging rating | IP67 |

Life Expectancy

| | |
|--|-------------|
| Shelf life | >7 years |
| Number of 8 bit blocks transmitted to Reader | >20 million |
| Low battery warning transmitted | |

Data Capacity

| | |
|-----------------------------|--|
| User-programmable data area | 256 bits, formatted as 32 x 8 bit blocks |
|-----------------------------|--|

Data Rate

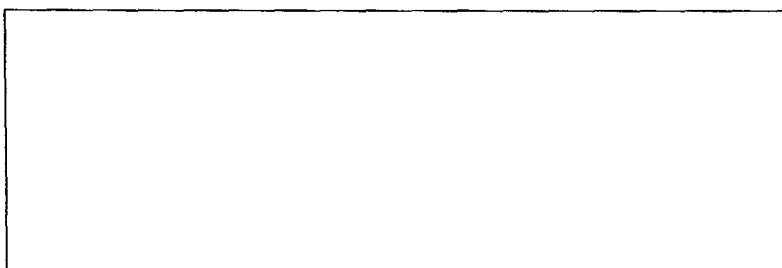
| | |
|-------------|--------------------|
| Reading | 4,800 to 38,400bps |
| Programming | 1,200bps |

Interrogation Range

| | |
|---------------------|-------|
| Optimum orientation | >1.5m |
|---------------------|-------|

DISYS

ELECTRONIC
IDENTIFICATION



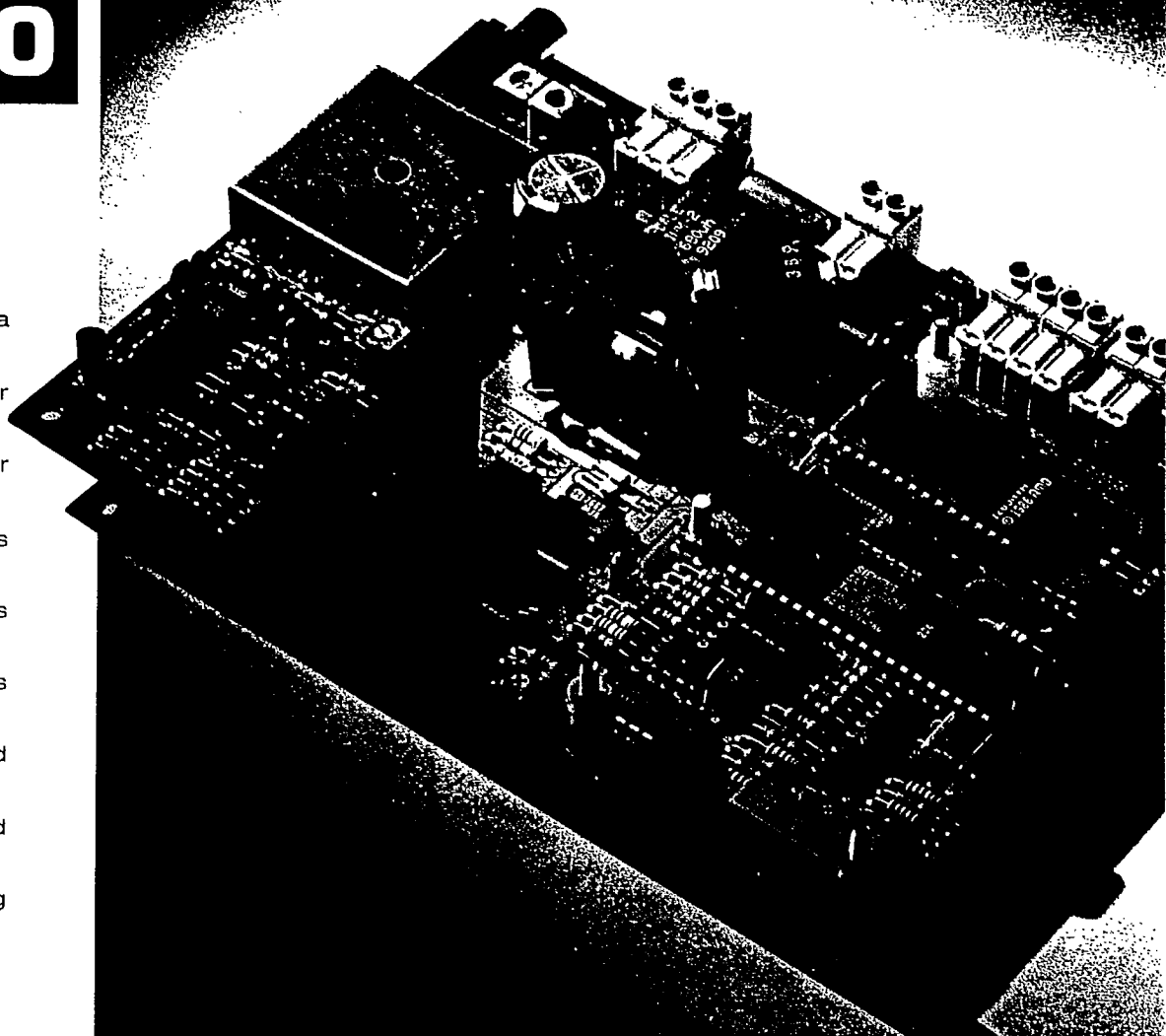
I D E N T I F I C A T I O N M A T T E R S

THE

CRM-90

READER

The CRM-90 Reader is a powerful microprocessor controlled RF transmitter and receiver which sends signals to and receives signals from 90 Series Tags. It decodes and then transmits captured data to a monitoring computer.



- Flexible operation - configured via resident firmware
- Output ports compatible with industry standard card and bar code readers
- Ease of installation
- May reprogramme 90 Series Tags in-situ
- Low power consumption
- No individual site licence required

DISYS

ELECTRONIC
IDENTIFICATION

IDENTIFICATION MATTERS

CRM - 90 SPECIFICATIONS

Physical

Dimensions: 170 x 120 x 30mm
Weight: 260g

Environmental

Operating temperature: -20 to +50°C
Storage temperature: -40 to +85°C

Asynchronous Serial Port

Data rate: 300 to 19,200 baud
Frame length: 7 or 8 data bits
Parity: optional
Addressable

Card Reader Output Port

Compatible with industry standard
Wiegand card reader heads and
magnetic stripe readers

Bar Code Output Port

Compatible with industry standard
wands and scanners.
Symbologies supported: Code 128, Code 39, Code 93,
Codabar, Interleaved 2 of 5,
UPC-A/EAN

Isolated Output Port

Maximum load: 30mA @ 240V AC(RMS) or
320mA @ 24V DC
Off-stage voltage: <250V DC or AC(RMS)
Isolation: >250V AC(RMS) or DC

Power Requirements

Input Voltage: 15 to 28V DC or AC(RMS)
Current: Not reading Tags <60mA
Reading Tags <200mA

DISYS
ELECTRONIC
IDENTIFICATION

I D E N T I F I C A T I O N M A T T E R S

PRESS RELEASE

DISYS ANNOUNCES CONTRACT WITH NUMMI (TOYOTA/GM) AUTOMOBILE PLANT.

Disys Inc. has received an initial order to provide a Radio Frequency communications system for the New United Motor Manufacturing Inc. plant in Fremont, California.

The plant, a joint venture between Toyota and General Motors produces a variety of automobiles and light trucks under the Toyota and General Motors nameplates.

The Disys system, including Radio Frequency transmitters, receivers, custom software and project management will assist in identifying and tracking chassis and engine blocks in the assembly process. The initial order represents a pilot test of the Disys system and when successful will result in deployment of the system throughout the plant.

From its new product and development facilities in Toronto and high volume production plant in Mexico, Disys designs, manufactures and markets radio frequency identification systems and consumer health, safety and security products for sale throughout the world.

-30-

Contact: Chris Gadula, Executive Vice President
(416) 745-3200 Ext. 144

Putting Technology on the Rails

Rail travellers arriving at St. Pancras station in London pass under a vast span of cast iron and glass that was hailed as an engineering wonder when it opened in 1868. If you look closely, you can still make out a stamped insignia at the base of each iron rib: *Butterley of Derby*.

Butterley Engineering has occupied the same site in Ripley, Derbyshire, since its founding in 1790. Today it is one of the world's leading engineering firms, producing specialized products for a wide range of industries, including mining and smelting, power generation, petroleum refining and transportation.

Customers around the globe count on this renowned firm to provide the most advanced technology available. So when Butterley engineers began a multi-million-dollar project calling for radio frequency identification (RF/ID) equipment, they specified the industry leader: DISYS.

Butterley's task, begun in June 1993, is to expedite the shipment of aggregates from a limestone quarry in Yorkshire to a coating plant in Leeds. The quarry receives its daily production requirements via computer modem from the Leeds plant. Aggregates of various gauges are automatically loaded by conveyor from storage silos to hopper-type rail cars.

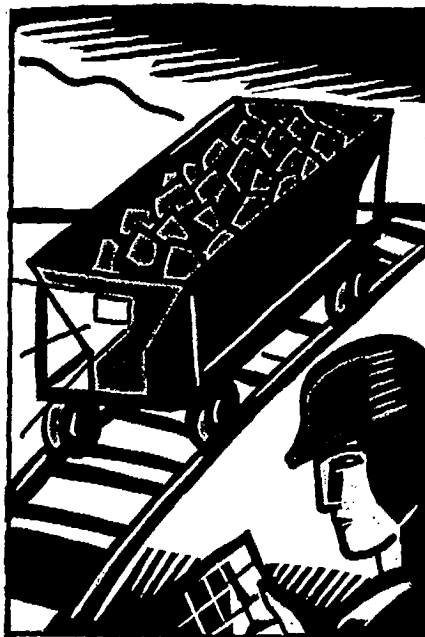
The identifying number of each hopper is programmed onto a pair of DISYS read-write tags, one on either side of the car. When the train passes by a trackside antenna, the cards are scanned by an electronic reader and the encoded data is transmitted to a host computer. Information on the type of aggregate being shipped is then sent by modem to the unloading site.

When the train arrives at the Leeds plant, the tags are scanned by a second antenna reader. Guided by this information, the plant's materials-handling sys-

tem directs each carload via under-track conveyor to one of 12 storage compartments for later processing.

For now, the DISYS tags' 32-character capacity is used only to identify individual hopper cars. But the tags could ultimately function as mobile databases carrying detailed information on each load.

The tags' specially-designed rubber mounts ensure long-term durability. And while the quarry application involves only stationary reading, the tags can be read at speeds up to 100 mph (160 km/h).



As the quarry train arrives at the processing plant, a rail-side antenna scans the DISYS cards and routes each car to the appropriate storage area.

Before implementing the DISYS system, Butterley engineers subjected it to a rigorous testing process. The rail-side antennas had to be two metres from the track to comply with regulations and allow sufficient room for unloading. They couldn't be placed underground because of the risk from falling rock and the large amount of metal in the area.

DISYS technology was ready to meet these challenges, offering sufficient range to cope with the required distance and other constraints. DISYS also supplied the galvanized antennas, custom-designed to Butterley's specifications.

"I was impressed by the quality of information received from DISYS," says John Price, Chief Electrical Engineer. "In this difficult working environment, the DISYS system came into its own, providing the solution we were looking for and doing a good job where other identification systems simply wouldn't work."

In addition to industrial sites and manufacturing plants, the DISYS RF/ID system has been designed for a wide range of applications, from public transit and health care to nuclear plants and facilities handling hazardous materials.

For more information on how our flexible, customized solutions can add value to your business, contact your DISYS representative.

DISYS Inc.
711 Clayson Road
Toronto, Canada M9M 2H4
Tel (416) 745-3200 Fax (416) 745-3223

DISYS Limited
DISYS House, PO Box 15
Cheltenham, Glos.
GL51 9UD United Kingdom
Tel (0242) 251 410 Fax (0242) 222 935

IRON AND STEEL ENGINEER

JULY 1994

U.K. steel producer using automatic weighing system to monitor movement of molten metal

BRITISH Steel recently challenged Railweight to solve an ongoing dilemma.

Molten steel is poured into 65-tonne ladles, which are suspended from 600-tonne on-track cranes. The cranes move ladles to any one of 13 points, where the molten steel is off-loaded for further processing.

There are three cranes and 25 ladles and knowing the precise location of each is crucial. Since the molten steel in those ladles is cooling all the time, to lose a ladle in the plant complex for any length of time could result in an expensive problem.

Railweight selected Disys for RF-ID (radio frequency identification) to complement their system with an automated identification facility for ladles and cranes.

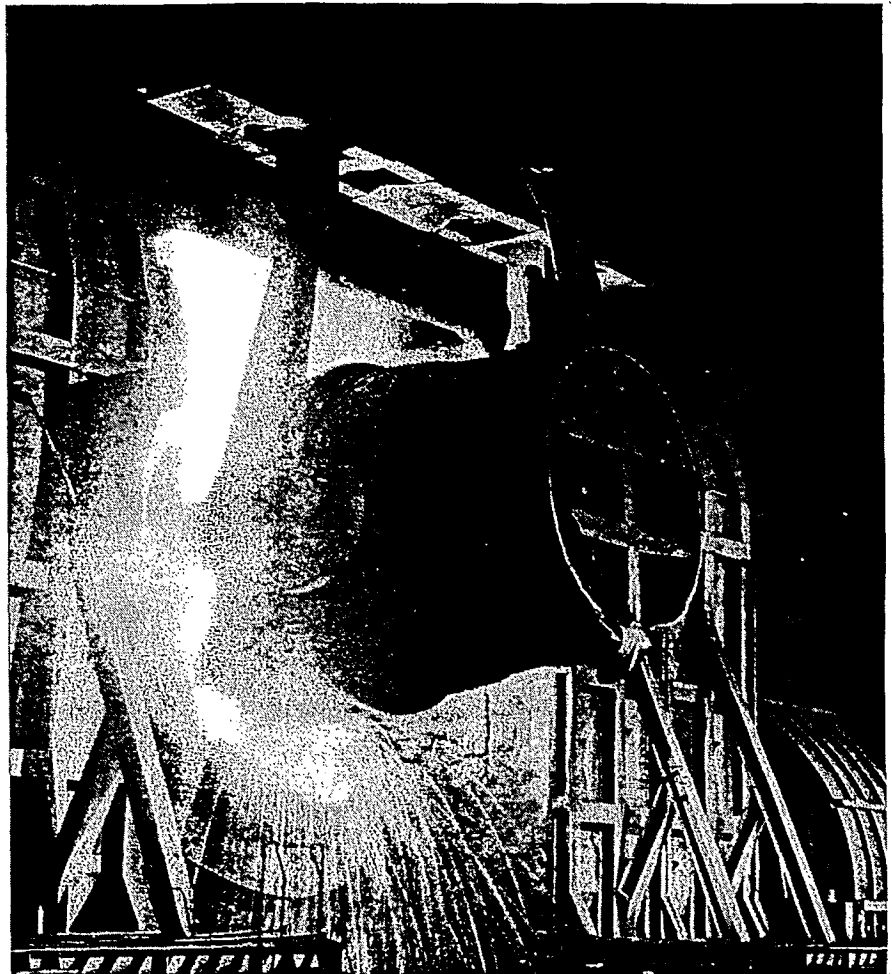
Disys electronic tags—programmed with an identifying number—are attached to each crane's supporting stanchions. Antennae, custom built for the job, are located on each of the cranes.

A feature of the system is its long operational range. This proved an essential asset in the ladle, as the tags have to be read at a distance from the antenna.

For the molten steel carrying ladles, which have an outside surface temperature of 80°C, Disys developed special mounts to house its tags. The ladles are serviced every three months, so active tags must be guaranteed operational for this period.

Railweight is a member of the Stavely Weighing and Systems Group. The company's Weighline system is revolutionizing the method by which information about on-track rolling stock is gathered.

In contrast to a conventional weighbridge, the Weighline installation requires no civil engineering, little maintenance and is commissioned in



An RFID-based system developed by Disys Inc. was selected to automate the identification and location of ladles and cranes at British Steel's Port Talbot plant.

hours or days, rather than weeks or months.

The system employs calibrated transducers attached to a section of track. As a train passes over, these strain gages transmit information to a computer. Interfaced with an automated vehicle identification system, a printout can record the number of wagons in a train, its direction of

travel and the weight of each truck. In addition, Weighline can alert if individual wagons are unevenly loaded or overloaded.

The company recently installed such a system for New Zealand Rail Ltd., which monitors the entire 4000 km complex from 19 strategic locations as trains pass at speeds up to 70 kph. ▲

MARK IV INDUSTRIES

Mississauga, Ontario

Products:

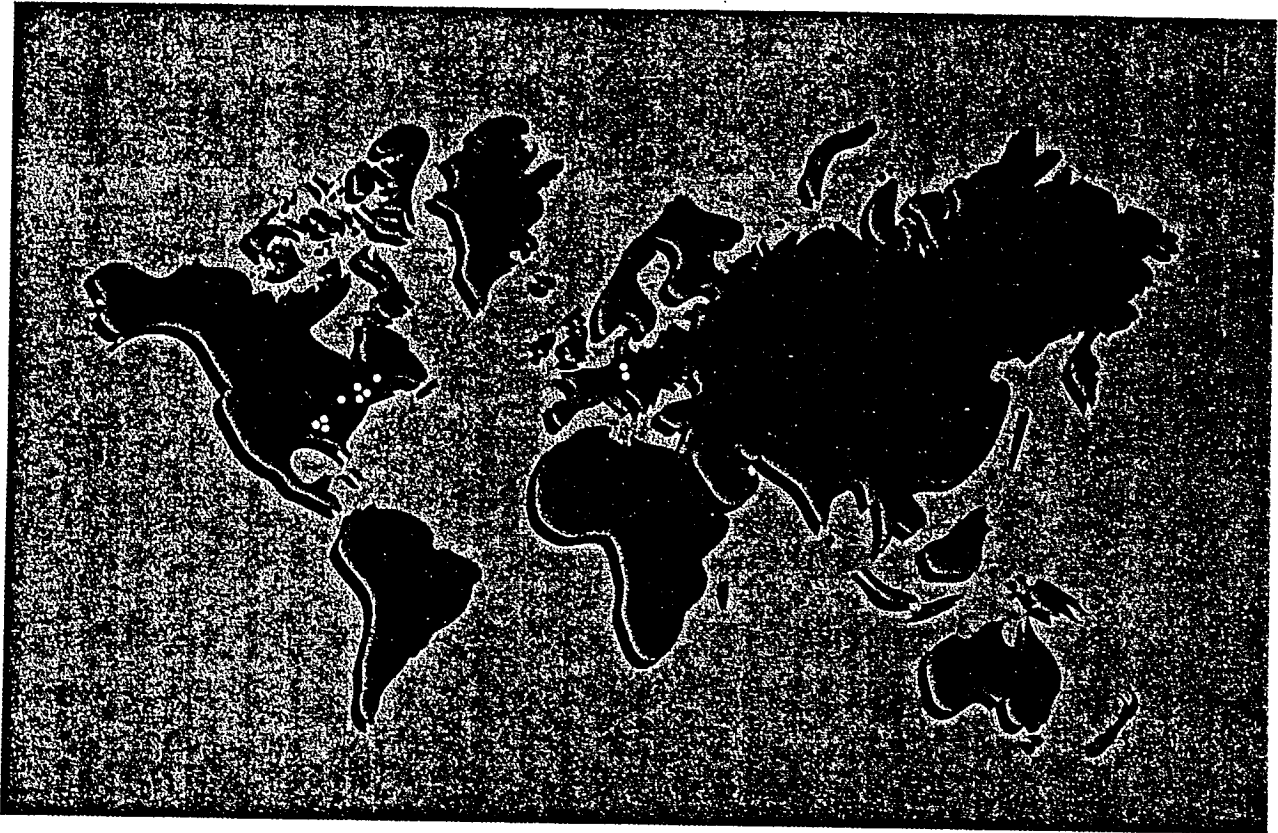
- Interior transponders
- Exterior transponders
- Road-side Reader Systems
- In-pavement antenna
- Lane kit

Selected projects for:

- Arizona Development of Transportation
- Greater Pittsburg International Airport
- Orlando/Orange County Expressway Authority

MARK IV INDUSTRIES INC.

TRANSPORTATION PRODUCTS GROUP



Mass Transit & Traffic Control Sector

A Fortune 500 company with corporate headquarters in Buffalo, New York, MARK IV Industries operates 65 separate manufacturing facilities in 10 countries, employing more than 11,000 people. The Mass Transit and Traffic Control Sector, which includes the MARK IV IVHS Division, is part of MARK IV's Transportation Products Group whose products include interior lighting, door control and passenger information systems for buses, trains and aircraft; highway directional signs, traffic signal controllers and traffic signals to manage the flow of vehicular and pedestrian traffic; and intelligent vehicle highway systems equipment for the increased safety and convenience of motorists.

MARK IV
IVHS Division



Will your AVI equipment be smart enough to keep up with tomorrow's intelligent vehicles and highways?

ROADCHECK's advanced capabilities ensure that you will be able to take advantage of all the benefits of future IVHS applications.

Intelligent Vehicle Highway Systems (IVHS) will require reliable, flexible, state-of-the-art Automatic Vehicle Identification equipment. ROADCHECK was designed with the future in mind. No matter what level of technology your system requires, today or tomorrow, ROADCHECK can supply it.

The future is built in

Upward compatibility to two-way communications is built into the system. All ROADCHECK equipment has the capacity to handle both one-way and two-way communications.

ROADCHECK offers you a free upgrade path to the world of advanced two-way communications with in-vehicle

units for tomorrow's intelligent vehicle highway systems

ROADCHECK components can be upgraded from one-way to two-way communications without requiring the purchase of new equipment.

Low cost installation

There is no need for toll plazas, barriers or overhead structures with ROADCHECK's unique in-pavement antenna. (Optional overhead antenna configurations are also available.)

In-pavement antennas are installed in shallow slots in the pavement, flush with the road surface. Overhead antennas can be easily attached to suitable new or existing structures. The Reader, housed in a weatherproof case, sits on the roadside. Encased in high-impact plastic, transponders are small enough to be easily installed on a licence plate or dashboard.

Since the Reader can handle up to eight lanes of free-flow high-speed traffic, a single

Flexible

ROADCHECK is also designed to communicate with industry standard computers as well as with other traffic monitoring systems such as Weigh-In-Motion, Automatic Vehicle Classifiers and automatic enforcement systems.

Using the Time Division Multiple Access (TDMA) protocol favored by the transportation industry, ROADCHECK can communicate with IVHS products offered by other leading suppliers. And the Reader hardware and software can be customized to achieve maximum performance on *your* particular system.



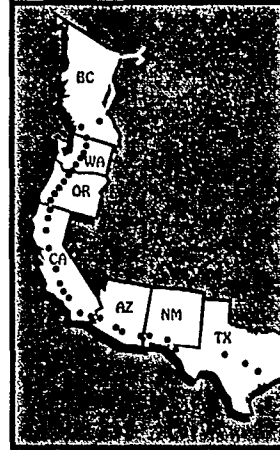
Road Pricing projects can ease traffic congestion in busy city cores.

Selected Projects

Arizona Department of Transportation

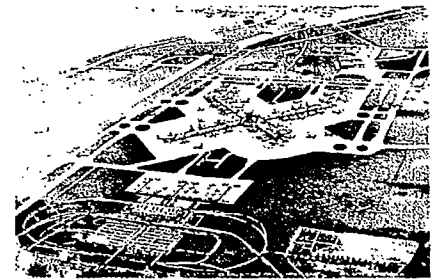
Heavy vehicle Electronic License Plate (HELP) Project

Read/write ROADCHECK AVI systems are installed at 39 sites along Interstate Highways 5 and 10, beginning in British Columbia and ending in Texas. In conjunction with a Weigh-in-Motion system, ROADCHECK monitors the weight and safety regulation compliance of the more than 5,000 participating trucks.



Greater Pittsburgh International Airport

Parking Control System



ROADCHECK AVI equipment is central to the revenue control system at GPIA's new mid-field terminal. This state-of-the-art system is used for controlling bus access and parking.

Orlando/Orange County Expressway Authority

Computerized Toll Collection and Traffic Management System

IVHS potential will be built into the 95 toll lanes to be equipped with ROADCHECK AVI equipment on Orlando/Orange County Expressway. An estimate of 50,000 motorists will eventually be able to enjoy

are only three components in ROADCHECK system: on-pavement or overhead antenna, the inside reader and vehicle mounted transponder. Each piece of equipment is easy to install and requires practically no maintenance. The transponder is powered by battery with a life of 15 years.

Key Applications

ROADCHECK's reprogrammable transponders can be used for two-way communications applications:

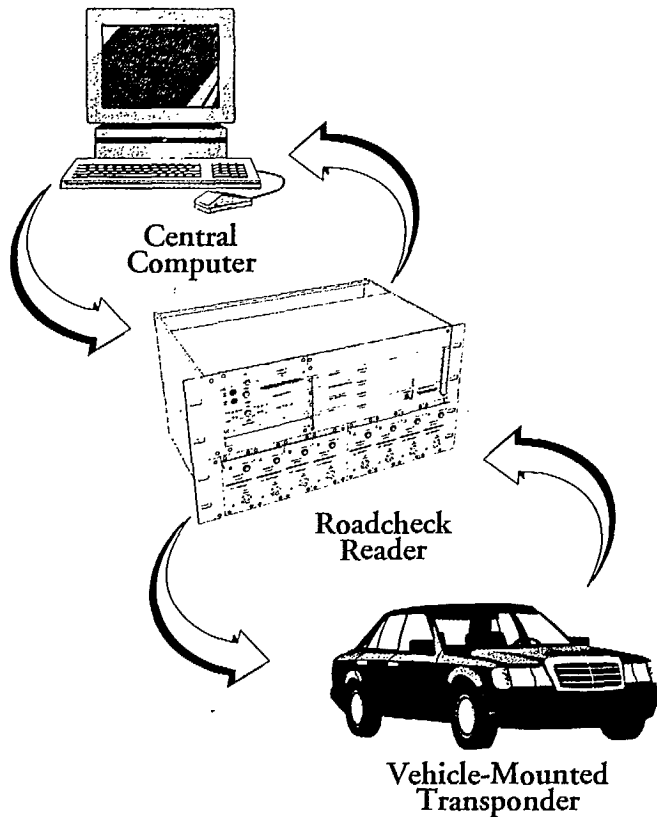
- roads and bridges
- tolls and turnpikes
- port terminals
- traffic control
- monitoring
- pricing projects
- heavy goods movement
- work monitoring
- pre-clearance
- vehicle sorting
- management

*For the technological
tomorrow's smart highways,
ROADCHECK is ready to provide solutions*

ROADCHECK™

Short Range Vehicle-to-Roadside Communications Equipment for Automatic Vehicle Identification

READER SYSTEMS



How Roadcheck works

1. The Reader, via its antennas, sends out a brief, periodic trigger pulse, establishing a capture zone around the antennas.
2. Any transponder passing through this capture zone is triggered to transmit its information packet to the Reader at 500 Kbits per second.
3. The Reader either passes the information to the central computer or stores it in RAM until requested.
4. At this point, the Reader may also be instructed by the central computer to reprogram the transponder, in which case the transponder is read again after programming to ensure accuracy.

At the heart of Mark IV's *Roadcheck*™ system is the Reader. It establishes high speed, two-way communications between vehicle-mounted transponders and a Central Computer system.

Readers are available in three basic models: Standard, Compact and Dual Redundant. These different configurations give the *Roadcheck* system unparalleled versatility.

Each of the Reader systems is compatible with both in-pavement and overhead site configurations and can communicate with all three types of Mark IV transponders.

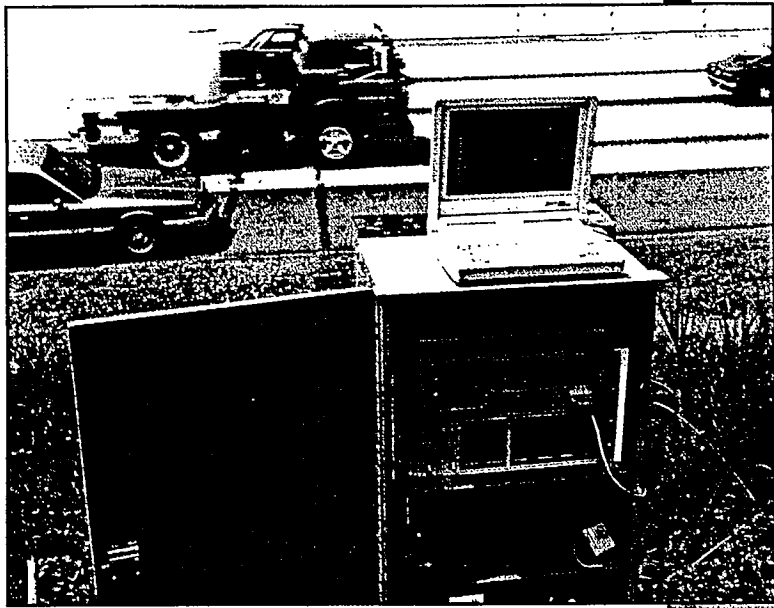
A single Reader using multiplexed antennas can interface simultaneously with up to eight lanes of traf-

fic moving at speeds of up to 100 mph (except in the case of the Compact Reader which is designed to monitor a single lane only).

Linked with other Intelligent Vehicle-Highway Systems (IVHS) technologies, the *Roadcheck* system is used in situations where a fast two-way communications link between vehicles operating at highway speeds and fixed roadside equipment is required. These applications include electronic toll collection, commercial vehicle operations and parking revenue control.

The *Roadcheck* system operates automatically and unattended. An extremely high level of accuracy and reliability is assured through the use of Cyclic Redundancy Checks (CRC) and self-tests.

The Reader is the heart of the Roadcheck VRC system



Travelling at speeds of up to 100 mph, Mark IV transponders mounted on passing vehicles transmit their data at 500 Kbits per second in response to the antenna's trigger pulse and in turn receive new programming from the Reader. Transactions take place in milliseconds.

Readers are installed in weatherproof cabinets located beyond the shoulder of the roadway. In cases where the lanes to be read are more than 88 feet away from the Reader, an extension kit, consisting of an RF rack, RF modules and a power supply, is needed.

The site pictured here uses a Standard Reader monitoring two lanes of traffic. *Roadcheck* Readers, using multiplexed antennas, can monitor up to eight lanes of traffic simultaneously with no loss of performance. Behind the Reader, vehicles can be seen passing over the two in-pavement antennas.

Using a portable computer (seen on top of the Reader cabinet), transponder messages can be reviewed as they are received by the Reader. This is invaluable for system maintenance and diagnostics.

Standard Reader

The Standard Reader can handle up to 8 lanes of traffic moving at speeds of up to 100 mph. Depending on the application, vehicles can, among other things, be identified without having to stop or even slow down.

Typically, the Standard Reader stores the vehicle information gathered in its memory until the central, or host, computer requests it. In case of a complete lack of power, battery-backed RAM in the Reader can hold records for up to 150 days, more than enough time to download them to the central computer.

READER SPECIFICATIONS

DIMENSIONS

| READER MODEL | MILLIMETERS | | | INCHES (approximate) | | |
|-----------------------|-------------|-------|-------|----------------------|-------|-------|
| | HEIGHT | WIDTH | DEPTH | HEIGHT | WIDTH | DEPTH |
| Standard | 178 | 483 | 229 | 7 | 19 | 9 |
| Dual Redundant | 356 | 483 | 229 | 14 | 19 | 9 |
| Compact | 127 | 102 | 229 | 5 | 4 | 9 |
| Cabinet* | 915 | 762 | 432 | 36 | 30 | 17 |
| RF Rack** (8 lanes) | 178 | 483 | 229 | 7 | 19 | 9 |
| RF Rack** (extension) | 178 | 254 | 229 | 7 | 10 | 9 |

* Factory can supply NEMA-4 cabinet which may be mounted on solid wall or concrete pedestal. Not applicable to Compact Reader.

**Not applicable to Compact Reader.

COMMON FEATURES

| | |
|--|--|
| Frequency: | 915 MHz. Readers can be tuned to meet any frequency in the 902-928 MHz band. Readers must be licensed under FCC Part 90 regulations |
| Error checking: | 16 bit Cyclic Redundancy Check (CRC) |
| Radiated power: | 100µW/sq. cm average output at antenna surface |
| Operating environment: | -40°C to +70°C (-40°F to +158°F) 5% to 95% relative humidity (non-condensing) |
| Reading speed: | 500 Kbits/second ±10% • up to 5 reads per transponder at 160 kph (100 mph) with vehicles present in 8 lanes simultaneously (single lane only for Compact Reader) |
| Maximum distance from Reader to antenna: | 27m (88 ft). 300m (1000 ft) with extension kit (27m for Compact Reader) |

STANDARD READER

| | |
|-----------------------|--|
| Interfaces: | RS-232-C interface • Up to 9600 baud asynchronous • Optional RS-422-A interface • Handshake protocol as required • 4 serial ports-upgradeable to 8 |
| Power requirements: | 120 Vac, 60 Hz, 20W (12 Vdc battery optional) |
| Lightning protection: | All inputs require protection by transorbs or optical coupling |
| Buffer: | Space for 10,000 AVI records and associated data • Upgradeable to 4 mbs of battery backed static RAM |

DUAL REDUNDANT READER

| | |
|-----------------------|---|
| Interfaces: | RS-232-C interface • Up to 9600 baud asynchronous • Optional RS-422-A interface • Handshake protocol as required • up to 8 serial ports |
| Power requirements: | 120 Vac, 60 Hz, 20W (12 Vdc battery optional) |
| Lightning protection: | All inputs require protection by transorbs or optical coupling |
| Buffer: | Space for 10,000 AVI records and associated data • Upgradeable to 4 mbs of battery backed static RAM |

COMPACT READER

| | |
|---------------------|--|
| Interfaces: | RS-232-C interface • Up to 9600 baud asynchronous • Optional RS-422-A interface • Handshake protocol as required |
| Power requirements: | +5 Vdc +15 Vdc (not provided) |
| Buffer: | Space for 100 AVI records and associated data |

Distributed by:

6020 Ambler Drive, Mississauga, Ontario, Canada L4W 2P1
(416) 624-3025 • fax (416) 624-4572

(As of October 1993 the area code changes to 905)

MARK IV IVHS is committed to the continuous improvement of its products and therefore reserves the right to vary from the specifications contained on this sheet without notice

ROADCHECKTM

Short Range Vehicle-to-Roadside Communications Equipment for Automatic Vehicle Identification

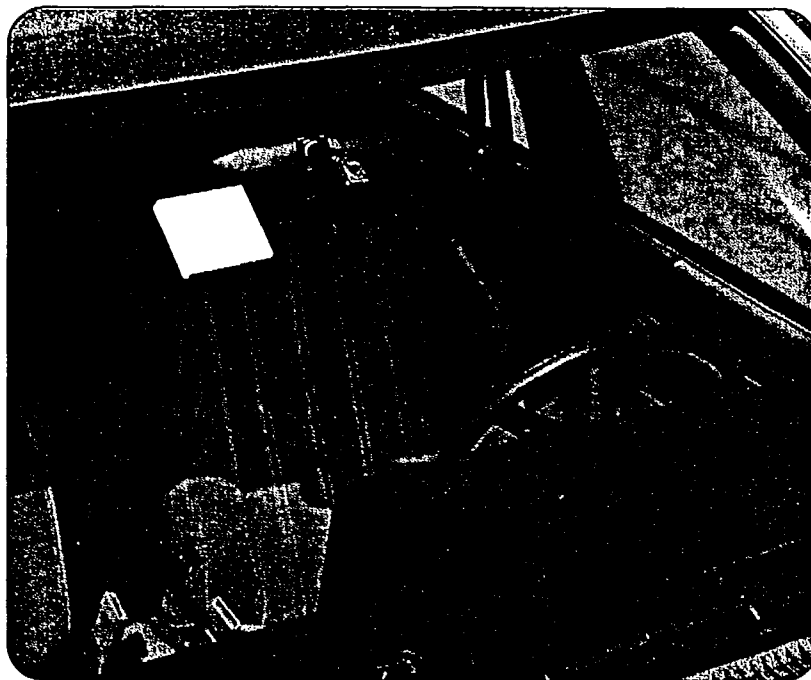
FLATPACK TRANSPONDER

The ROADCHECKTM Flatpack Transponder functions as a vehicle's short range communications device. Communication between vehicle-mounted transponders and roadside-mounted ROADCHECK readers occurs at 500 Kbits per second, permitting data transfer between the roadside and vehicles travelling at highway speeds.

ROADCHECK Flatpack Transponders are suitable for every type of vehicle and application where portability is desired. Although transponders are designed to be mounted securely on the interior surface of the vehicle's windshield, they can still be removed if required.

Installation of the Flatpack Transponder is quick and simple. Using adhesive-backed material, the transponder is easily installed in the correct position on the windshield.

The transponder is a half-duplex device which uses the same frequency and modulation scheme for both up and downlinks. Its receiver is a simple AM detector while its transmitter is a single stage on/off unit. This elegant design has consistently demonstrated excellent performance in testing and field operations.

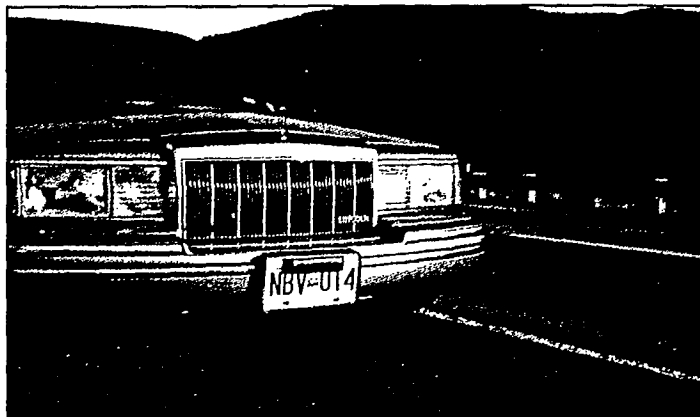


The transponder mounts on the interior surface of the windshield, maintaining a clear view of the road for the driver.

ROADCHECK's semi-active technology employs a lithium battery as the transponder's source of power, giving the transponder a minimum life of 5 years, regardless of the number of interrogations it undergoes. The transponder casing is made of durable impact-resistant molded plastic. All Mark IV transponder types have a compatible interface with ROADCHECK reader equipment and are highly suitable for Intelligent Vehicle Highway Systems (IVHS) applica-

tions such as electronic toll collection, traffic management and commercial vehicle management.

The Flatpack Transponder has "read/write" capabilities, storing both fixed, pre-programmed data as well as data added in real time as the vehicle passes a ROADCHECK reader at highway speeds. Partitioning between fixed, pre-programmed data fields and reprogrammable fields can be altered to suit the needs of the distributing



Typical license plate transponder installation.

All Mark IV Type 1, 2 and 3 transponders are compatible with ROADCHECK Readers. They can be integrated with Intelligent Vehicle Highway Systems (IVHS) applications such as confidential transaction systems, or serve as an interface between on-board computers and roadside readers. Mark IV transponders are compliant with FCC Part 15 rules and require no licensing.

For example, Type 2 transponders can hold information on the vehicle's weight compliance to permit automated preclearance for transponder equipped trucks. Type 2 transponders can also allow closed toll systems to write point of entry data directly to the transponder, enabling automated toll collection.

Location updating and traffic information can be implemented using Type 3 tags. Since these transponders can communicate with devices such as on-board computers and smartcard readers, traffic and safety notices can be transmitted to motorists while they travel. High security installations can employ frequently updated passwords and driver identification as well as automatic access.

ROADCHECK's high data rate ensures that these advanced features can be implemented while maintaining maximum system performance levels.

EXTERIOR TRANSPONDER SPECIFICATIONS

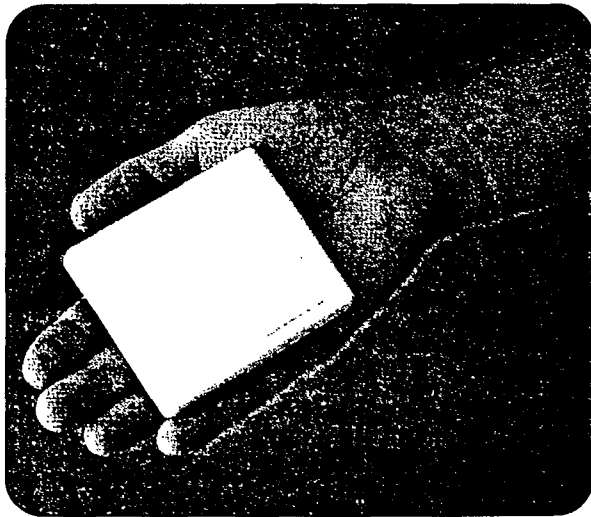
| | |
|---------------------------------------|---|
| | 198mm long x 45mm wide x 22mm high (apx 7.78" x 1.75" x .84") |
| | 128 or 256 |
| | Manchester keyed carrier |
| | 16 bit Cyclic Redundancy Check (CRC) |
| | 500Kbits ±10% per second |
| | 915 MHz (nominal) |
| | 915 MHz (nominal) |
| | 1mW (nominal) |
| | -40° to +70° C (-40°F to +160°F) |
| | 140g (5 oz) |
| 10 years (no external power required) | |
| Miniature lithium battery | |

Distributed by:

6020 Ambler Drive, Mississauga, Ontario, Canada L4W 2P1
 (905) 624-3025 • fax (905) 624-4572

MARK IV IVHS is committed to the continuous improvement of its products and therefore reserves the right to vary from the specifications contained on this sheet without notice.

Revised: 1995-01-10



ROADCHECK™ Flatpack Transponder: This compact transponder can be installed on any kind of vehicle quickly and easily.

agency. Closed toll systems can write variable point of entry data into the transponder for subsequent toll payment calculations. Commercial vehicle operators can program vehicle load status information, vehicle maintenance and safety inspection dues dates, or other time sensitive data to improve their operational efficiency.

A combination of Mark IV transponders may be employed in a common system to enhance functionality while maintaining the lowest possible cost. Controlled access compounds can use frequently updated passwords and electronic driver identification to enable highly secure, automatic vehicle entries and exits.

ROADCHECK's high data rate ensures that these advanced features can be implemented while maintaining maximum system performance levels.

FLATPACK TRANSPONDER SPECIFICATIONS

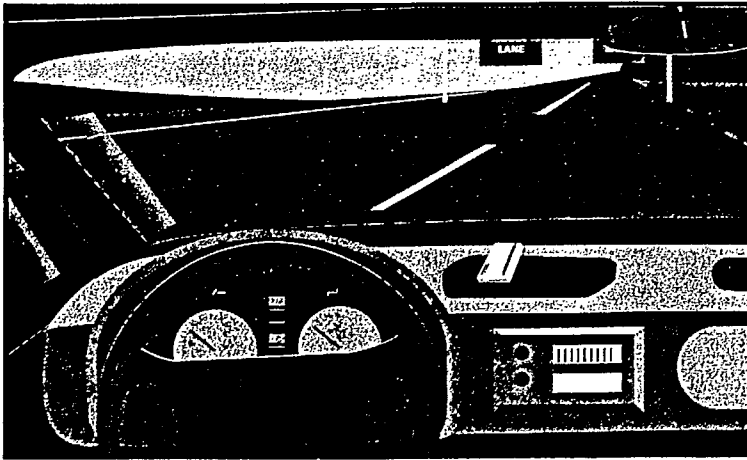
| | |
|--|--|
| | 3.5" wide x 3" high x 0.5" deep (89mm x 76mm x 13mm) |
| | 2.5 oz (70g) |
| | 256 bits |
| | Manchester keyed carrier |
| | 16 bit Cyclic Redundancy Check (CRC) |
| | 500Kbits ±10% per second |
| | 915 MHz (nominal) |
| | 915 MHz (nominal) |
| | 1mW (nominal) |
| | -40° to +70° C (-40°F to +160°F) |
| | 5 years (no external power required) |
| | Internal lithium battery |

6020 Ambler Drive, Mississauga, Ontario, Canada L4W 2P1
 (905) 624-3025 • fax (905) 624-4572

MARK IV IVHS is committed to the continuous improvement of its products and therefore reserves the right to vary from the specifications contained on this sheet without notice.

Distributed by:

© 1994 IVHS Corporation. All rights reserved.



Typical dashboard installation of the ROADCHECK Interior Transponder

For example, TYPE II transponders can hold information on the vehicle's load status: dangerous goods can be monitored to ensure compliance with restricted zone regulations. Closed toll systems can write point of entry data into the transponder.

Credit accounts can also be stored on TYPE II tags, allowing customers to verify charges.

Location updating, traffic information and other advanced IVHS functions can be implemented using TYPE III tags. Since these transponders can communicate with devices such as on board computers and smartcard readers, traffic and safety notices can be transmitted directly to motorists. High security and limited access installations can use frequently updated passwords and driver identification, as well as automatic access.

ROADCHECK's high data rate ensures that these advanced features can be implemented while maintaining maximum system performance levels.

Interior Transponder Specifications

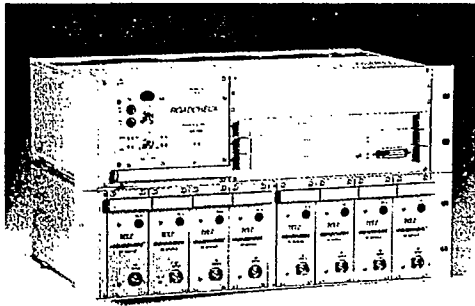
| | |
|------------------------------|--------------------------------------|
| Number of data bits: | 128 |
| Data format: | Manchester keyed carrier |
| Error checking: | 16 bit Cyclic Redundancy Check (CRC) |
| Data rate: | 500Kbits \pm 10% per second |
| Data frequency: | 915 MHz (nominal) |
| Trigger frequency: | 915 MHz (nominal) |
| Mean radiated power: | 1mW |
| Operating temperature range: | -40° to +70° C (-40°F to +160°F) |
| Service life: | 5 years (no external power required) |
| Power source: | Miniature internal lithium battery |

Distributed by:

6020 Ambler Drive, Mississauga, Ontario, Canada L4W 2P1
(416) 624-3025 • fax (416) 624-4572

(As of October 1993 the area code changes to 905)

MARK IV IVHS is committed to the continuous improvement of its products and therefore reserves the right to vary from the specifications contained on this sheet without notice.



Full RF Rack beneath Standard ROADCHECK Reader
 The RF modules slide into a rack under the reader unit.
 Each reader can handle up to 8 modules.

OVERHEAD ANTENNA

This ruggedized yagi antenna is made of gold anodized aluminum rod and seamless drawn pipe. The internal balun, coax feed and connectors are sealed in foam potting to prevent moisture penetration. The antenna is installed on a suitable overhead or road-side structure using stainless steel fasteners.

IN-PAVEMENT ANTENNA

The lane-wide flexible collinear antenna is inserted into a housing installed in a shallow slot cut in the road surface. The housing is made of a durable, shock-resistant polyurethane material designed to cushion the antenna cable from road stress.

PATCH ANTENNA

Used for mass transit and special applications, this antenna can be installed on a vehicle. The antenna receives information from the MARK IV ground-fixed transponders it passes.

LANE KIT SPECIFICATIONS

RF MODULE

| | |
|------------------------------|---|
| Dimensions: | 229mm long x 51mm wide x 127mm high (apx. 9" x 2" x 5") |
| Operating temperature range: | -40° to +70° C (-40°F to +160°F) |
| Weight: | 1.675 kg (apx. 3.7 lbs) |

IN-PAVEMENT ANTENNA

| | |
|-----------------------------|---|
| Antenna housing dimensions: | 3.7m long* x 76mm wide x 51mm high (apx. 12' x 3" x 2") |
| Power density: | 100 μW/sq. cm at the antenna surface. |
| Mounting: | Sealed into a shallow slot cut in the surface of the roadway. |

**Other lengths are available.*

OVERHEAD ANTENNA

| | |
|---------------------|---|
| Dimensions: | 60mm long x 18mm wide (apx. 2.3" x 18") |
| Input power rating: | 100 W |
| Weight: | 1.5 kg (apx. 3.25 lbs) |
| Mounting: | Attaches to a pipe or mast with maximum O.D. of 60mm (apx. 2.37") |

PATCH ANTENNA

| | |
|----------------------|--|
| Dimensions: | 197mm long x 117mm wide x 57mm high (apx. 7.75" x 4.62" x 2.25") |
| Average input power: | 100 mW |
| Weight: | 0.6 kg (apx. 1.3 lbs) |

Distributed by:

6020 Ambler Drive, Mississauga, Ontario, Canada L4W 2P1
 (416) 624-3025 • fax (416) 624-4572

(As of October 1993 the area code changes to 905)

MARK IV THIS is committed to the continuous improvement of its products and therefore reserves the right to vary from the specifications contained on this sheet without notice.

Business Wire

09/08/94 08:44

**Mark IV to supply toll collection equipment for Highway 407;
the first all-electronic toll road in North America**

AMHERST, N.Y.--(BUSINESS WIRE)--Sept. 8, 1994--Mark IV Industries, Inc. (NYSE:IV) today announced that its IVHS division is a member of a consortium of companies selected to provide an automated toll collection system for Highway 407 in Toronto, Ontario, Canada. This selection is conditional upon successful completion of contract negotiations with the Ontario Transportation Capital Corporation and Canadian Highways International Corp.

The consortium, which also includes Bell Canada of Toronto, Bell Sygma of Don Mills and Hughes Aircraft of Canada Ltd., will supply both hardware and software for the new highway -- the first all-electronic toll road to be built in North America. The new highway system will eliminate the need for toll plazas, along with the traffic congestion normally associated with them. Mark IV will provide fixed-installation roadside readers and variable message signs supplied by the consortium for the highway, along with vehicular-mounted transponders, which transmit and receive data necessary for processing toll charges and other information. While construction of the 69 kilometer highway has already begun, the project will not impact Mark IV's results of operations in the current fiscal year, but will begin to have an effect in the company's fiscal 1996 year (calendar 1995).

Mark IV's selection for the Highway 407 project follows the March 1994 selection of the company's technology and equipment by the Interagency Group (IAG), a combination of the seven major toll agencies of the states of New York, New Jersey, and Pennsylvania, for a compatible and integrated toll collection system for that region.

Sal H. Alfiero, chairman and chief executive officer of Mark IV, said, "We are excited and pleased to have been chosen to supply our equipment for Highway 407. Mark IV's inclusion in this project is particularly significant in that it can provide technical compatibility between the Northeastern toll operations of the United States and the new Canadian toll systems. This compatibility can ensure that, upon completion of appropriate cross-jurisdictional agreements, private and commercial users on both sides of the border can enjoy the convenience of electronic toll collection internationally. This project also creates the opportunity to implement compatible automated border crossings, resulting in significant savings to both economies, and further enhancing the world's largest trading relationship."

Mark IV Industries, Inc., located in the Buffalo suburb of Amherst, New York, manufactures products and systems for Power and Fluid Transfer; Transportation; and Professional Audio markets.

CONTACT: Mark IV Industries, Inc., Amherst

Sharlene Vogler, 716/689-4972

INTERGRAPH CANADA
Mississauga, Ontario

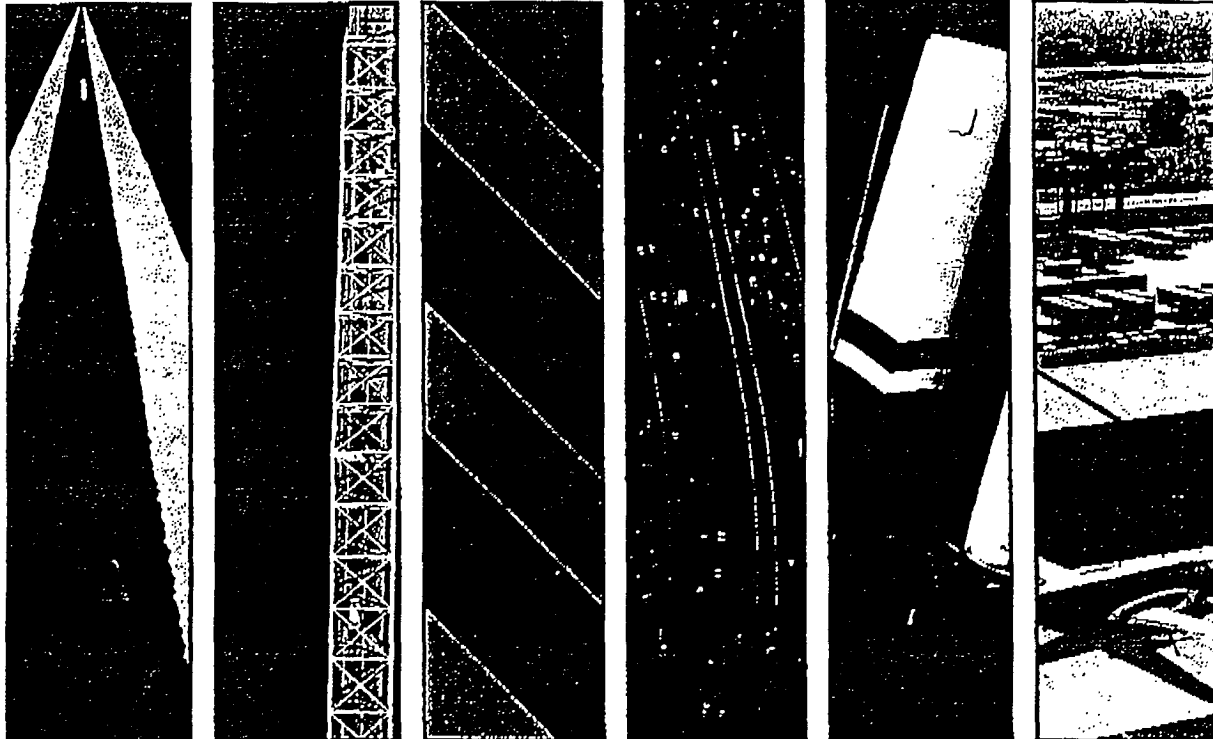
Geographic Information System (GIS) Mapping
Highway Design
Transportation Management Systems

**Systems environment provides single interface to safety,
bridge, pavement, environmental G.I.S and other types of data.**

A partner of 40 state departments of transportation.

Intergraph's Transportation Management Systems Environment

Infrastructure Management Through Integrated Information Systems

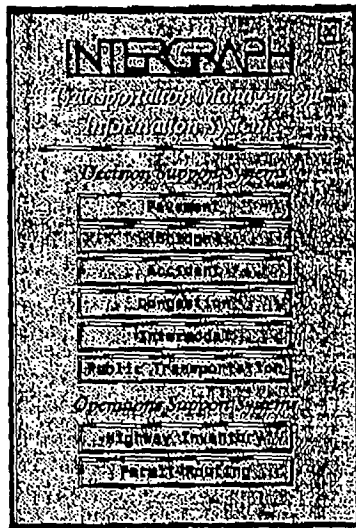


INTERGRAPH

Managing the nation's vital transportation infrastructure places a heavy burden on state and local transportation agencies to make efficient use of limited funds. Safety, environmental, and economic interests must be considered while maintaining and improving highways and bridges as well as designing and building new roads and structures. The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 mandates the implementation of formal transportation management systems to streamline workflows and contains the promise of federal matching grants in return.

The strategic and efficient use of maps, inspection reports, traffic statistics, property records, survey and engineering data, and other information is essential for efficient infrastructure management. This information provides tools for day-to-day operations and strategic direction for business decisions and long-term planning.

Intergraph, a partner of 40 state departments of transportation, can integrate heterogeneous data management systems and provide efficient access to information across an organization. Our transportation management systems environment provides a single interface to safety, bridge, pavement, environmental, geographic information system (GIS), and other types of data. This comprehensive environment incorporates features optimized for each ISTEA-mandated transportation management system, including pavement, bridge, safety, congestion, public transit, and intermodal.



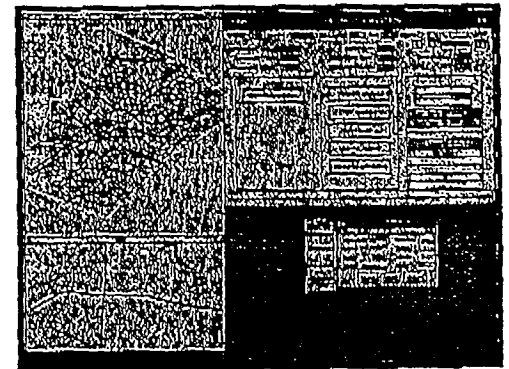
Pavement



Intergraph's transportation management systems environment integrates customers' existing systems, including those created to meet the earliest ISTEA requirements for pavement management systems. Our solution also incorporates pavement history and records management systems and accepts existing digital mapping

data and central mainframe repositories of transportation data. Accessing your existing systems through Intergraph's configurable graphical interface allows users to easily locate, access, and distribute information right from the desktop.

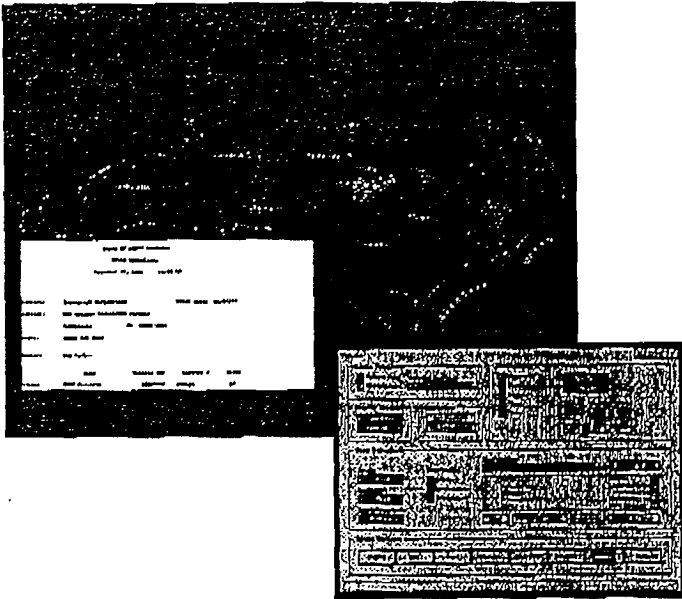
Utilizing GIS technology, our solution adds value to data by making it possible for users to view data graphically. Geographic data are integrally tied to a continuous, intelligent basemap to provide a foundation for graphical display, analysis, and validation of the data. Network and spatial analysis capabilities add intelligence to the data and clarify the impact, allowing quick determination of the location and severity of problems. Dynamic segmentation capabilities allow engineers and planners to analyze features that vary over the length of the transportation network, such as speed limits, lane width, average daily traffic, and surface type. These capabilities provide many benefits, including quick assessment of paving costs and estimates of pavement deterioration.



Additional Technologies

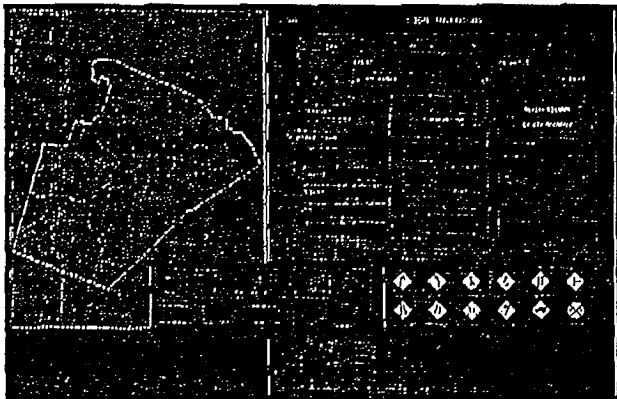
Permit routing

Using criteria provided at permit routing terminals through a customizable user interface, the Intergraph solution can provide specific instructions on optimal routes and produce a hardcopy map. Routes can be determined by criteria such as minimum distance, travel cost, number of turns or intersections, and travel time.



Highway inventory

Our advanced highway inventory technology incorporates video logging for visual validation of database information. Dynamic interaction between video images and the map display enables users to tag signs, markers, and other features on the map to display visual images of the corresponding area along the highway. Video display of a frame containing a particular sign will automatically display the database information for that sign and highlight its location on the map. Optical storage of video images provides fast retrieval and optimized storage.



The Only Source You Need

Intergraph isn't a new name to the transportation industry. We are its leading provider of computer-aided engineering solutions. Forty state departments of transportation have turned to us for GIS, highway design, and information management systems. Our comprehensive transportation management systems environment adds value to these existing systems by utilizing the data they create and store. And our solution can expand as your needs grow.

While other vendors are offering point solutions, Intergraph is providing a total systems solution. Our environment incorporates functionality from data capture and document management to the creation of high-quality plots and reports.

Intergraph solutions incorporate your existing investments in computer technology, actually increasing their value by helping you utilize them more efficiently. And Intergraph can provide the hardware, software, and services necessary to optimize the solution for your unique needs.

All it takes is one call to put you on the path to a solution that fits all your needs, today and down the road.

And you thought we were only a CADD vendor.

MGE VistaMap

Integrating MGE and multimedia

Product number SJBX428AC-0100A

MGE VistaMap is an intuitive geographical data viewing product for the Modular GIS Environment (MGE). MGE VistaMap provides a window to the corporate spatial database for a broad audience of users needing access to geographic data. The software also integrates multimedia and GIS, offering a low-cost multimedia viewing system.



MGE VistaMap's intuitive interface enables users to easily view geographic data.

The product's object-oriented design supports the Microsoft Windows 3.1 environment. The software is so easy to use, anyone can operate the system without any previous GIS experience. For example, municipalities can use the software with public terminals, providing users an easy way to access land information.

Multimedia

MGE VistaMap integrates MGE and multimedia by associating video, sound, and images with geographical data features. These files are accessed (played or viewed) when features appearing on the screen are selected. MGE VistaMap's multimedia capability provides users a comprehensive, cost-effective tool for viewing and analyzing data.

Raster backdrop

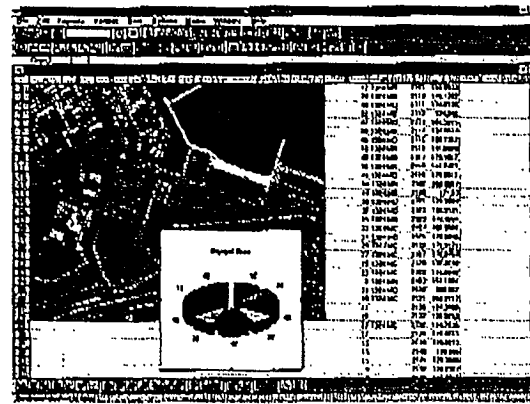
One differentiating point of MGE VistaMap is the geographic *intelligence* in the raster background image, or GeoCanvas. The GeoCanvas can be any map, aerial photo, or satellite image stored on hard disk or CD. The GeoCanvas provides a geographically intelligent raster backdrop on which to display vector data. For example, spatially referenced vector lines can be displayed over a raster backdrop depicting a section of highway.

Redlining

MGE VistaMap's redlining capability provides a means for marking and making notations within a view. Technical managers can use this option to comment on data features, efficiently sharing information throughout an organization.

Office automation tools

MGE VistaMap integrates with office automation tools like Microsoft Word and Excel. This integration feature lets users easily incorporate MGE data into reports, charts, and diagrams.



MGE VistaMap integrates geographic data with standard office automation tools.

INTERGRAPH

Sessions and queries

MGE VistaMap enables users to access data through customized sessions and queries. The active view, for instance, can be saved as a session, allowing it and all related attributes to be reopened. A query provides users an easy means for accessing features and attributes in the database. MGE VistaMap's session and query functionality automates repetitive tasks, making the process of viewing geographic data more efficient.

Features and benefits

- Video, sound, and image capability
 - Integrates GIS and multimedia
- Microsoft Windows based application
 - Reduces training time for new users
 - Provides easy viewing of MGE data
- User-defined viewing sessions
 - Quickly recall prior work to the screen
 - Automate repetitive queries and sessions
- User-defined MGE database queries
 - Efficiently access features and attributes across the network
- GeoCanvas functionality
 - Provides geographic intelligence
 - Offers a raster backdrop on which to display vector data
- Redlining capability
 - Allows users to mark and make notations on data appearing on the screen
- Intel-based PC compatibility
 - Uses existing hardware and software
- Office automation integration
 - Shares geographic data with word processors and spreadsheets
 - Offers efficient way to place MGE data into reports, charts, and diagrams

Applications

- Parcel mapping
- Energy exploration and production
- Transportation planning and maintenance
- Land records information management
- Tax assessment
- Environmental resource management
- Executive management data viewing
- Municipal counter query

Software requirements

- Microsoft Windows 3.1 or Windows NT
- Access to MGE project database
- RIS server software

Hardware requirements

- Intel 386-based PC or later
(math coprocessor not required)
- Eight megabytes RAM
- Fifteen megabytes disk space

For more information or a demonstration, call:

| | |
|--------------|---------------|
| U.S. | 800-345-4856 |
| Asia-Pacific | 852-8933621 |
| Canada | 403-569-5559 |
| Europe | 31-2503-66333 |
| Middle East | 971-4-367555 |
| Other areas | 205-730-2700 |

Or contact an Intergraph representative.

Intergraph, the Intergraph logo, and RIS are registered trademarks of Intergraph Corporation. Other brands and product names are trademarks of their respective owners.

Intergraph believes the information in this publication is accurate as of its publication date. Such information is subject to change without notice. Intergraph is not responsible for inadvertent errors. Copyright 1994 Intergraph Corporation, Huntsville, AL 35894-0001. Printed in USA.

INTERGRAPH

RESEARCH IN MOTION (RIM)

Waterloo, Ontario

Products:

- Products are used to link mobile data users with cellular data communications networks.
- RIMGate: Interfaces to standalone host PC running custom traffic monitoring software.

Integrated and specialty wireless terminals:

- Integrated and custom terminals for credit authorizations, one and two-way messaging, global positioning and bar code reading.



Technology Business Park
180 Columbia Street West
Waterloo, Ontario
Canada N2L 3L3

Phone: (519) 888-7465 Fax: (519) 888-6906

Company Background

Research In Motion is a world leader in product and service solutions to the emerging wireless computing industry, and specifically for the Mobitex technology.

Ericsson and Swedish Telecom have developed a world-leading digital cellular radio technology called Mobitex. Mobitex is used for packet-switched digital data communications. RIM has been working with Mobitex since 1988, longer than any company in the world outside Scandinavia.

Mobitex networks are installed in countries such as the United States, United Kingdom, Canada, Sweden, France, Netherlands, Finland, Australia, Chile, Norway, and Mexico. Networks currently being established are located in Singapore, Germany and Venezuela.

RIM was founded in 1984 to provide hardware and software solutions for communications systems. RIM's success came from providing complete electronics design, software development, PCB layout, prototyping and manufacturing for various communications systems.

RIM's Mobitex technology is being used by the leaders of the wireless computing industry. Companies such as AT&T, Bell South, France Telecom, Rogers Cantel, Ericsson, Intel, MCI, Lotus and Microsoft have all adopted RIM's hardware and/or software.

RIM has focused its business on providing products and services in four areas:

- Wireless Communications Strategy and Implementation Consulting
- Standard Wireless Modem Technology
- Host Gateway (routing) Solutions Software
- Integrated and Specialty Wireless Terminals

Products and Services

Wireless Communications Strategy and Implementation Consulting

Before making important decisions relating to the selection and implementation of a wireless strategy, it is critical that the decision-maker is aware of all of the various alternatives available and their attendant attributes. RIM provides comprehensive advisory services on to those making these decisions.

Standard Wireless Modem Technology

RIM provides to the wireless marketplace, world-standard AT & X.28 modem technology. Current partners include Ericsson (Mobidem-AT & X.28) and Intel (Intel Wireless Modem). RIM developed the Hayes-PAD, X.28, MTP/1 and MCP/1 protocols used in the wireless modems and provides on-going support and maintenance.

Host Gateway Routing Software

The RIMGate software provides a data communication bridge between the wireless network and a host service. The communications choices include standard X.25 and PSTN.

The radio communication protocols inside the wireless modems also inside the RIMGate. This guarantees 100% compatibility with the industry standard Ericsson and Intel radio modems.

Integrated Wireless Terminals

RIM offers a number of integrated and custom terminals for wireless communications. Terminals are modular in design so that features may be integrated to meet the need of the particular application. Features options include: credit/debit card authorization, paging, two-way messaging, global positioning, printing, and bar-code reading.

RIMGate features included

- Full-screen monitoring of each active session including MAN number, name of host connection and packet transfer information.
- Remote scripting language (TERS) saves time by reducing the number of packets transmitted over the network.
- Gateway management tools such as MPAK logs, error logs and accounting logs help monitor system activity.
- Host initiated calls can be made to a mobile terminal.
- The RIMGate is 100% compatible with the Intel and Ericsson AT-compatible radio modems having total MTP 1 and MCP 1 compatibility.
- Three different internal compression methods (V.42 bis, run length encoding and table lookup) save money and improve performance by reducing the number of packets transmitted over the network.
- A "pass-through" mode is available for MASC applications.
- RIMGate uses the X.25 network adapters manufactured by Eicon Technology. These products are available from RIM or a local Eicon distributor.
- Support for up to 64 simultaneous users per RIMGate.
- Support for multiple X.25 channels allows physical connections to multiple hosts or multiple MOX ports simultaneously.
- As of December 1993, the software is available for MS-DOS based PCs and will soon be available for Windows, OS-2, Unix and Windows NT.

RMF features included

- Automatically receive "I am alive" messages from any number of remote RIMGates.
- Continuously receive updated console activity screens from a remote RIMGate.
- Retrieve remote files such as MPAK, accounting and error logs.
- Send new configuration or executable files to a remote RIMGate.
- Modify the configuration of a remote RIMGate.
- Send commands such as session close, reboot or re-configure to a remote RIMGate.
- Password protection on each RIMGate.
- Communication to a RIMGate is via X.25 or Mobitex.
- As of December 1993, RMF is available for Microsoft Windows. The software requires a 486 33Mhz PC. Support for other environments (such as Windows NT, Unix and OS 2) are planned for 1994.
- Normally the RMF software would be running on a computer located in close proximity to the Network Control Center, however it could be located anywhere that X.25 or Mobitex coverage exists. This permits access to RIMGates located on different Mobitex networks.

TERS - Time Efficient Remote Scripting

One of the most powerful features of the RIMGate is the scripting language called TERS - Time Efficient Remote Scripting. TERS provides a method to dramatically improve the efficiency of communications between the remote mobile computer and the host computer.

A series of TERS commands will cause the RIMGate to filter the data transmitted by the host and transmit data back to the host in response to specific information detected in the data stream.

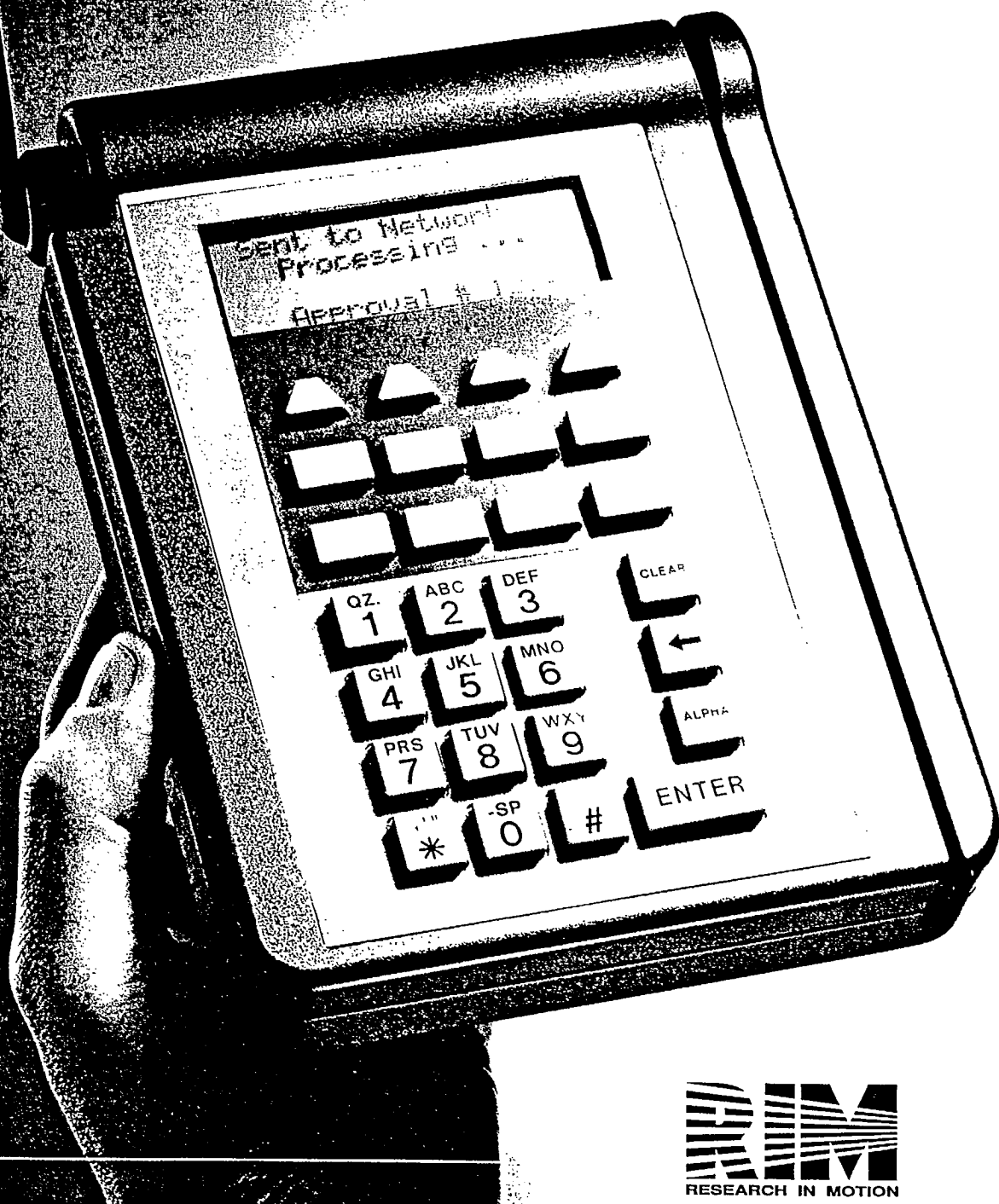


**Technology Business Park
180 Columbia St. West,
Waterloo, Ontario
Canada N2L 3L3**

**Tel: (519) 888-7465
Fax: (519) 888-6906**

M P T

Portable Terminal



MPT Portable Terminal

The MPT is a hand-held Mobitex compatible terminal with complete support for wireless credit card and debit card authorization. The MPT can be used in a wide range of point of sale situations such as retail sales, delivery, and transportation.

Designed for fixed or mobile use, the MPT is fully programmable and can be customized for special applications such as two-way paging, transportation dispatch notices, inventory control, field data-acquisition and GPS.

Features include

- Magnetic card reader (tracks 1 and 2 or tracks 2 and 3 simultaneously).
- Four line by twenty character back-lit LCD display.
- Telephone-style numeric keypad with three dedicated transaction keys.
- Four function keys point to on-screen software-controlled commands.
- Eight programmable function keys.
- Three interface ports:
 - Two RS-232 interfaces for printer, bar-code wand, separate keypad, cash register connection, or reprogramming.
 - One RS-485 interface for networked operation so that multiple terminals can share the radio modem of a single MPT.
- Application software is stored in Flash memory for easy software upgrades.
- Application data and set-up information is stored in non-volatile memory.
- Audible tone generator.
- Real-time clock.
- Rechargeable battery with built-in recharging circuitry.
- Power management circuitry allows mobile operation for an entire day.
- The terminal can be used while the batteries are being charged.
- Operates from a standard 12 VDC unregulated power supply.
- Dimensions: (5.75in. x 7.75in. x 1.5in.) (14.5cm x 19.5cm x 4cm).
- Rugged injection molded plastic case.
- Weight: 1.75 pounds / 0.8 kg.
- Model 190 for the North American 900 MHz band and Model 140 for the 400 MHz band.



Technology Business Park
180 Columbia St. West,
Waterloo, Ontario
Canada N2L 3L3

Tel: (519) 888-7465
Fax: (519) 888-6906

*Mobitex is a trademark of the
Swedish Telecommunications Administration*

*Printed in Canada
Design by Design Communications*

The Financial Post Magazine

March 1994

Top 25 Up-and-Coming Technology Companies

by Shelley Burke, The Bramhall Consulting Group

Canada continues to provide the world with leading-edge technologies and creative innovations in the software and professional services marketplaces.

In addition to the top revenue-generating companies included in the "Bramhall Top" listings, 25 Canadian companies have been selected as personifying the dynamic nature of Canadian companies in these fields.

Hundreds of such Canadian companies were recommended by a variety of sources, including federal and provincial governments, local and regional economic development organizations, national and regional industry associations and our in-house experts.

These companies were then short-listed by a panel who attempted to choose innovative new companies and existing companies that had significantly redirected their activities into emerging areas.

The following is a brief glimpse into the various areas in which Canadian firms are making a name for themselves internationally.

Research In Motion (RIM), a Waterloo, Ontario based company, has strategically positioned itself in the fast-emerging wireless computing industry by providing connectivity solutions for this market. RIM software controls the radio modems sold by Intel and Ericsson internationally.

The company's innovative debit and credit card authorization products function without the restriction of a telephone line.

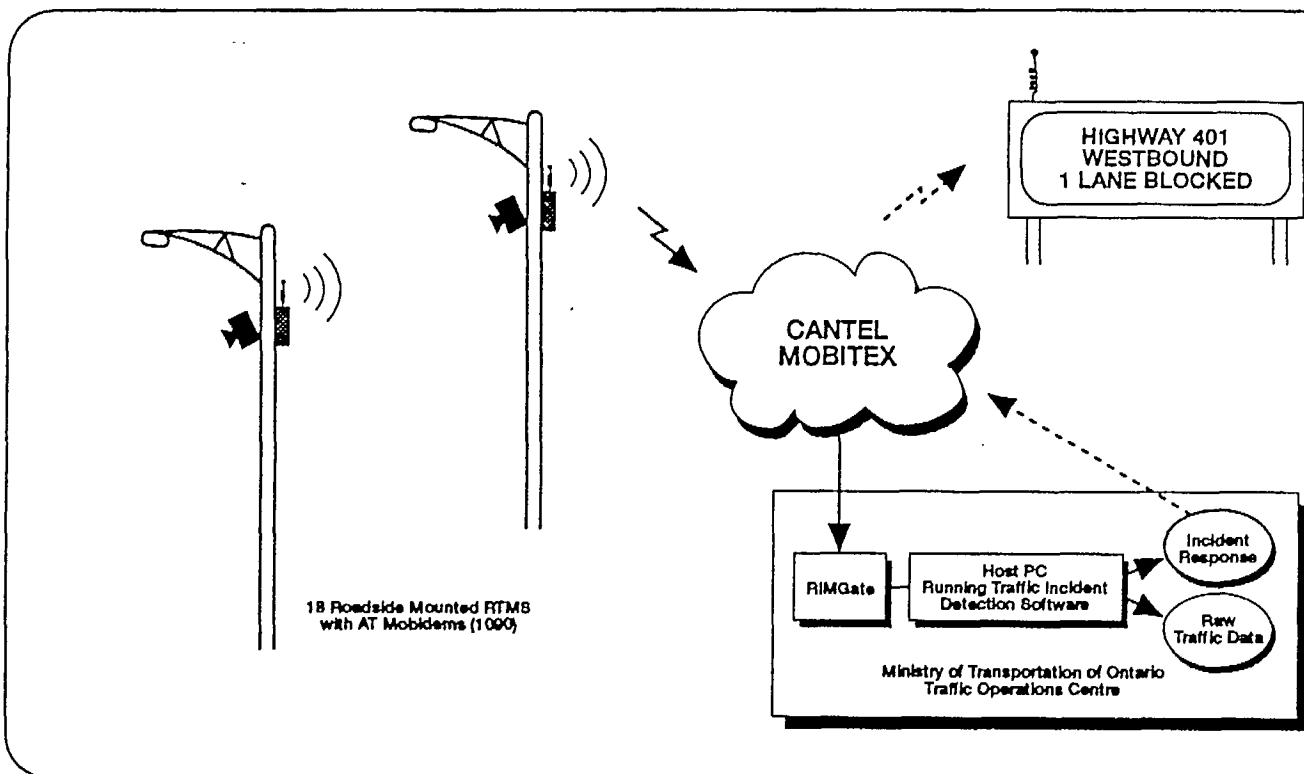
RTMS INCIDENT DETECTION SYSTEM DEMONSTRATION PROJECT

IBI Group has implemented a **Remote Traffic Microwave Sensor (RTMS) incident detection system** for the **Ministry of Transportation of Ontario** along a 4km segment of Toronto's Highway 401. The system automatically monitors traffic flow conditions along the freeway corridor and alerts operators in the event of traffic congestion due to accidents and disabled vehicles.

The demonstration project employs the RTMS vehicle sensor as designed and manufactured by **Electronic Integrated Systems Incorporated**. This device is a low cost, self contained microwave sensor for monitoring traffic volume, speed, and occupancy for intersections and freeways. It monitors multiple lanes from roadside mounting locations, allowing easy and safe installation without traffic disruption. An **Ericsson AT Mobidem** is installed alongside each sensor in order to communicate via the

Cantel Mobitex digital data network to a PC running **Research in Motion's RIMGate**. The RIMGate interfaces a standalone host PC running custom traffic monitoring application software which includes an automatic incident detection algorithm originating from **McMaster University** in Hamilton, Canada. Traffic incident information can be conveyed to motorists using roadside electronic variable message signs.

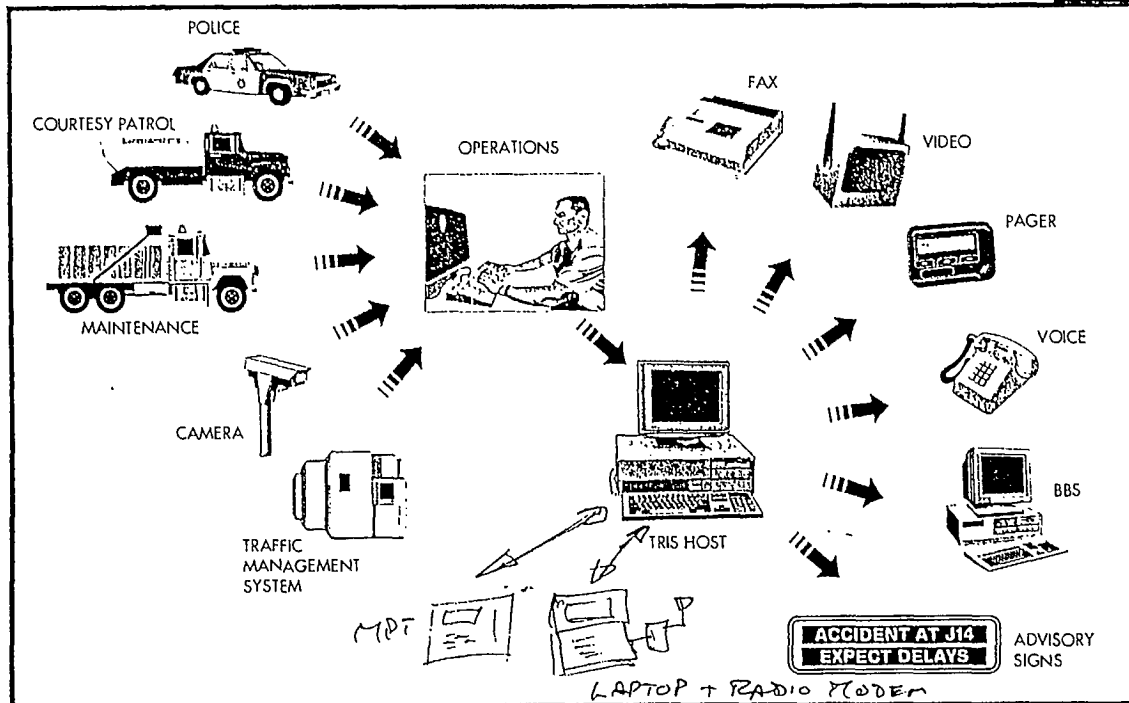
The field sensors and communications were implemented over a period of three months. The Ministry of Transportation is evaluating the performance of the demonstration system as compared to its conventional inductive loop based traffic monitoring system communicating over dedicated field plant. The RTMS incident detection system offers readily deployable comparable detection performance without the system infrastructure costs associated with conventional means of traffic monitoring.



C O N T A C T

Mr. Kevin Bebenek, IBI Group 230 Richmond Street West, 5th Floor, Toronto, Ontario M5V 1V6 (416) 596-1930 Fax (416) 596-0644

Traffic & Road Information System



IBI Group conceived, developed, implemented, and is continuing to enhance the Traffic & Road Information System (TRIS). TRIS improves the utilization of roads by collecting, managing, and then disseminating to users of the roads accurate and up-to-date information about traffic events and road conditions.

TRIS is transportable: it can be readily implemented in any roads authority - national, regional, local - around the world.

TRIS is modular: its elements can be fitted together in any combination; that is, in any given implementation, any or all of the output technologies can be used.

TRIS is extendible: it can support new input or output technologies in a simple, consistent manner.

TRIS is reliable: the operation of any one input or output device does not affect the operation of any other device or of the system as a whole.

TRIS is affordable: it offers the functionality of a non-instrumented advanced traffic management system at a fraction of a full system's cost.

TRIS is a readily deployable, proven system: it is used by the roads authority that manages 11,000 lane-miles of highways, including North America's second busiest highway; its output is used by postal authorities, courier companies, passenger-bus operators, and media outlets.

IVHS FUNCTIONS



LOCATION
Toronto, Ontario

CLIENT
Various

PROJECT BUDGET
\$1 million

IBI
GROUP

MOBILE WORKSTATION PROJECT PILOT IMPLEMENTATION

The Ministry of the Solicitor General & Correctional Services of Ontario is piloting the implementation of fully functioning personal computers ("workstations"), including printers, in the cruisers of several police services in Canada's most populous province. These workstations will communicate with computer-aided dispatch systems and databases of driver and vehicle information and offenses and offender information through public wireless networks.

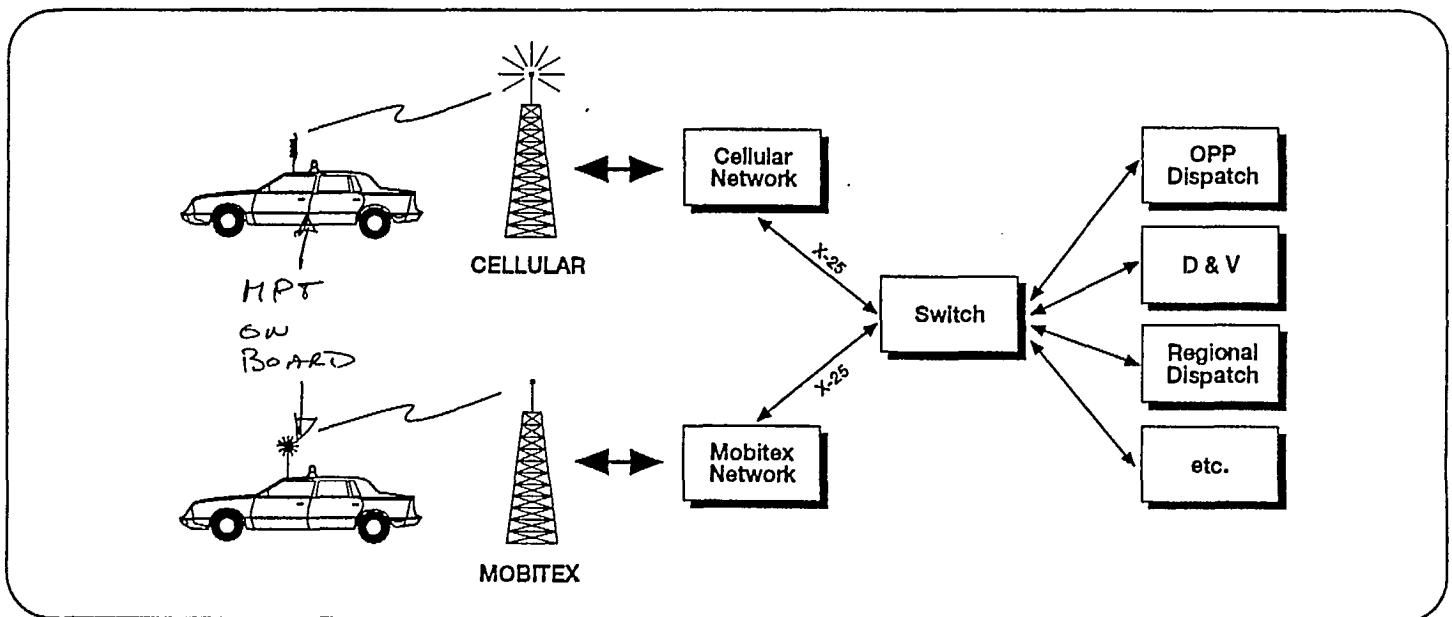
The work involves:

- selecting an industry-standard personal computer that meets the police services' rigorous environmental and functional requirements;
- selecting and testing printers that meet similar requirements;
- integrating into a mobile client environment what have, up to this time, been non-mobile applications;
- designing and upgrading the public wireless network connections (through Cantel's Mobitex packet-switched data service and Cantel's circuit-switched cellular telephone service);

- installing and validating a complex wireless-to-wireline switch at the Ontario Provincial Police General Headquarters to route communications between the mobile clients and groundside servers.

The prime contractor for this work is **Rogers Cantel Mobile Incorporated**. For Cantel, **IBI Group** has four roles:

- overall project manager, responsible for co-ordinating activities of both Cantel and its partners in this project, and with representing the consortium to the Ministry, on both technical and management issues;
- overall system integrator, responsible for end-to-end integration and testing of the mobile workstations;
- provision of hands-on training; and
- operation of the consortium's 24-hour Help Desk.



CONTACT

Mr. Richard Nelson, IBI Group 230 Richmond Street West, 5th Floor, Toronto, Ontario M5V 1V6 (416) 596-1930 Fax (416) 596-0644

IBI
GROUP

ABL CANADA INC.
Montreal, Quebec

- **Digital-switched video highway surveillance system**
- **VT34A 34Mb/s video encoders, at cameras along the highway**
- **VT34A 34Mb/s video decoders, at Regional and National Headquarters**
- **SW1616E Broadband switched at Regional Headquarters**
- **Features UNIX software controllers AT2 Audio Codecs**
- **Customers in North America and Europe**



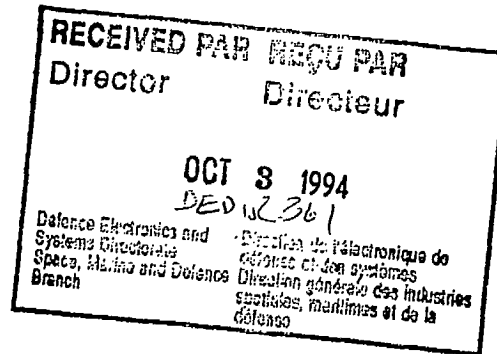
Technologies multimédias interactives

ABL CANADA INC.
8550, Côte-de-Liesse
St-Laurent (Québec)
Canada H4T 1H2

Tél. : (514) 344-5432
Télec. : (514) 344-5439

September 28, 1994

Mr. C.G. Oldridge
Defence Electronics Directorate
Defence Electronics and Space Branch
Industry, Science and Technology Canada
235 Queen Street, O6E
Room 635A
Ottawa, Ontario
K1A 0H5



Dear Mr. Oldridge:

Further to our telephone conversation, please find enclosed two information packages concerning ABL and our products.

ABL Canada Inc. is a publicly-listed Canadian company and our international headquarters, along with R&D and manufacturing are located in Montreal. We also have a manufacturing, engineering, and support facility in Cleveland, Ohio.

Historically, ABL's products have been in the broadband digital video communications market where we have acquired a solid video expertise with broadcasters and their carriers. For this market, we manufacture a very flexible video switch as well as a complete line of video codecs ranging in transmission speed from 140 mb/s to 22mb/s depending on the particular application requirements. ABL also manufactures a Sonet OC-1 fiber multiplexer which is sold to telephone companies.

Our newest video codec is targeted to narrowband applications such as video conferencing, corporate training and video surveillance all of which have a requirement to connect through the public switched network (such as ISDN or Centrex Data). This narrowband codec is fully compliant with the CCITT H.320 international video conferencing standard. It is point-to-point and multipoint compatible and is designed to interface to currently available multipoint control units and bridges.



Page 2

Mr. C.G. Oldridge
Industry, Science and Technology Canada

Our core compression engine consists of a single card and is based on four highly-integrated state-of-the art VLSI chips. The card is sold either as a self-contained codec (product name VT2C) which is used for conference rooms or rollabout applications or alternatively, as a PC add-in card for desktop video conferencing (product name InterDesk) or for customer-specific application development.

Our codec card is also offered with an optional Multimedia Software Development Kit (MM-SDK). This tool kit has been designed for programmers developing applications (such as video surveillance, training, video mail etc.) with our Multimedia Application Programming Interface (MM-API). The key components of the MM-SDK are a complete MM-API programming documentation, sample C++ source code, interactive debugger and complete access to ABL drivers.

We would be pleased to receive you at our Montreal location for a demonstration of our products and perhaps a tour of our R&D and Production facilities. In the meantime, please feel free to contact me at any time if you would like any further information regarding ABL or our products.

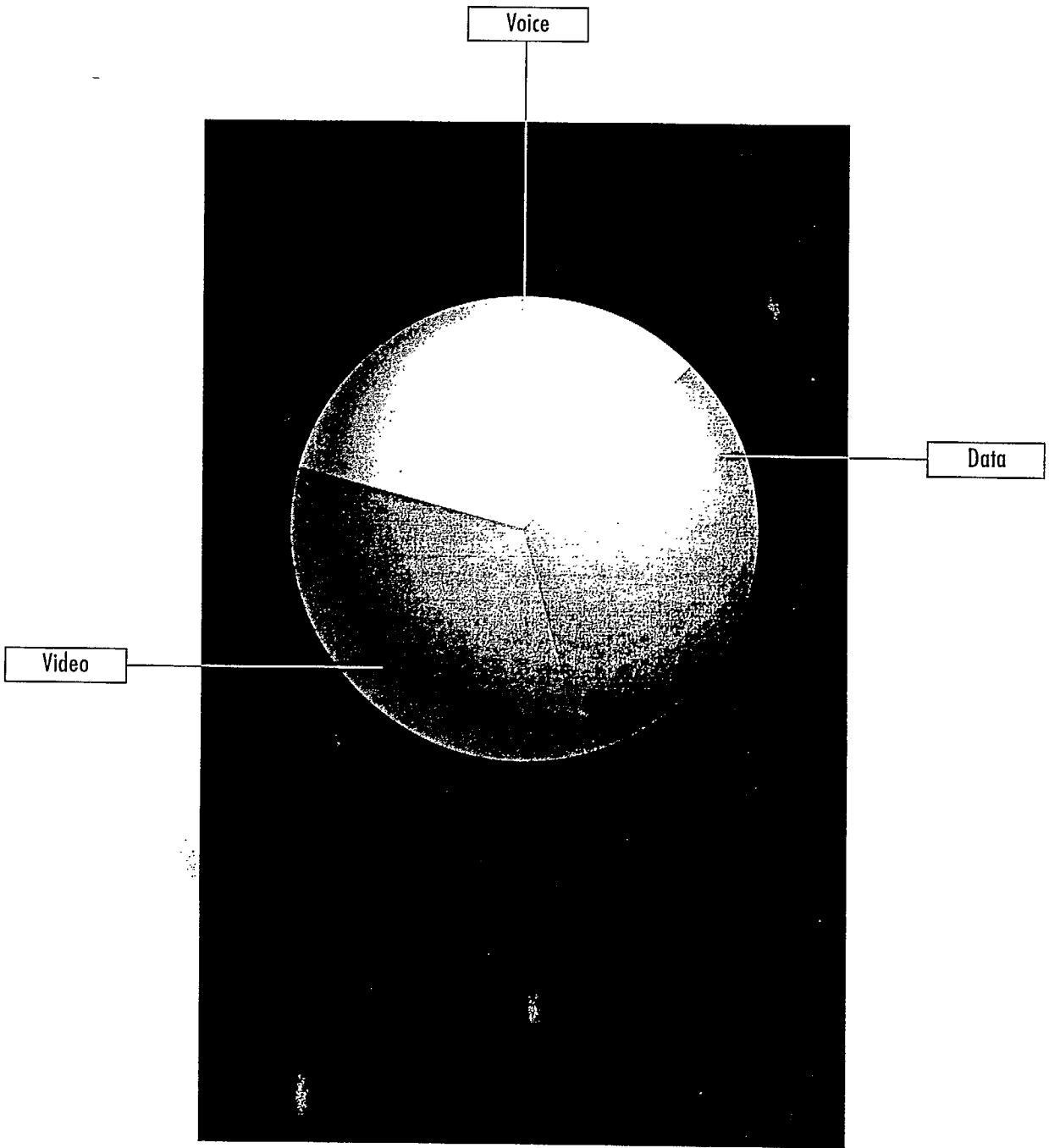
We thank you for your interest in ABL.

Sincerely,

A handwritten signature in cursive script that reads "Diane Laverdière".

Diane Laverdière
encl.

ABL



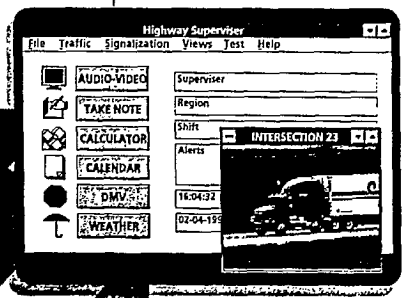
ALL MEDIA, ALL BANDWIDTHS

ABL MANUFACTURES PRODUCTS FOR ALL MEDIA AND ALL BANDWIDTHS

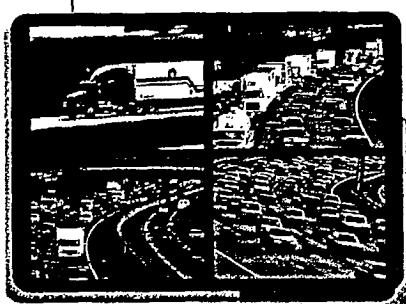
| | NARROWBAND | MIDBAND | BROADBAND | ULTRABAND |
|-----------------------------------|--|--|---|--|
| | < DS1/E1 64 kb/s – 2.048 mb/s | DS1/DS2 > 3 – 18 mb/s | DS3/E3 19 – 45 mb/s | DS4E/E4 > 46 – 140mb/s > |
| | "Phone-line quality" via copper, ISDN | "Cable TV quality" via copper, fiber optics, satellite | "Broadcast quality" via fiber optics, satellite, broadcast, wireless | "Studio quality" via fiber optics, broadcast |
| ACCESS | | | | |
| Video | ● VTH261 | | ● VT 21 ● VT45 ● VT34 | ● VT140 |
| Audio | ● AT2 ● AT1.5 | | | |
| Telephony | ● NX-100 | ● NX-100 | ● NX-100 | ● NX-100 |
| SWITCHES AND TRANSPORT | | | | |
| | ● SW1616E | ● SW1616E | ● SW1616E ● NX-100 | ● SW1616E ● NX-100 |
| NETWORK MANAGEMENT | | | | |
| Broadband control | ● | ● | ● | ● |
| NX-100 control | ● | ● | ● | ● |
| Basic control | ● | ● | ● | ● |
| APPLICATIONS | | | | |
| Video conferencing | ● | | ● | |
| Remote surveillance | ● | | ● | |
| Distance Learning | ● | | ● | ● |

Information is subject to change without prior notification.

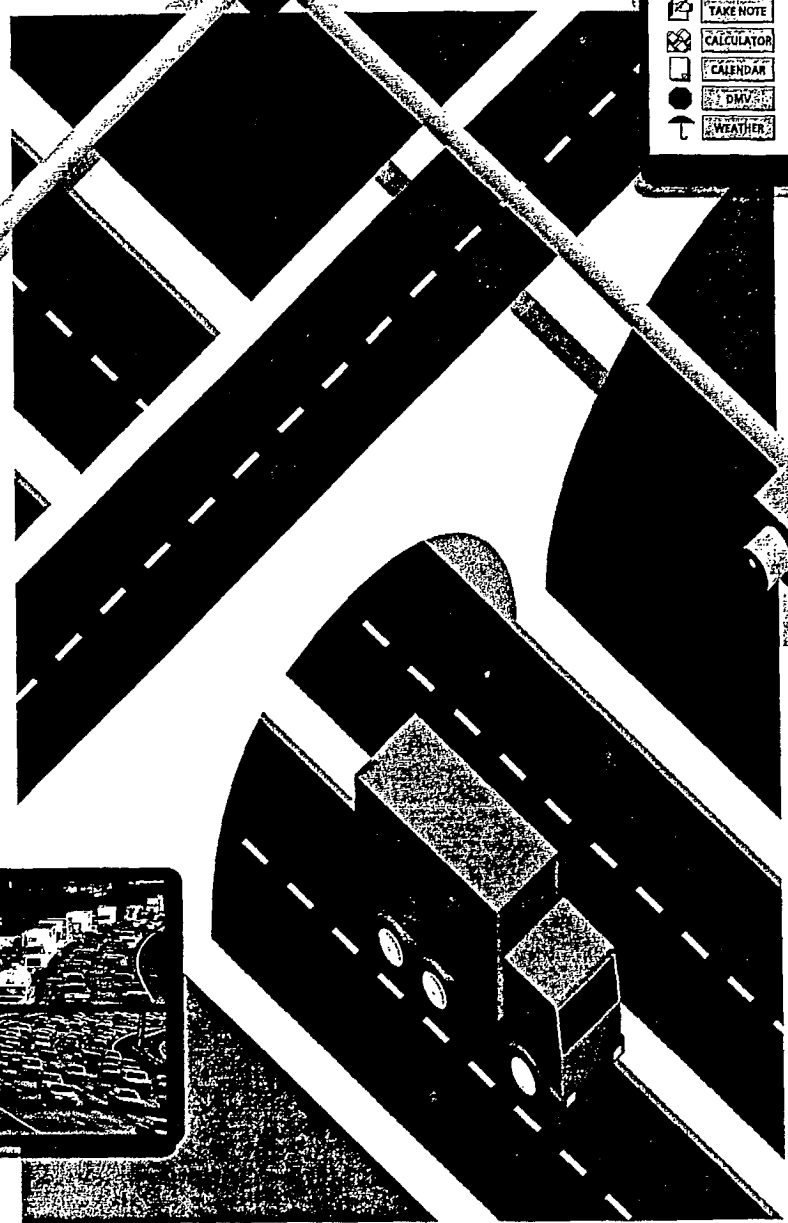
Network Management



Highway Monitoring



Video Surveillance



ABL: ADVANCED BROADBAND LINKS

READY, WILLING AND ABLE TO INTEGRATE VIDEO, VOICE AND DATA

ABL products drive video, voice and data networks, worldwide. Many of our core products accommodate all three media, across all bandwidths.

Our product line is anchored by switches and codecs for broadcast-quality video over highspeed broadband networks. We also manufacture a range of communications products for mid and lowband networks. ABL also has the systems capabilities to create turnkey multimedia networks featuring high-quality video. Our pioneering experience with interactive applications, like distance learning, has shown us what it takes to make multimedia networks really work.

THE BUSINESS CASE FOR ABL

ABL products, services and systems are in use by major broadcasters, telecommunications corporations and government agencies across Europe and North America.

Our competitive advantage? The quality of ABL's technology reduces overall customer costs, while increasing efficiency and productivity. ABL's industry-leading broadband video codecs (which code and decode analog video into digital signals) provide a case in point.

BT (British Telecom) uses our codecs to send TV signals over a digital backbone network, for distribution across the U.K. The digital signal provides broadcast quality, consistently and reliably. Network transmission costs are lower due to our bandwidth capacity. Finally, digital networks require far less upkeep than do analog networks.

STRUCTURED FOR INDUSTRY LEADERSHIP

Headquartered in Montréal, Québec, ABL is a merger of companies with interlocking specialties — video, voice, data, fiber optics and multimedia applications. ABL has a breadth of technological and management skills not often found in growth companies in a growth industry.

ABL is privately owned with management holding a substantial equity position. Our strong balance sheet reflects the presence of two established investment partners. Miralta Capital Inc. is part of the Altamira group, and its shareholders include the Canadian Imperial Bank of Commerce and some of Canada's leading pension funds. Les Investissements Novacap Inc.'s major shareholders are the National Bank of Canada, Le Caisse de Dépôt et Placements du Québec and Le Groupe SGF.

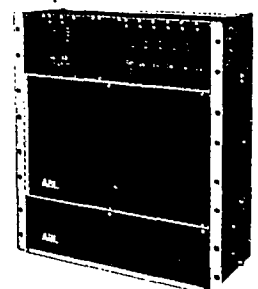
Senior executives from our two investment partners sit on ABL's board of directors, deepening our pool of management expertise.

A WORLD FIRST FOR ITALY AND ABL

The first digital-switched highway surveillance system, on Italy's nationwide highway, identifies vehicles using remote video cameras. Key system components are ABL switches and software controllers, which transport video surveillance as well as telephone and data signals over a digital backbone network.

This interactive multimedia application was implemented by one of our OEM partners, Marconi SPA. ABL's contribution was guided by our expertise with all aspects of multimedia: network capabilities, communications technology, and applications that meet end-user needs.

ABL's digital broadband switches reduce the number of control headends required for the highway's video surveillance network, lowering the overall cost of the network.



PRODUCTS: FOR EFFECTIVE SYSTEMS AND NETWORKS

A WIDE PRODUCT LINE, IN ACTION WORLDWIDE

ABL manufactures a full range of multimedia products. We reach the global marketplace through: ABL's own salesforce; OEM partners; and distributors in regional markets. All three might be involved in a large project, such as a major network. For service, our engineers are always at hand.

ABL's priorities — quality, responsiveness, a full product line and meeting industry standards — make for effective systems and networks:

- **Barcelona Olympics:** ABL codecs convert the video feed from farflung venues into digital signals sent over fiber optics to the central control. The result is reliable *broadcast quality* video, over long distances.
- **Broadcast network in Manitoba, Canada:** ABL is *responsive* to the requirements of the Manitoba Telephone System in providing video codecs for a high speed network that carries both national and local television broadcasts in the province.
- **Telefonica, Spain's dedicated, 2 mb/s videoconferencing network:** Our sophisticated network management and switching equipment allows us to provide connectivity for national and international communications.
- **AT&T earth station in Saudi Arabia:** Interconnectivity between a satellite and the international telephone exchange is provided by ABL, in *conformance with industry standards*.

R&D AND RESULTS

In keeping with the needs of multimedia networks, our R&D focus is on maximizing product capabilities. Mainly, we build on proven technologies. One of many examples is the NX-100 fiber access multiplexor, based on the international SONET standard.

Designed for end-user installations, the NX-100 is the size of a 9600 baud modem — but it has capacity for 672 voice channels. This allows high-quality video transmissions and a LAN interface. Both hardware and software are expandable. As with other ABL products, the NX-100 is designed to provide cost-effective performance.

This same approach is guiding our work, with our strategic partners, on the next generation of multimedia technologies and applications.

..... Narrowband Midband Wideband Ultraband

MEETING AND SETTING STANDARDS

ABL products conform to both North American and European industry standards. Each product is based on a core platform, and can be adapted to specific needs, by changing interfaces and software.

Currently, ABL is implementing ISO 9000, the international standard for overall quality management.

Our strength is in the broadband communications that make multimedia possible. A strategic goal for ABL is to reduce the cost of broadband technology, making it cost-competitive with narrowband and midband equipment. This will help make multimedia a mainstream technology.

The broader the bandwidth, the greater the capacity, speed and quality of transmission. For example, more lines are available for telephony, data transfers are faster, and video quality is far superior.

**CANADA****ABL CANADA INC.**

8550 Côte de Liesse
St. Laurent, Québec
H4T 1H2
Canada
Tel.: (514) 344-5432
Fax: (514) 344-5439

Ontario

50 Grave Road
Markham, Ontario
L3P 4M4
Canada
Tel.: (416) 472-0747
Fax: (416) 472-6101

Québec

965 Newton
Suite 265
Québec City, Québec
G1P 4M4
Canada
Tel.: (418) 877-1112
Fax: (418) 877-1047

U.S.A.**ABL ENGINEERING INC.**

6111 Heisley Road
Mentor, Ohio 44060
U.S.A.
Tel.: (216) 974-8585
Fax: (216) 974-0089

California

664A Freeman Lane
Suite 395
Grass Valley, CA
U.S.A. 95949
Tel.: (916) 274-3346
Fax: (916) 274-8630

Georgia

6642 Club View Court
Flawery Branch, GA
U.S.A. 30542
Tel.: (404) 967-2050
Fax: (404) 967-2090

New Hampshire

196 Green Acres
Manchester, NH
U.S.A. 03109
Tel.: (603) 627-9016
Fax: (603) 624-4965

Utah

7620 Buckboard Drive
Park City, UT
U.S.A. 84060
Tel.: (801) 645-7994
Fax: (801) 649-5668

Wisconsin

9832 28th Avenue
Kenosha, WI
U.S.A. 53143
Tel.: (414) 942-4000
Fax: (414) 942-4001

EUROPE**ABL U.K. LTD.**

Watermans Court
Kingsbury Crescent
The Causeway
Staines, Middlesex
TW18 3BA
Great Britain
Tel.: +44(0) 784 441585
Fax: +44(0) 784 442218

UMA SYSTEMS INC.

Mississauga, Ontario

“TRAPEZE” Software system features:

- 1. Trip building, vehicle and driver assignment and rostering system for fixed route operations, and**
- 2. ‘Realtime’ demand responsive scheduling and dispatching system for paratransit operations.**

Add on products include mapping, bidding, passenger counting/ridership analysis, corridor, demographic analysis.

Sample of UMA’s 50 international clients:

- Metropolitan Area Rapid Transport Authority, Atlanta, Georgia**
- Madison County Transit of Granite City, Illinois**
- Alameda Contra Costa District, Oakland, California**

ABL

ABL PRODUCTS USED ON THE NETWORK:

- **VT34A 34 Mb/s video encoders**, at cameras along the highway

ABL codecs provide broadcast quality digital video over long distances, while the small size is an extra benefit in this application.

- **VT34A 34 Mb/s video decoders**, at Regional and National Headquarters

ABL's modular technology allows cost-effective reconfiguration and servicing.

- **SW1616E Broadband Switches**, at Regional Headquarters

ABL's cross-connect switch supports many transmission rates, formats, and frequencies. Its highly reliable system architecture ensures dependability.

- **UNIX software controllers**

The leading network management services broadband switch software for control.

- **AT2 Audio Codecs**

Used to carry program radio transmissions to broadcast antennas along highways.

ABL PRODUCTS IN ACTION THE FIRST DIGITAL-SWITCHED VIDEO HIGHWAY SURVEILLANCE SYSTEM

Key traffic points along Italy's national highway system are now monitored using digital-switched remote video. The benefits include safety, efficient traffic monitoring, quick response to emergencies and convenience for commuters. The monitored broadcast-quality video is fed to the national TV network, to provide concise TV traffic reports.

ABL's broadcast-quality video, digital switching and network management control capabilities were the prime considerations in winning a role in the project. ABL's products allowed transport of video as well as telephone and data signals over a single digital backbone network.

VIDEO MONITORING: ONE OF THREE NATIONWIDE ITALIAN NETWORKS

The video monitoring network is now in use by the Regional Headquarters on Italy's 2,000-mile publicly-owned highway system and is administered on a regional basis in Bologna, Milano and Genoa; as well as the National Headquarters in Rome and Florence. The network will expand to include the other regions and Regional Headquarters across Italy between 1993 and 1996.

Two other integrated networks are being implemented as well as the video network:

- 1) A long-distance 565 Mb/s digital backbone network linking each of the Regional Headquarters with the National Headquarters, for voice, video monitoring, video conferencing, data, audio and LAN traffic.
- 2) A regional service network linking each Regional

Headquarters with the toll and service stations in its region, for data collection and voice traffic.

VIDEO MONITORING IN ACTION: REGIONALLY AND NATIONALLY

Video cameras are installed at key traffic control locations, such as major interchanges. At the camera site, an ABL codec encodes the analog video into a digital signal, for fiber optic transmission over a point-to-point 565 Mb/s network to the Regional Headquarters.

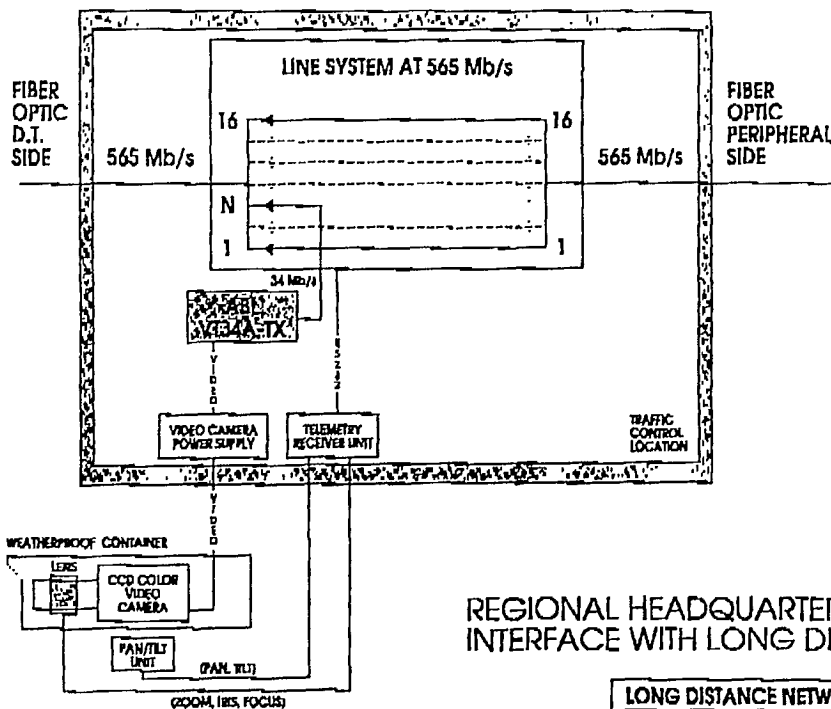
At the Regional Headquarters, an ABL codec decodes digital signals into analog form, for viewing at the central control center, using only six video monitors. Each individual video monitoring network can carry signals from up to 16 cameras. ABL's digital switch allows users to quickly scan the video from one camera to another.

Regional Headquarters also send digital video signals to the National Headquarters, in Rome, over the 565 Mb/s digital backbone network allowing centralized video monitoring of traffic from across the nation.

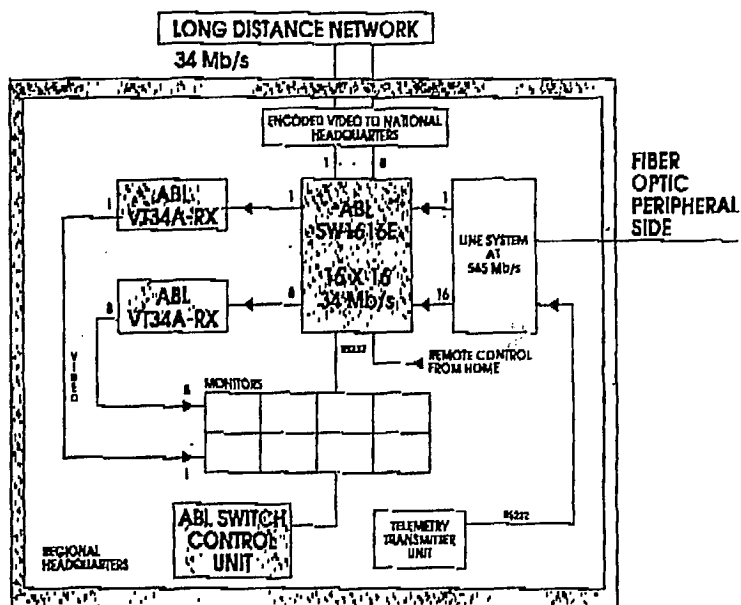
Italy's radio broadcasters also send digital audio signals to broadcast antennas at selected locations along the highway network using ABL audio codecs. Result: Compact-disc quality audio for car radios.

The network management switch software allows precise commands to be sent to each camera, for comprehensive surveillance of a site. The use of ABL's broadband switches allow for fewer control headends, reducing overall costs.

CAMERA LOCATION AND INTERFACE WITH 565 Mb/s LINE SYSTEM



REGIONAL HEADQUARTERS AND INTERFACE WITH LONG DISTANCE NETWORK



ABL

CANADA
ABL CANADA INC.
 8550 Côte de Liesse
 St. Laurent, Québec
 H4T 1H2
 Canada
 Tel.: (514) 344-5432
 Fax: (514) 344-5439

U.S.A.
ABL ENGINEERING INC.
 6111 Heisley Road
 Mentor, Ohio 44060
 U.S.A.
 Tel.: (216) 974-8585
 Fax: (216) 974-0089

EUROPE
ABL UK LIMITED
 Watermans Court
 Kingsbury Crescent
 The Causeway, Slaines
 Middlesex, TW18 3BA
 UK
 Tel.: +44 (0)784 441585
 Fax: +44 (0)784 442218

For further assistance, please dial toll free in the U.S. 1-800-883-4225

1M993M



UMA Systems Inc.

5080 Commerce Blvd., Mississauga, Ontario, Canada L4W 4P2
Telephone (905) 238-0007, Fax (905) 238-0038

September 15, 1994

File: 001-00

Telephone: (613) 954-3326
Facsimile: (613) 991-4469

Mr. Cliff Oldridge
Project Officer
Industry, Science and Technology Canada
235 Queen Street
Ottawa, Ontario
K1A 0H5

| | |
|--------------|-------------------------------------|
| Send by: | |
| Facsimile | <input type="checkbox"/> |
| Regular Post | <input type="checkbox"/> |
| Courier | <input checked="" type="checkbox"/> |
| Hand Deliver | <input type="checkbox"/> |

Dear Mr. Oldridge:

Re: UMA's Software Products

Further to our recent discussion, I have enclosed some information on UMA's products, as well as a copy of our Annual Report.

UMA's software system, *TRAPEZE*[™], consists of a variety of planning and operational components. It has two major components - a trip building, vehicle and driver assignment and rostering system for fixed route operations and a 'real time' demand responsive scheduling and dispatching system designed for paratransit operations. Other 'add-on' products include mapping, bidding, passenger counting/ridership analysis, corridor/demographic analysis, passenger information/itinerary planning, monitor (for AVL). There are also a number of utilities, such as map-edit, and database translators.

UMA also offers service programs that are designed to suit each client and complement the software products. These services include project management, planning and feasibility studies, system analysis, application design, customization and implementation, client training and support and other product integration.

I hope the enclosed information will help you support your review of our company and its products. We look forward to further discussions.

Yours very truly,

UMA SYSTEMS INC.

Fran Fendelet
Marketing Manager
Transportation Software

FF/cr

Transportation Software

UMA Engineering's Transportation Software Section, now called UMA Systems Inc., has become a leading developer and supplier of innovative software products for the public transportation industry in North America and overseas. Designed for the microcomputer environment, the products provide solutions for fixed route, rail, longhaul and para-

transit (demand responsive) operations of virtually any size. **TRAPEZE** for fixed route operations and **QUOVADIS**, originally commissioned by the Ministry of Transportation Ontario and developed by UMA, for paratransit operations have gained wide acceptance and are recognized as systems which set new standards for the industry.

Decision making capabilities of these products include trip

building, vehicle scheduling, driver scheduling, weekly crewing (rostering/bidding), client registration/booking, batch and real-time vehicle and crew scheduling and dispatching.

Development and integration of the automated mapping (GIS) capabilities provide a more extensive solution for defining and geocoding locations, determining distances and simulating vehicle routing.

4.



TRAPEZE was successfully installed for the Metropolitan Area Rapid Transit Authority (MARTA), Atlanta, Georgia. The system supporting this operation has approximately 150 bus routes and 33 rapid rail stations with 39 miles of track. MARTA operates approximately 550 peak hour buses and 160 rail cars, operating seven days per week and providing transportation to approximately 65.7 million riders per year.

*Madison County Transit of Granite City, Illinois is one of the first operations to use both the **TRAPEZE** and **QUOVADIS** systems. Service is provided to over 1 million riders using up to 21 buses on 12 fixed routes, six days a week. Demand responsive services for the elderly and handicapped are provided seven days a week on 22 vans serving as many as 500 passengers per weekday.*



TRAPEZE™-QV

TRAPEZE™-QV is a 'real time' demand responsive scheduling and dispatching system designed to register clients, take client bookings (*subscription, casual*), schedule the clients to the available vehicles, and dispatch the vehicles and the drivers.

TRAPEZE™-QV was designed for the micro computer 'multi-user' environment, and is comprised of a number of integrated components which permit you to perform a series of tasks.

One key aspect of *TRAPEZE™-QV* is its proprietary **Mapping** capabilities which utilizes a digitized map of your service area. Arterial distances (*and times*) between locations can be checked directly on the map; the location of all the vehicles, or a detailed itinerary of each vehicle, can be displayed at any time.

Clients can be registered with all your necessary information recorded. Using the streets and numbers, commonly travelled **Locations** are identified on the map and support the client identification process by assigning the client a location (*longitude/latitude/zone*).

The client's request is accommodated by **Booking** the trip that is to be scheduled together with the day(s) on which the trip is requested. Once the request is made, it can automatically be scheduled or rescheduled at a later time. Using the 'on line' capabilities to determine if your requested trip can be inserted within the current vehicle itinerary. If so, you are informed and the transaction will be completed. If the trip cannot be inserted within the specified time range, you may determine the closest times that are available. If these times are unacceptable then the request, if so desired, will be logged as an unaccommodated trip which can perhaps be reconciled with appropriate trip cancellations. Other features enable you to individually and/or collectively cancel and re-direct bookings, and check the bookings for consistency.

The **Scheduling** capabilities permit you to assign the vehicles to the clients. Prior to scheduling, you may specify the method that you wish to use to calculate the distances (*routing, triangulation, xy*), the number of vehicles that are available on the service day, the hours, (if appropriate), that a vehicle is available, and the average speed of the vehicles. This process is very fast and presents you with the results prior to implementation.

Dispatching enables you to identify and correct possible service difficulties by dynamically responding to 'problem' situations as they occur. Geographical displays add another dimension to the system and enable you to **Monitor** the scheduled location of the vehicles by time of day.

TRAPEZE™-QV is easy to use and has numerous on-line help and edit messages. Data input, is minimized by the use of 'hot' keys which readily recall, in a window, data that has been previously entered. Furthermore, data can be interfaced directly to 'third party' software for further analysis and/or ad hoc reporting.

Some of the many features of the system include:

Mapping

- landmark and location geocoding
- import interfaces for digitized base maps of your service area
- street map displays
- calibration and viewing of distances
- display/edit zones and map grids

Client Records

- storing relevant client information
- locating/coding a client on a street map
- locating/coding a client in a service area that is not on the street map

Bookings

- booking subscription trips and one-time user requests
- automatic cancellation/redirection of bookings at the client and location level
- check for all bookings that do not return to origin
- book unscheduled returns
- book any number of days in advance
- check bookings while client is on the phone

Scheduling

- calculation of distances by xy, triangulation, and routing methods
- input of statutory holidays on the calendar to ensure, if necessary, that trips are not scheduled on certain days
- viewing of all the trips for a particular client (*tabular, calendar*)
- trip insertion, at request time, onto an existent schedule and view of the effect of the insert on the vehicle itinerary
- provision of alternate trip times when the requested time cannot be accommodated
- global/individual trip modification
- vehicle prioritization process
- flexible scheduling parameters
- selective vehicle availability
- batch scheduling
- graphical simulation of vehicle routing
- provision for trying what if scenarios
- save/restore multiple scheduling solutions
- match previous solutions from history database
- adhere to labor agreement

Dispatching

- vehicle profiles by time of day
- monitoring of scheduled vehicles by time of day
- trip reassignment
- redistribution of trips from one vehicle to another
- incident capturing
- trip cancellation/schedule adjustment

Monitoring *

- capabilities to determine vehicle position
- make logical trip decisions based on vehicle position
- schedule adherence

Data Management

- complete data integrity at the record and file levels
- standard record management system with a report generator
- dynamic modification of input format (*date, time, distance*)
- use of special keys to minimize user input
- dynamic screen input management feature
- forced data values on certain user defined input fields
- backup and restore data without leaving the system

Reporting

- General unformatted data (*locations, clients, schedules, vehicles*)
- Clients
- Locations
- Bookings
- Vehicle Manifests
- Driver Itineraries
- Statistical (*time & distance*)

Interfacing

- interfaces for 'off-the-shelf' software (*e.g. spreadsheets, word processors, desktop publishers*)
- interfaces for other systems (*e.g. MDT's, AVL, etc.*)
- interface to *TRAPEZE™* (UMA's fixed route scheduling system)

* optional 'add-on' for vehicle location monitoring

TRAPEZE™ - MAP-EDIT

This application allows for graphical modification (*add, delete, change*) of all geographic data such as street segments and landmarks. Modification of street segment data can be done on a segment by segment fashion or in a group by highlighting all segments with the same street name. All relevant street segment data fields are accessible for modification.

The system's features include:

Data Modification

- Add/change/delete street segments and attributes
- Add/change/delete barriers
- Add/change/delete landmarks
- Add/change/delete one-way streets
- Add/change/delete street aliases
- Address matching
- Random street labeling

Database Characteristics

- Major highways, freeways, arterial, collector and side streets
- Rail networks
- Rivers, creeks and other water bodies
- Street names and addresses

Reporting

- Log of transactional changes

Interfacing

- Import - digital base maps (*e.g. tiger, amf, dime, ARC/INFO, ETAK, Intergraph, Etc.*)
- Export - modified data (*digitized maps*)

Presentation

- Map overlays (*two imported digitized maps*)
- Variable zoom feature at any scale
- Clear displays for routes and nodes
- Color graphics for easy differentiation
- Pan maps

TELERIDE SAGE LTD.
Toronto, Ontario

TELETRANS:

- **Integrated software solutions for mass transit industry.**
- **Systems running in over 60 sites in Canada, the U.S. and U.K.**
- **Systems based on state-of-the-art tools including: 4 GL technology, relational databases and case tools**
- **Systems can easily be ported and supported on UNIX, AIX, DOS, MS-Windows and VAX/VMS, etc.**
- **Alliances with number of major transit industry hardware and system integrators, as well as other software vendors.**

TELERIDE SAGE Ltd.
156 Front Street West, Suite 500
Toronto, ON, Canada, M5J 2L6
EXPORT CONTACT: Mr. Brian K. Kalanda, Director, Sales and Marketing
PHONE: 416-596-1940 FAX: 416-595-5653

KEYWORD PRODUCT AND/OR SERVICE: Mass Transit Integrated Software

BACKGROUND:

TELERIDE SAGE LIMITED (TSL), founded over 15 years ago, is a leading provider of integrated software systems for the mass transit industry. TSL systems are currently running in over 60 customer sites in Canada, the U.S. and the United Kingdom. The company has an established reputation of meeting the diverse needs of transit in areas such as computerized scheduling, operations, automated vehicle location and public information through the use of innovative software packages. TSL can also draw on our 60 plus in-house experts to offer supporting consulting services, where appropriate. With our systems, transit management can improve service and minimize costs. These systems often provide a payback of in less than a year.

PRODUCTS AND/OR SERVICES:

TSL distinguishes itself from the competition by offering TeleTRANS, a broad line of INTEGRATED products that facilitate the information flow across department boundaries. our systems are based on state of the art tools including; 4GL technology, relational databases and CASE tools. Our systems are prepared such that they are easily ported and supported on a wide variety of hardware and operating system platforms, including UNIX, AIX, DOS, MS-Windows and VAX/VMS. We also have systems and technical staff that support English, French or Spanish. By offering tremendous flexibility with systems that are designed for optimized results and easy to use interfaces, TSL offers an unbeatable solution.

TSL can offer any organization a full range of services from new product development, through to consulting, turn-key installation and long-term support. We have alliances with a number of major transit industry hardware and system integrators as well as other software vendors. This ensures TSL can provide a single source solution to transit systems.

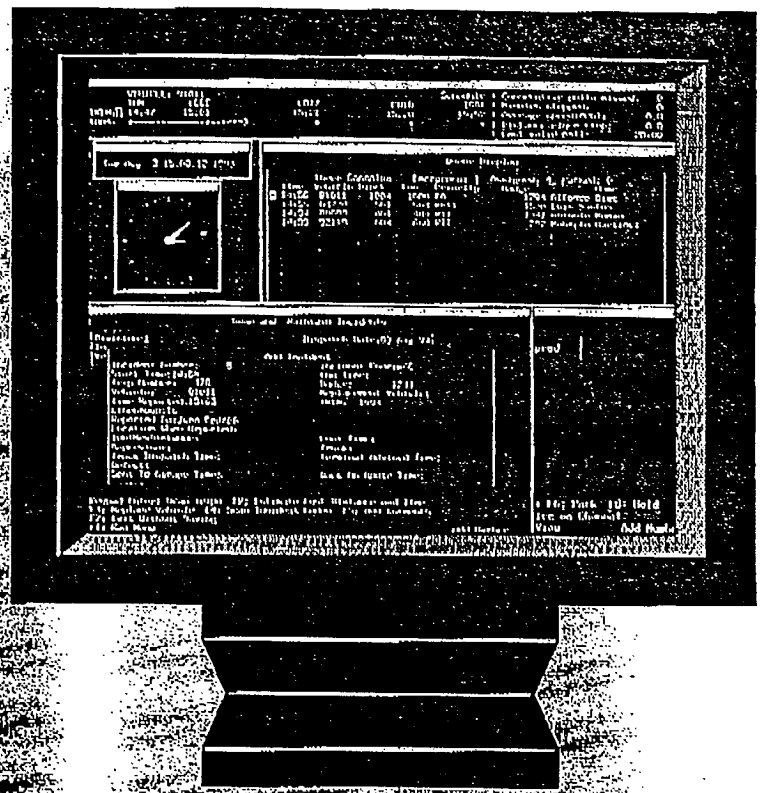
Software Directory - Department of Foreign Affairs & International Trade -
International Business Development Branch (1993)

TELETRANS

"Transit Software Solutions"

TeleTrans enables transit managers and staff to access all of the information they need to make optimal decisions in a timely manner.

The bottom line is: Improved operational efficiency, improved service to the riding public, increased staff productivity and significantly reduced costs.



PORTABLE

across a wide variety of hardware platforms, operating systems, user interfaces and relational databases so that applications are easily tailored to any operating environment.

FLEXIBLE

design so that all applications can be purchased separately or together, depending on the needs and resources of your property.

ADVANCED

4GL development tools and relational databases have been combined with functionality designed specifically for transit.

QUALITY

real-time information that is accurate, consistent and easily shared among Planning and Scheduling, Operations, Fleet Maintenance and Public Information.

OPERATIONS MANAGEMENT

TELEDRIVER streamlines the entire Operations process by enabling all levels of decision makers to eliminate errors, maximize productivity and minimize costs in the areas of: Bidding, Daily Dispatch, Timekeeping, Complaint Investigation, Performance Tracking and Drug Testing.

BIDDING Automating the bidding process ensures a correct pick.

DISPATCH Spareboard guarantee payments are minimized by eliminating errors in driver assignment and daily dispatch.

TIMEKEEPING Preparation time is significantly reduced and payroll errors are virtually eliminated.

PERFORMANCE Issues, such as absenteeism and accidents are easily tracked.

COMPLAINTS Investigate and respond to customer complaints or compliments quickly and easily.

PROVEN Installed at over 20 transit properties.

FLEET AND INVENTORY MANAGEMENT

THE FLEET is a powerful and easy to use on-line software tool allowing maintenance management to monitor current activity at all functional areas, establish performance measures, track the impact of specific changes to the operating environment, set shop standards, pro-actively schedule resources to meet future requirements, analyze budgets and much more.

TRACKING Work-in-process tracking eliminates substantial cost overruns and significantly improves warranty cost recovery.

INVENTORY Parts are available for all scheduled work without overstocking. Stock-outs are eliminated and order requests are carefully tracked.

LABOUR Mechanics are scheduled as needed for Preventive Maintenance.

VENDORS Immediately recognize changes in supplier performance and improve pricing.

PERFORMANCE Employees can be correctly evaluated and deviations in performance levels can be responded to in a timely manner.

PROVEN Over 20 installations and 25 years cumulative years of experience.

PLANNING and SCHEDULING

The TELETRANS set of products for the Graphical Scheduler, a method for survey facility to maintain run-costing information "what-if" scenarios.

EASY For staff use of graphical user interface.

STANDARDIZED The "one" product to produce.

INTERFACES A single interface to stable, long-term data.

SAVINGS Customized software solutions.

PROVEN Over 50 years of experience.

PUBLIC INFORMATION

THE TELETRANS Public Information product provides to the public. Independent customers have shown that improved information increases ridership, particularly in the information systems.

TELE RIDER Interactive information system.

TELE VIEWER Video on general transfer information.

TELE POSTER Automated cable transfer information.

TELE CENTER Provide schedule information more effectively.

TELERIDE SAGE

PLANNING AND SCHEDULING

The TELETRANS set of products for Planning and Scheduling departments includes: A Graphical Scheduler, a method for surveys and collecting and analyzing the data, and a facility to maintain run-costing information that can be easily modified to analyze "what-if" scenarios.

EASY For staff with little or no computer knowledge, the use of graphics, color and on-line help make it easy to learn and use.

STANDARDIZED The "one-button" run-cut uses the latest (AI) technology to produce a truly "streetable" run-cut in minutes.

INTERFACES A single, common executable at all installations creates a stable, high quality product with regular upgrades.

SAVINGS Customized reports are easily prepared with third-party software.

PROVEN Over 50 installations.

PUBLIC INFORMATION & MARKETING

TELETRANS Public Information products improve the quality of information a transit property provides to the public. Independent studies and results from many of our customers have shown that improved information is directly related to significant increases in ridership, particularly in the off-peak. TELERIDE SAGE offers a suite of Public Information systems:

TELE RIDER Interactive Telephone Systems which provided schedule information to more than 40 million transit riders last year.

TELE VIEWER Video or LED display signage providing schedule and general transit information to passengers at terminals and transfer stops.

TELE POSTER Automates the production of on-street, stop-specific timetables. TELEPOSTER helped one major North American property increase production five times, enabling them to provide current, accurate schedule information at every bus stop.

TELE CENTER Provides Information Operators with automated access to schedules, delays, detours, news bulletins and much, much more.

COMPUTERIZED DISPATCH

TELEDISPATCH is a fully integrated system for CAD (Computer Aided Dispatch); AVL (Automatic Vehicle Location). TELEDISPATCH can be used to support various A technology, including: GPS (Geographic Positioning by Satellite), Loran-C, signpost; odometer with layover logic. For properties that do not have AVL equipment, the A features can be "turned off", resulting in a CAD system that can easily be upgraded, should AVL equipment be installed later.

QUEUE Call Priority ensures calls are handled in order of importance.

ALARM The silent alarm provides safe reliable service.

DISPATCH Real-time information means better fleet control for operator performance, bus utilization, schedule adherence, en-route management and vehicle assignment.

QUALITY Management is better informed about the service being provided.

ANALYSIS Provides schedulers/planners with service analysis statistics.

PROVEN Over 6 installations and 25 years of cumulative experience.

DIVERSIFICATION

TELERIDE SAGE can offer a team of experts in the transportation, traffic management and other high tech markets. Our experts have recently been involved in development and installation of a Police Dispatch system, a traffic signal control system (over 1,600 signal sites) and a pilot Intelligent Highway System. We can provide a wide range of products and services including:

CONSULTING Customized software and hardware for unique applications.

PROJECT MANAGEMENT Technical and software expertise in these fast growing markets.

IHS and IVHS Technical and software expertise in a complex environment.

TRAFFIC MANAGEMENT Analyze your internal work process to streamline activities and take full advantage of new systems.

PROCESS MANAGEMENT Our team of experts can either lead or participate with you through the development and implementation of new systems and processes.

TELERIDE SAGE

CORPORATE PROFILE

Since 1977, TELERIDE SAGE LTD. (TSL) has been the leading supplier of integrated software solutions for the Transit industry. TSL has an established reputation for solving problems in the areas of Scheduling, Operations, and Public Information with software products that assist transit management in improving transit service while minimizing costs. Our staff of over 60 Transit software experts have successfully installed software solutions in over 80 transit organizations and continue to provide support to all of our clients 24-hours a day, 7 days a week.

KNOWLEDGE and EXPERIENCE

An important aspect of any software project is the experience and knowledge of the project team members. For every software engineer, product specialist and project manager employed by TELERIDE SAGE has extensive experience in transit applications and systems. It is this knowledge and experience that has made TELERIDE SAGE the recognized leader in software solutions for transit.

FUTURE COMMITMENT

TELERIDE SAGE has been successfully installing software applications since 1977. Our products undergo constant development and extensive refinement and TSL will continue to incorporate the most sophisticated and user-friendly technologies available. TELERIDE SAGE remains committed to helping our customers operate more efficiently by providing the most advanced software solutions available today.

THE LAST WORD... From our customers:

"the result is that we have introduced new working practices which will save us \$5 million annually."

"detailed cost information, efficient preventive maintenance scheduling and meaningful statistics have allowed us to greatly improve the effectiveness of our operation."

"OptiMISER saves us \$500,000 annually."

"With TELERIDER, ridership increased by more than 4%, generating an extra \$1.5 million in revenue."

"Your firm's commitment to this project, your understanding of our requirements, and your ability to deliver a quality product have been key to the success of this project."

For more information about TSLTRANS or any of its modules, please contact:

TELERIDE SAGE LIMITED
156 Front Street West
Toronto, Ontario M5J 2L6
Phone: (416) 596-1940
Fax: (416) 595-5653

TELERIDE (UK) LIMITED
30 Gaultgate Street
Stafford, England
Phone: (0785) 224242
Fax: (0785) 225552



EIS Electronic Integrated Systems Inc.

150 Bridgeland Ave., North York, Ontario, Canada M6A 1Z6 (416) 785-9248, Fax: (416) 785-9332

FAX COVER SHEET

FAX # 613/954-4246

PLEASE DELIVER THE FOLLOWING MATERIAL AS SOON AS POSSIBLE TO:

COMPANY: Industry Science & Technology

DATE: 14 SEP 94

ATTENTION: Chris Oldridge

FAX NO. _____

SUBJECT: Information re IVHS

FROM: Dan Manor

OUR FAX # (416) 785-9332

MESSAGE: Enclosed is some info on the RTMS
Radar traffic sensor.

A preliminary package of information is being
mailed to you at your request.

| | |
|---|---|
| RECEIVED PAR | REÇU PAR |
| Director | Directeur |
| DEDIR. 276. | |
| SEP 14 1994 | |
| Defence Electronic Systems Division Space, Marine and Oceanic Branch | Direction de l'électronique de systèmes et des systèmes Direction générale des Industries spatiales, maritimes et de la défense |

THE FOLLOWING CONTAINS 2 PAGES INCLUDING THIS SHEET.
IF NOT PROPERLY RECEIVED PLEASE NOTIFY SENDER AT (416) 785-9248

EIS ELECTRONIC INTEGRATED SYSTEMS INC.

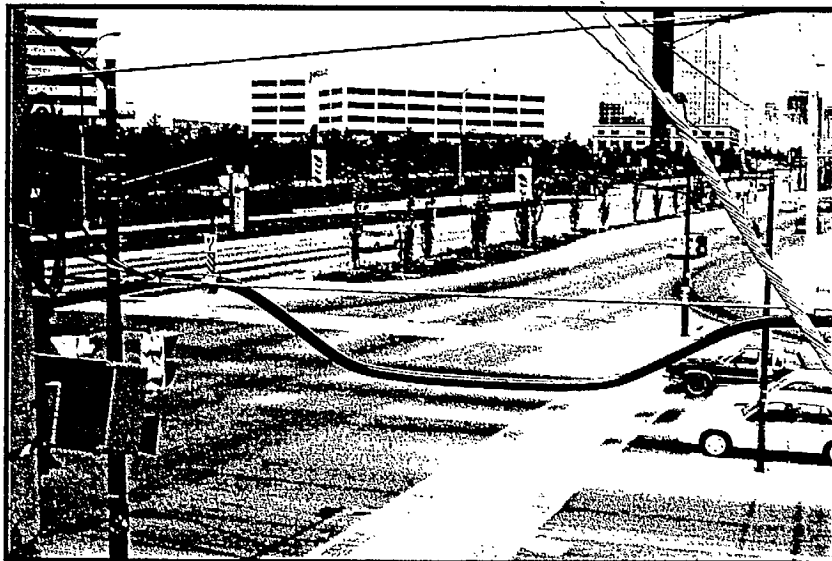
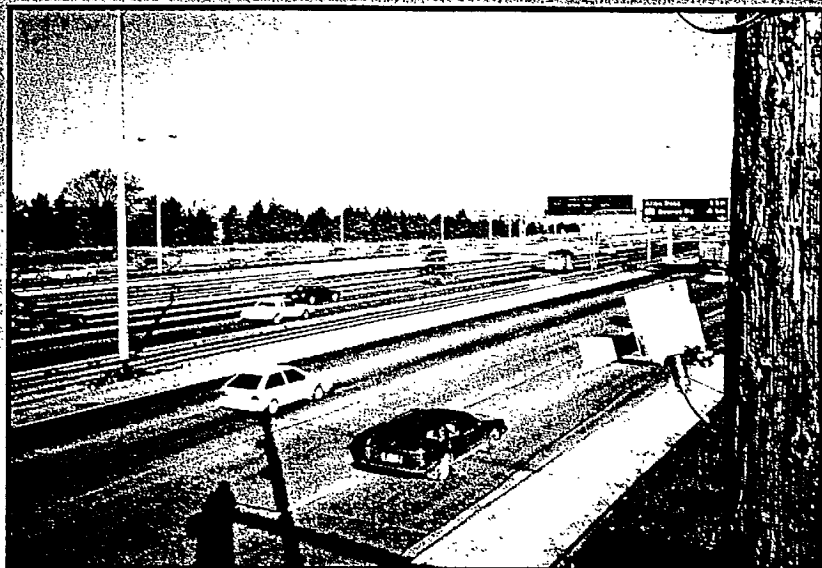
North York, Ontario

- **RTMS Radar Detector**
- **Sensor mounts on pole near highway**
- **Features:**
 - **12 detection zones**
 - **Detects moving & stationary vehicles**
 - **Measures volume/occupancy**
 - **Serial port data**
 - **Self-testing**
 - **Ease of installation**
 - **Side fire or overhead mounting**

RADAR TECHNOLOGY

1 R.T.M.S. SENSOR IS ALL YOU NEED:

TO MONITOR 12 INDIVIDUAL
LANES, MEASURING VOLUME,
OCCUPANCY AND SPEED
FROM EXISTING POLES



TO DETECT STATIONARY
VEHICLES AT A
MULTI-LANE STOP-BAR
FROM EXISTING POLES

NO LANE CLOSURES DURING INSTALLATION!



EIS Electronic Integrated Systems Inc.

DESCRIPTION

The Remote Traffic Microwave Sensor (RTMS) is a low-cost self-contained advanced sensor for detecting and monitoring road traffic at intersections and on roadways.

This single compact true presence detector provides per-lane presence indication, as well as volume, occupancy and vehicle speed information, simultaneously in up to twelve lanes or detection zones.

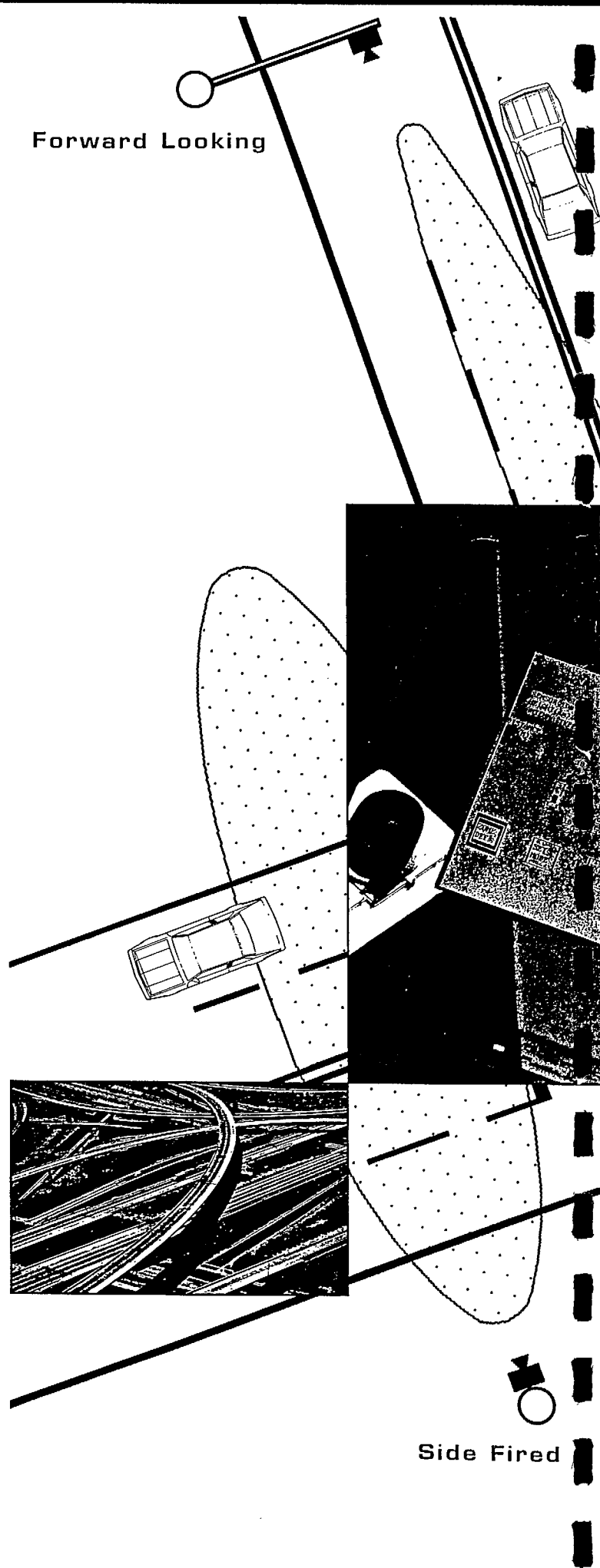
Its output information is compatible with existing controllers via contact closure and with other systems by serial data communications lines. As a result, it can directly replace multiple inductive loop detectors.

The RTMS is a tiny radar operating at the microwave band. Mounted on side-of-the-road poles, it is easy and safe to install and remove without traffic disruptions. Because it is fully programmable, the RTMS supports a wide range of applications and can be upgraded in the field to handle future requirements.

- multi-lane highway traffic counting and real-time monitoring
- multiple stop-bar loop replacement in major intersections
- off-ramp metering and actuation
- stand-alone sensor for major/minor road intersections
- multi-lane system loop replacement for intersection approach monitoring
- speed measurement

- standard strapping of ball-joint bracket to any pole at heights of 5 to 7 metres (17 to 23 ft.)
- quick lock of RTMS to the bracket and single MS connector attachment
- tilt and lock into desired direction,
- define detection-zone settings by observing real-time vehicle blips on a PC laptop screen (see photo)
- connect outputs to a controller and/or a modem

Forward Looking



Side Fired

FEATURES

The RTMS was designed to eliminate many of the costs and inconveniences caused by present-day traffic monitoring devices. Highly reliable with a low life-cycle cost, the RTMS is powerful and intelligent. It provides the user with a choice of 12 user-definable detection zones. The side-fired mode supplies data on multi-lane traffic and the forward-looking mode monitors a long stretch of road or single lane, measuring vehicle speed, queue length and size (see diagram).

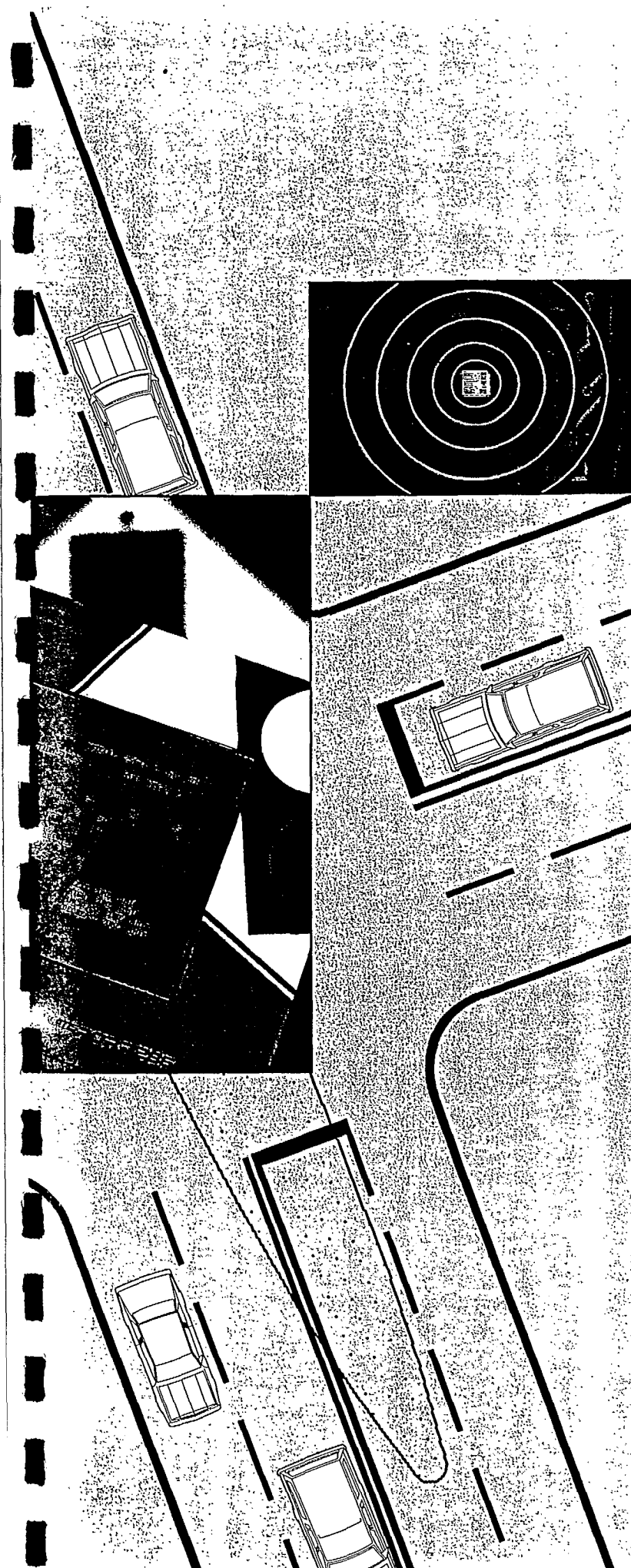
The RTMS is both a valuable short-term asset and a significant component of Advanced Traffic Monitoring Systems of the future. Users can tie its contact outputs directly to NEMA or 170-type controllers for loop emulation and, for future applications, access a wide variety of information through its serial data bus.

The RTMS is also easy to install, set up and maintain. There is no need to disrupt traffic and it can be applied to any road type (including steel bridges, reinforced concrete, soft foundations and gravel roads) without weakening the road surface. It is self-testing before and after installation - complete with diagnostics - and eliminates the need for field troubleshooting.

The high degree of reliability and maintainability of the RTMS results in a low life-cycle cost. Sturdy and compact, it was designed for a long life unaffected by the environment, construction work or lightning surges. And because it is software driven, it is reusable, reprogrammable and expandable.

Of superior design and construction, the RTMS is maintenance free.

Consequently, its life-cycle cost is substantially lower than the systems currently in use. While cutting costs, its built-in intelligence enables you to receive more data, more dependably.



ALL SENSORS ARE NOT CREATED EQUAL...COMPARE:

| | RTMS RADAR DETECTOR | LOOP DETECTOR | MICROWAVE MOTION DETECTOR |
|---|------------------------------------|-----------------------------|--|
| True Presence (Moving And Stationary Vehicles) | YES | YES | NO |
| No. of Detection zones | 12 | 1 | 1 |
| Speed Measurement | YES (per lane) | Need 2 Det. & Controller | Only above 5 mph |
| Volume/Occupancy | YES | YES | NO |
| Serial Port Data | YES | NO | SOME |
| False Calls Rejection | GOOD | GOOD | POOR |
| Diagnostic Self-Testing | YES | NO | NO |
| Road-type Suitability | GOOD | POOR | GOOD |
| Mounting Configurations | Sidfire or Overhead | In-Road | Overhead (Bridge required) |
| Ease of Installation | GOOD | POOR | GOOD |
| Avoid Traffic Disruption (During Installation) | GOOD | BAD | POOR |
| Freeway & Urban Use | YES | YES | NO |
| Repairable | YES | NO | YES |
| Future Upgradeable | YES | NO | NO |
| Intelligent | YES | NO | NO |



EIS Electronic Integrated Systems Inc.

150 Bridgeland Ave., Toronto Ontario, Canada M6A 1Z5 (416) 785-9248, Fax:(416) 785-9332

RTMS Multiple Zone

Radar Detector

and its applications

RTMS (Remote Traffic Microwave Sensor) radar is an advanced off-road multiple-zone presence detector. It is installed on poles beside the road or on bridges above it and provides presence indication in up to 12 separate zones, as well as measurements of Volume, Occupancy and average speed in each of the user-defined detection zones. RTMS has been used in a wide range of applications including Stop-Bar loop replacement, Actuation of temporary intersections, System Loop replacement, Automatic Incident Detection systems and permanent counting stations. The article is presented by Dan Manor, president of EIS Electronic Integrated Systems Inc.

RTMS (Remote Traffic Micro-wave Sensor) radar is a low-cost self-contained general-purpose traffic sensor which can detect and monitor road traffic in multiple independent zones. It is designed to serve in applications of both urban traffic control (actuated intersection control) and that of highway traffic monitoring and management.

The RTMS is a true presence detector providing presence, volume, occupancy and speed information in up to 12 discreet and user-defined detection zones. Output information is provided to existing controllers via 12 contact pairs and to other systems via serial communications lines.

The RTMS is mounted on existing side-of-the-road poles, is easy to install and remove, and is fully programmable to support a variety of applications.

The RTMS is currently being used in the following typical applications: multi-lane intersection approach monitoring (upstream & downstream),

multi-lane highway traffic counting monitoring and management including Automatic Incident Detection systems, stand-alone sensor in major/minor road intersection and off-ramp signal control actuation.

PRINCIPLES OF OPERATION

The RTMS is a radar operating in either of two microwave bands, employing the FMCW (Frequency Modulated Continuous Wave) principle. It transmits a low power microwave signal of constantly varying frequency in a fixed fan-shaped beam. The beam "paints" an elliptical field of view on the surface. Any non-background targets will reflect the signal back to the RTMS where they are detected and their range measured (proportional to the change in frequency during the transmit/receive time interval).

The RTMS range measurement resolution is about 2 meters. It allows the "slicing" of the field-of-view ellipse into range slices. The user can define a number of detection zones, each con-

sisting of a group of range slices.

The RTMS internal microcomputer, controls in real-time 12 opto-isolator switches - each corresponding a detection zone. Each zone-switch is closed while a target is present within the group of range-slices defining the zone. The switches' contact pairs can be connected directly to any traffic controller. As well, some short-term statistical data on each zone is accumulated and transmitted by the RTMS via a serial port. Every 30 seconds a message containing the volume, occupancy and average speed as measured over the preceding period in each of the defined zones, is transmitted.

MOUNTING CONFIGURATIONS

As shown in Figure 1, there are three possible mounting configurations:

- Side-fired
- Forward-looking
- Diagonal.

The side-fired configuration is useful when lane-specific information is required, such as in multi-lane road

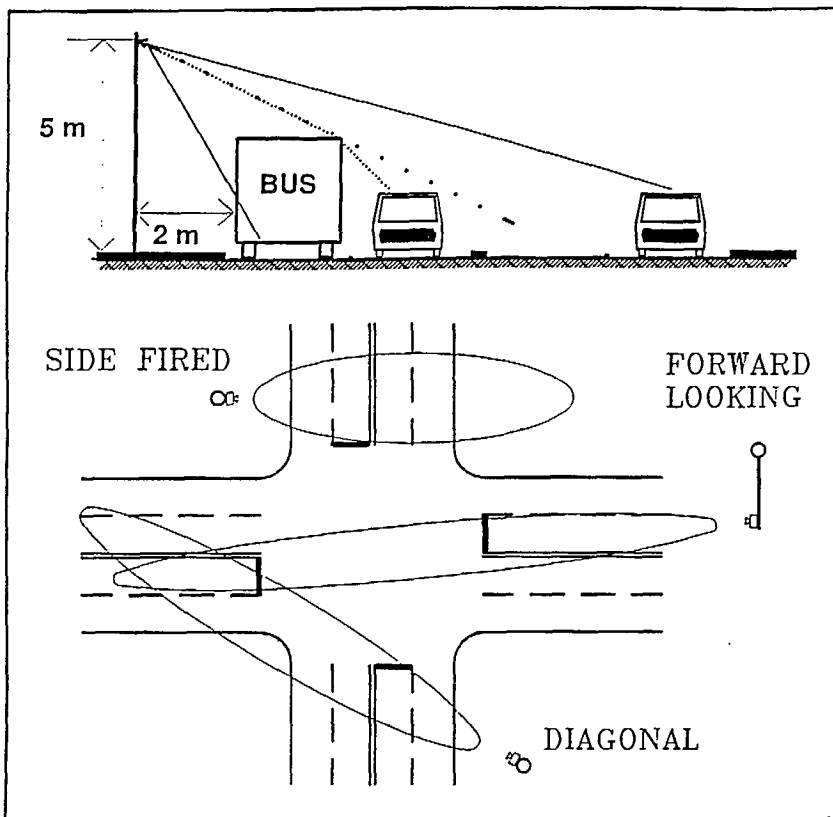


Fig. 1: RTMS mounting configurations

monitoring. The range resolution is utilized to define one zone for each lane. The forward-looking configuration is useful when single lanes are to be monitored or when presence or queue-length must be measured in multiple lanes where lane definition is not required. The diagonal mounting is useful when a large detection zone is required but lane definition is not.

SETUP PROCEDURE

The RTMS setup is performed using any IBM-compatible Laptop or Notebook computer. An intuitive and user-friendly setup software allows the user to define the operating mode, the required number of zones and their locations as well as verifying correct operation. As shown in Figure 2, during setup every vehicle which enters the field of view will be shown on the PC screen as a "blip" at its corresponding range. The user has to recognize the blip as belonging to a vehicle he sees on the road at that moment, and to move a zone-box on the screen to encompass the blip, thus defining the zone. A zone can encompass one or more lanes. After a zone is defined, its corresponding contact pair will close at any time a blip is shown in it. Once all zones are defined, a simple observa-

tion or manual count comparison with the RTMS count allows verification that the zones are properly defined.

APPLICATION EXAMPLES

A few actual and typical installations of the RTMS and their performance indi-

cations are provided as examples of the potential of this versatile sensor.

Side-fire highway monitoring

A permanent counting station mixing RTMS-and-loops, was installed by the Ontario Ministry of Transportation in Toronto on the Don Valley Parkway (a heavily travelled highway) during the 1991/1992 winter. As shown in Figure 3 (overleaf), all 7 lanes were monitored in parallel by loops in the road and by the RTMS. Hourly lane counts were taken and telemetered to MTO for further analysis. Of special interest was the level of occlusion of vehicles in far lanes by tall trucks in nearer lanes. Figure 3c shows the integrated counts for the entire month of March 92 for the 7th lane (off-ramp) which is the most susceptible to occlusion from other vehicles. The results show an almost identical count to loops all through the month and an RTMS/loop count ratio close to 1.0 at all times of the day including peak hours.⁷

A test on the Autobahn No. 4 near Aachen, Germany was done in October 93 by the Heusch Boesefeldt Engineering company. The test provided very good counting results for each of the four lanes. It is important to note that about 40% of the traffic in lane 1 consisted of heavy trucks.

The test compares the RTMS counts to manual counts over a 15 minutes interval. The results are shown in Table 1 overleaf.

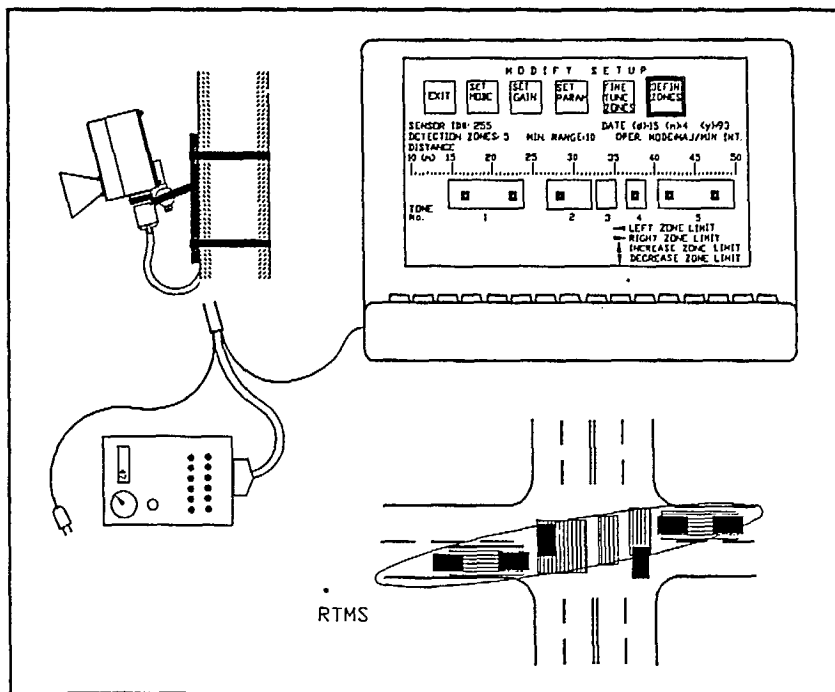


Fig. 2: Setup procedure

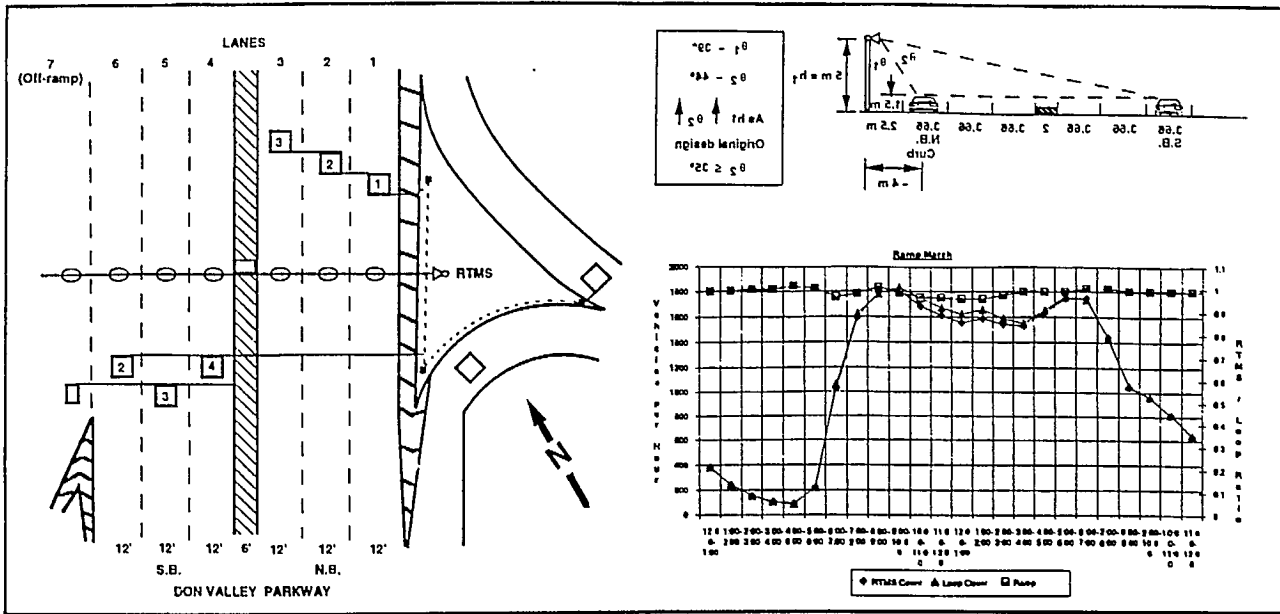


Fig. 3 (above) : Don Valley parkway permanent counting station

Table 1: Autobahn Test Counts

| Lane # | 1 | 2 | 3 | 4 |
|--------------|-----|-----|-----|-----|
| RTMS count | 181 | 222 | 266 | 217 |
| Manual count | 176 | 222 | 262 | 202 |

Forward-looking highway monitoring
 RTMS units have been operating since January of 1993 in an overhead mounting position on the New Jersey Turnpike (A 12-lane highway between New York and Philadelphia). All units have been mounted on overpass bridges as shown in Figure 4, and tilted down so as to narrow their field of view to the middle of three lanes. By defining two detection zones in the lane, approximately 5m apart - a speed-trap was formed. The RTMS contacts feed a controller which supplies a central computer with Volume, Occupancy and Speed information on the traffic in this lane. The purpose of the system is to monitor flow, detect incidents and provide driver with real-time information via changeable message signs.

A full RTMS-based Freeway Traffic Management System is under construction in Milwaukee, Wisconsin. It employs many RTMS units in both Forward-looking and side-fired mounting configurations.

Side-fired actuated intersection control
 There are various schemes of actuated signal control at an intersection. One of the simplest requires stop-bar loops

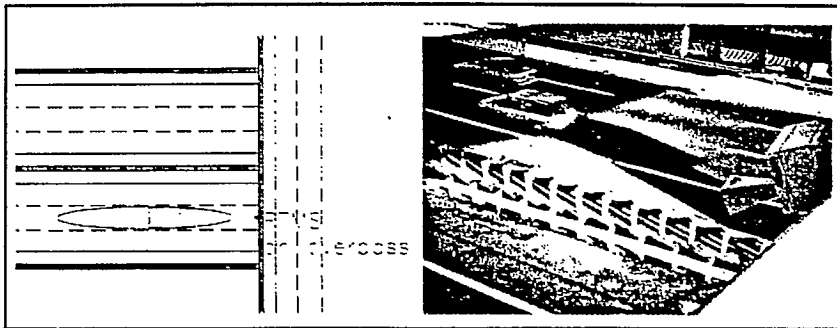


Fig. 4: Forward looking highway monitoring on the New Jersey Turnpike

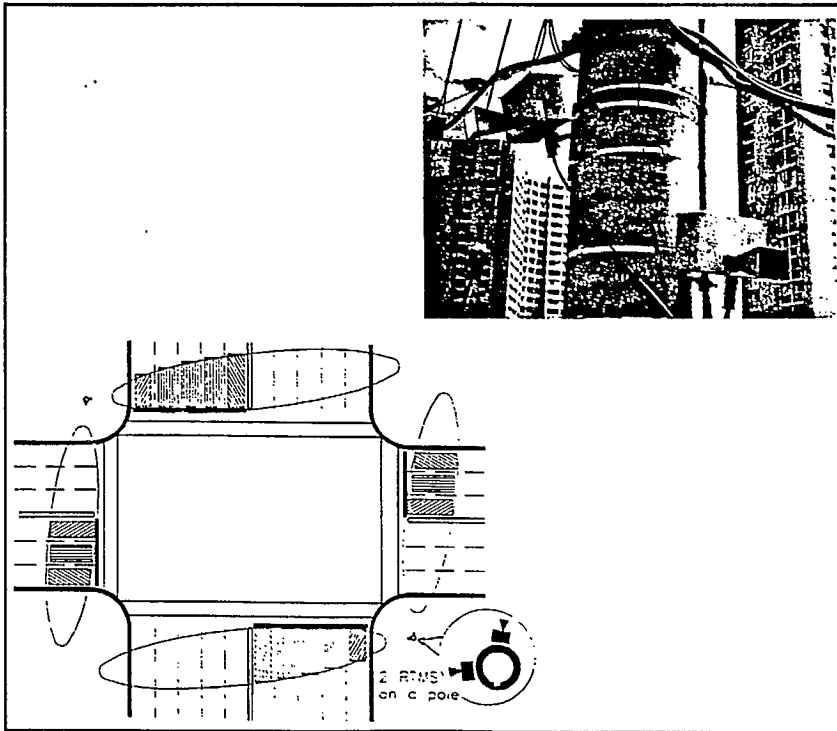


Fig. 5: Side-fired actuated intersection control

to indicate presence at the various lanes. A typical large intersection where lane-specific presence indication is required for fully-actuated control is the Highway 10 at Burnhamthorpe Road in Mississauga, Ontario. As shown in Figure 5, it requires one RTMS per approach. The intersection has been RTMS-actuated now for almost two years.

Diagonal mounting actuated intersection control

Another example of an actuated intersection control is that of Highway 10 at Dundas Street in Mississauga, Ontario. A mixed usage of loops and RTMS feeding the same controller provides presence indication at the stop-bar and "long queue" indication on the left-turn lanes.

Since the application did not require lane resolution but defined each approach's stop-bar area as a single detection zone, the diagonal mounting could be employed and each of the two RTMS units provides presence indication on two approaches (replacing six loops).

Forward-looking actuated intersection control

Two simple intersections can be controlled by a single RTMS unit. The major/minor street intersection control lets the major arterial traffic flow unless the minor street approaches are indicating presence. The Off-ramp "T" intersection control can measure the queue length and enable the off-ramp traffic to flow into the arterial to avoid back-up of the queue into the highway.

In both implementations, a more intelligent control is made possible by defining additional zones on the RTMS which measure the traffic in the main arterial. The timing and length of allowing the other direction, can be affected not only by the queue length but also by the density of the arterial traffic.

Highway automatic incident detection system

A new architecture for a low-cost automatic incident detection system is now in demonstration implementation on highway 401 in Toronto. In it, a simple method of detecting, communicating, processing and reporting of incidents on a 12-lane highway is demonstrated using a chain of pole-mounted Vehicle Detection Stations (VDSs). Each VDS consists of a single side-fired RTMS, monitoring a large number of lanes and an RF modem. The RF modem transmits the statistical information the RTMS collects via the

Mobitex public packet-data network. Every 30 seconds each VDS transmits a message containing the Volume, Occupancy and average speed information on each of the lanes it monitors. Each message is transmitted as a single packet and all packets are multiplexed in order of transmittal to a single phone data line and through it to a single PC computer. The computer runs the McMaster algorithm² for incident detection and reports incidents on its own display screen. ○

KISS LOOPS GOOD-BYE.

Finally, the world's first affordable, true presence, off-road, multi-lane detector.

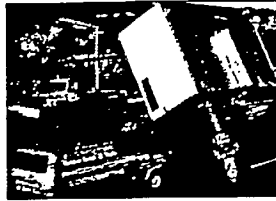
Dozens of installations throughout North America says it works flawlessly. EIS's background in advanced military radar technology made this breakthrough possible.

The EIS detector is designed for urban and freeway traffic. It provides presence, volume, occupancy and speed information. On up to twelve lanes.

Our units are simple to install; most average an hour. They are maintenance free. And

they're built to last 15 years, making them many times more cost-effective than conventional loops.

The EIS radar detector cuts down traffic headaches. Forget about everything you ever heard about other off-road detectors. This one works. Guaranteed. Call, write or FAX us for the full story.



Advanced radar technology. Multi-zone. Up to 12 lanes.



Easy to install and simple to use. Yet surprisingly cost-effective.

FAX THIS COUPON TO EIS TODAY
Check the boxes that apply

NAME: _____
 JURISDICTION: _____
 ADDRESS: _____
 CITY: _____ STATE: _____
 PHONE: _____ FAX: _____

Urban Freeway
 Send me the EIS information kit.



Electronic Integrated Systems Inc.
 2888 Bathurst St., Toronto, Ont., Canada M6B 4H6
 Tel: (416) 785-9248 Toll free (U.S.) 1-800-668-9385
 FAX: (416) 785-9332

REFERENCES

- 1 The RTMS/ Jackson Wang, E. Ryerson Case and Dan Manor - a paper presented at the VNIS '92 conference in Oslo, Norway.
- 2 Distinguishing Between Incident Congestion and Recurrent Congestion: A Proposed Logic/ Ana I. Gall and Fred L. Hall, Transportation Research Record 1232.

SPECIFICATIONS

Area Coverage

The RTMS field of view covers the area defined by:

| | |
|------------------------|------------------------------|
| Elevations Angle | 50 degrees |
| Azimuth | 15 degrees |
| Range | 60 metres (200 ft.) |
| Measurement Resolution | |
| Detection Zones | up to 12 zones |
| Range (zone length) | 2 metres (7 ft.) |
| Zone Width | 1 to 10 metres (3 to 33 ft.) |
| Time events | 10 mSec |

Power Requirement

115 +/-20 volts AC 60 Hz @ 0.25 A
Surges: Per IEEE C62.41-1980 category C

Interface

single MS multi-pin connector provides power and output signals

- 12 isolated o.c. contact pairs rated for 50 mA at 30 volts
- a serial RS-232 data bus at 9600 baud rate

Mechanical

The unit is encased in a rugged metal water-tight box. It is mounted on a universal bracket, enabling securing of unit to poles, tilting in both axes and quick locking.

Size

16cm x 24cm x 28cm (6 in. x 9 in. x 11 in.)

Weight

4.5 Kg (10 lbs.)

Reliability

Mean Time Between Failures (MTBF) designed to be 90,000 hours (10 years)

Maintainability

- shop repairable
- set-up or replacement time: 15 minutes

Environmental Conditions

Temperature Range -37° C to +74° C

Humidity to 95%

Vibration 2g up to 200 Hz

Shock 5g 10mSec half sine wave



EIS Electronic Integrated Systems Inc.

150
Bridgeland Ave.
North York, Ontario
Canada
M6A 1Z5

Tel:
(416) 785-9248
Fax:
(416) 785-9332

APPLIED ANALYTICS CORPORATION

Markham, Ontario

- **POS (Positioned Orientation System) for precision navigation, remote sensing, and motion compensation measurements**
- **Selling systems into markets such as airborne remote sensing and mapping, road surveying, railroad track geometry measurements and sonar sea floor mapping**
- **Transportation electronics applications:**
 - **Cars, trucks & railroads**
 - **Geographic info system data bases**
 - **On-vehicle precision position & navigation systems**
 - **Gyro/inertial instruments and integration of same with GPS and other aiding sensors**

Applied Analytics Corporation

September 14, 1994

Mr. Cliff Oldridge
Defence Elect. Directorate
Defence Elect. & Space Branch
Industry, Science & Technology Canada
235 Queen Street
Ottawa, ONT
K1A 0H5

Dear Cliff,

Thanks for your fax.

I've enclosed a copy of our company brochure. The brochure is somewhat out of date but provides info on our background and capabilities.

As I mentioned on the phone, we have developed a family of products called POS (Position and Orientation System) for precision navigation, remote sensing and motion compensation applications. POS integrates GPS and inertial sensors to provide full 6 degree of freedom measurements (position and attitude) of vehicle motion and dynamics.

POS applications include: airborne remote sensing and mapping, road surveying, railroad track geometry measurements and sonar sea floor mapping. We are currently selling systems into all of these markets.

The specific areas of relevance in the Transportation Electronics field include:

- cars, trucks and railroads
- generation of geographic information system (GIS) data bases
- on-vehicle precision position and navigation systems
- gyro/inertial instruments and integration of same with GPS and other aiding sensors such as magnetometer and odometer

Please give me a call if you need more information.

Yours sincerely,



Blake Reid
President

Company Profile

1 Company Background

Applied Analytics Corporation is a wholly Canadian-owned company incorporated in the Province of Ontario, Canada, in February, 1991. The Company retains the core capability of Honeywell Canada's Advanced Technology Centre (ATC), which Honeywell closed in July, 1991, following its strategic decision to terminate all aerospace & defence-related R&D activities in Canadian operations.

2 Business Purpose and Capabilities

Applied Analytics is an applied research and product development company with advanced capabilities in the fields of signal/image processing, navigation, and systems control. These capabilities are focused in the areas of navigation systems integration, motion compensation systems and infrared image processing systems. Currently, the Company's engineering activities are split approximately equally between military and civilian applications, a number of which are off-shore.

The business purpose of the Company is:

- a) to act as a technology resource to the aerospace sector, providing strong systems engineering, systems integration and R&D capabilities in the navigation, motion compensation and image processing fields for both government defence agencies and large avionics contractors.
- b) to apply its advanced defence-sponsored technologies in the development of custom products for niche markets in the civilian sector, especially in the areas of surveying, remote sensing and environmental monitoring.

Specific areas of excellence include:

- Analysis, design, simulation and evaluation of multi-sensor navigation systems, motion compensation systems, and infra-red target detection and processing systems.
- Design and implementation of advanced signal processing and control algorithms for integrated navigation, target detection and recognition, and systems control applications.
- Development of scientific and embedded software for the above applications, with Ada and C++ being the preferred languages for many of these.
- Design, build and test of advanced development models and engineering models of multi-sensor systems for proof of concept and subsequent product release, including hardware assembly, embedded software development, system integration, and lab, van and flight test activities.

In the military sector, Applied Analytics provides its services to the Canadian Department of National Defence and large U.S Department of Defence contractors to develop and validate

new system concepts, from initial feasibility studies through to implementation and test of system prototypes. Applied Analytics personnel have experience in MIL-STD 490 system development and DoD-STD 2167 software development. The company actively supports the transition of demonstrated technology to major avionics contractors for implementation and production.

In addition to its defence orientated activities, Applied Analytics is actively involved in commercial applications of its technology, and is currently developing new products for the commercial marketplace. For example, Applied Analytics is now applying advanced inertial sensing technology to the aerial survey and remote sensing fields with the development of its position and orientation system (POS), which offers significant improvements in the performance and cost-effectiveness of resource and mapping surveys using advanced navigation and post-mission data analysis techniques.

3 Programs

Specific programs carried out by Applied Analytics include:

- *Helicopter Integrated Navigation System (HINS)*: a project with the Canadian Department of National Defence (DND) for continued development of the HINS and for its transition to production. HINS integrates a number of state-of-the art navigation sensors and subsystems (including a ring laser gyro inertial navigation unit and a P/Y-code Global Positioning System receiver). Advanced estimation methods and signal processing techniques are implemented to optimize overall system accuracy and fault tolerance.
- *IR Target Processor Test Bed*: a project with DND for continued development of an advanced prototype IR target processor for real-time multi-target detection, tracking and frame registration in infrared imagery. This system is one of the most powerful and complex processors of its type in the world.
- *SAR Motion Compensation*: lead by Holomax Limited, Applied Analytics participated in a project with the U.S. Air Force (WRDC) for continued development of advanced techniques for motion compensation of airborne synthetic aperture radar with specific application to high dynamics aircraft. An inertial measurement unit integrated with GPS is employed to accurately measure radar antenna motion and thereby obtain high-resolution, high-contrast imagery at long range.
- *Geophysical Survey System*: a multi-year project with a large Canadian resource company to develop a new family of airborne systems for geophysical survey applications. These systems combine inertial sensing technology, differential GPS and advanced signal processing methods.
- *ARPADS*: a project with DND for the development of a highly accurate Aircraft Reference Profile and Data System (ARPADS) to be used as a reference for evaluation of aircraft flight characteristics, navigation equipment and weapons delivery systems. ARPADS integrates a Ring Laser Gyro (RLG) inertial system with differential GPS, and includes a post-mission processing capability for generation of reference profile data and analysis of target system performance.

- *Position and Orientation System (POS)*: development of a family of position and orientation systems for airborne, land and marine applications. The POS integrates an inertial measurement unit with differential GPS to provide navigation and motion compensation data for accurate positioning and attitude reference.

Further information concerning AAC's capabilities and programs is given in Section 2.

4 Facilities

Applied Analytics has the staff, computer equipment and facilities to support projects in the above areas. Applied Analytics maintains a 4,400 square foot facility in Markham, Ontario. The facility is cleared to NATO SECRET and COMSEC.

Applied Analytics computing facilities include the following:

- SUN SPARC-2 workstations, with approximately 10 GByte of hard disk space, running UNIX, configured for numerically intensive work and embedded software development,
- Macintosh and PC computers for word processing and desktop publishing,
- 386 and 486 computers equipped with serial (ARINC-429) and parallel (24 and 96 lines) interface cards for avionics systems interface, control and data acquisition,
- EtherNet and AppleTalk networks,
- Ada, C and C++ software development environments,

Other equipment include: inertial and laser test equipment, a variety of target computers, cross-compilers and embedded software development tools.

Applied Analytics has on loan from DND the following equipment (GFE) for product development work and HINS technology life cycle management:

- inertial reference systems (Honeywell H423, HG1050 and H478)
- HINS ADM prime mission equipment (including inertial, P/Y-code GPS and Doppler subsystems) and support equipment,
- HINS program generation centre for maintenance of the HINS software and processing of HINS flight test data.

Applied Analytics has on loan the following GFE for conducting work under contract to DND on the infra-red target processor testbed:

- IRTP test bed hardware,
- SUN SPARC IPC with 1.5 GByte hard disk.

Background

Business:

- Honeywell Canada closed its Advanced Technology Centre (ATC) in 1991
 - casualty of Honeywell's progressive divestiture of aerospace & defence operations
- AAC formed in Feb '91
 - acquired Intellectual Property from Honeywell
 - emphasis on commercial application of military technology
 - product focus

People:

- AAC retains core Honeywell staff
 - approximately 200 man-years combined experience in navigation, motion compensation, image processing and systems control

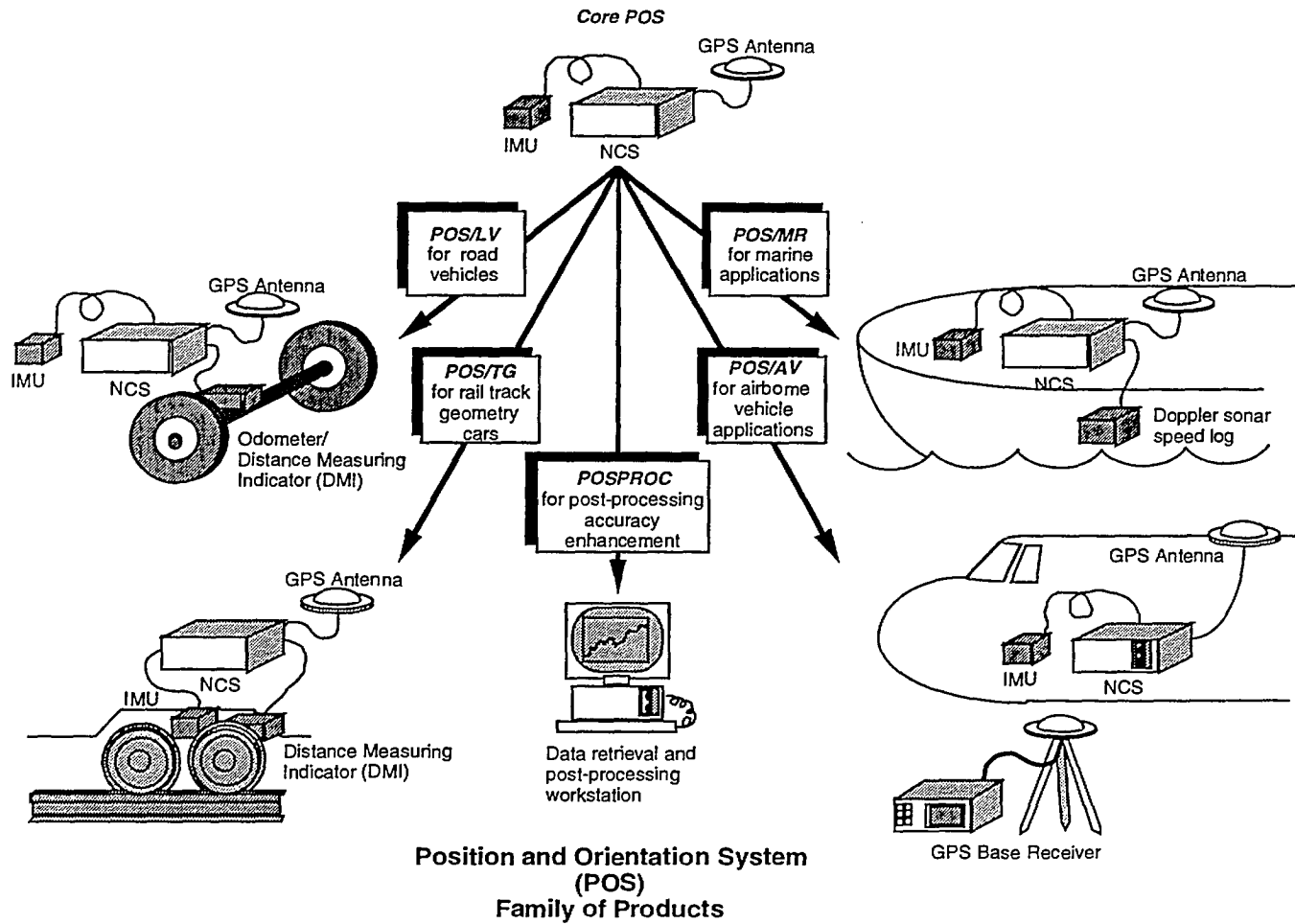
Applied Analytics

March, 1994

POS Product Family

- POS/LV - for road survey/monitoring applications
- POS/TG - for railroad track geometry applications
- POS/MV - for marine charting & surveying
- POS/AV - for airborne remote sensing & surveying

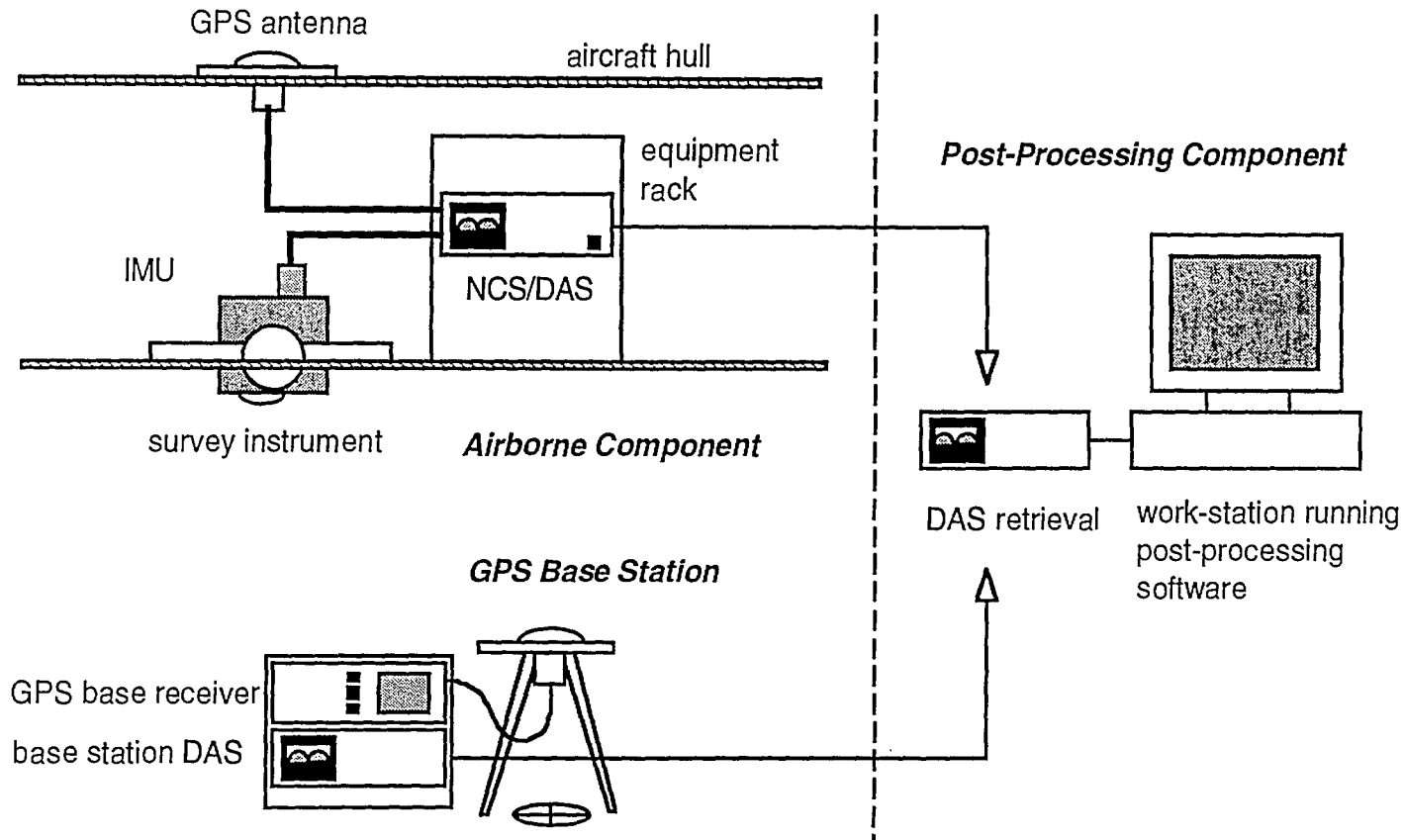
POS Product Family



Position and Orientation System (POS) Family of Products

Applied Analytics

POS/AV System Configuration



GIRO ENTERPRISES INC.
Montreal, Quebec

'Hastus' family of transit scheduling products used in 80 public transit companies in major cities worldwide.

Transit operations and information systems.

'Autotec" Fleet management software.

'Geo Bus' school transportation system.

'Post Cards' generates GIS carrier/postal vehicle routing and produces detailed maps.

Customers in 17 countries.

Corporate history

GIRO Enterprises Inc. and its associated companies are privately held Canadian corporations with all shares owned by senior management. GIRO currently employs one hundred professionals in Montréal, seconded by an international network of field representatives, agents and distributors.

GIRO Inc. was founded in 1979 to further develop and commercialize the *HASTUS* transit vehicle and manpower scheduling system, originally conceived at the University of Montréal. GIRO's first customers were Montréal's STCUM and Québec City's STCUQ. *HASTUS*, based on sophisticated operations research algorithms, is used to plan and optimize transit vehicle and operator schedules.

By 1982, *HASTUS* produced savings in operating costs in excess of 3% per year for the STCUM. At that time, this was equivalent to more than \$2,000,000 annually, and the software gained international recognition in the public transit industry.

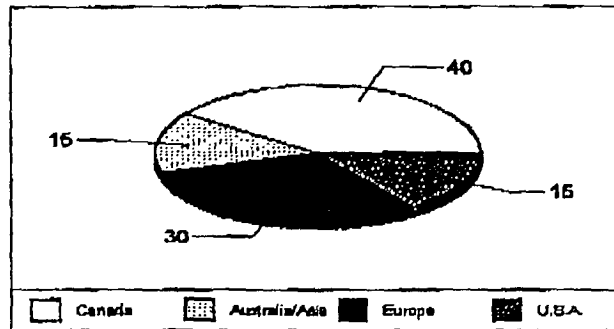


Figure 1: Sales revenues by geographical area (1990-1993 fiscal years)

Today, the system is utilized in more than sixteen countries. Transit authorities in Boston, Los Angeles, Buffalo, Seattle, Calgary, Ottawa, Québec, Sheffield, Canberra, Edinburgh, Nantes, Lyon, Barcelona, Stockholm, New York, Aarhus, Melbourne, and Singapore are among the more than 80 *HASTUS* customers. Figure 1 provides a breakdown of sales by geographical area over the last three years.

Products and consulting activities

GIRO Enterprises Inc. maintains an active presence in various specialized markets through the member companies of the group. The general strategy of the firm has been to concentrate on products and services that combine sophisticated mathematical techniques and/or specialized know-how with modern information management systems.

Activities by major sector

Four major activities can be identified for GIRO Enterprises Inc. Figure 3 provides a breakdown of sales for each.

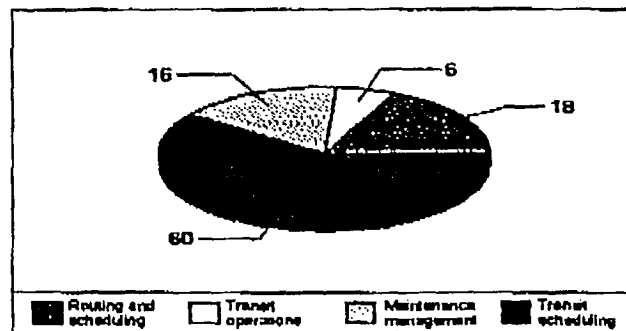


Figure 3: Sales by major activity (1990-1993 fiscal years)

Transit scheduling

The *HASTUS* family of products, based on linear programming and specialized heuristics, is now used by over 80 public transit companies in major cities world-wide. This system is a tool for scheduling vehicles (buses, trains, ferries, subways, or trams) and their operators. Through the generation of extremely efficient schedules, *HASTUS* permits significant savings in both labour and vehicle operating costs for public transit providers.

GIRO Enterprises Inc.

This system has evolved considerably since its initial introduction in 1981. Major enhancements and additions - such as *HASTUS-Graphics*, the PC version of *HASTUS*, improved and new optimizing algorithms, support for relational databases and windowing operating systems - have made the product even more flexible and attractive to new and existing clients.

Transit operations and information systems

As an extension to *HASTUS*, GIRO Inc. has developed related products to aid in day-to-day transit operations.

HASTINFO is an innovative customer information system that provides transit patrons with information on transit schedules and suggested itineraries.

HASTUS-DDAM is used to manage the daily assignments of drivers and other employees. It facilitates both real-time decision-making and payroll reporting.

GIRO Inc. has also developed expertise in integrated systems that can include *HASTINFO*, *HASTUS*, automatic vehicle location systems and/or electronic radio systems.

Vehicle routing and scheduling

GIRO Enterprises Inc. has developed several products in the area of computer-assisted and automated vehicle routing systems.

GeoRoute is a general-purpose PC-based system that allows the localization of items on street networks. These networks can be updated interactively and detailed maps can be produced on demand.

GeoRoute can be used as a stand-alone system or integrated into specialized systems such as *GeoBus*, *HASTINFO*, *Post Cards*, and the Meter Reading Route Optimization System (*GeoRoute-MRROS*) and the new *HASTUS-Geo* module.

Products and consulting activities



GeoBus is a complete school transportation management system. *Post Cards* automatically generates letter-carrier and postal delivery vehicle routes and produces the detailed maps required for planning and daily operations. *GeoRoute-MRROS* generates routes for utility meter reading personnel.

The *GIRO/ACCES* paratransit management system integrates comprehensive information management with an automated scheduling system for elderly and handicapped door-to-door transportation services. It is in use in six of North America's largest disabled transportation services.

In addition, a number of related products are under development as part of a multi-year R&D project. The main thrust is to provide computer tools for physical distribution network planning and operations, based on advanced optimization algorithms, map-based displays, and the *GeoRoute* street network database.

Fleet management software

One group within GIRO develops *LOGIMAINT* fleet and facilities maintenance management software. Features include maintenance management and scheduling, spare parts inventory and purchasing, fuel disbursement and reservoir management, and the entry of employee time sheets.

The latest version of the *LOGIMAINT* family, *Autotec*, employs relational database technology. It is used by Bell Canada to manage activities at more than 100 sites throughout the provinces of Québec and Ontario.

Computing environments

Target systems

All software is designed from the start with **portability** as a major objective. This is achieved by adhering to industry standards, both official and de facto, and carefully minimizing dependency on vendor-specific features. GIRO Entreprises Inc. can thus offer total solutions that best fit a customer's current and future computing environment.

The success of this approach is best illustrated by examining the list of environments in which the company has installed software:

| | |
|---------------------|--|
| Mainframes | : IBM (under CMS, TSO, and CICS), Honeywell-Bull, ICL, CDC and CYBER |
| Minis | : DEC VAX/VMS, PRIME/PRIMOS |
| UNIX servers | : SUN, Convergent, H-P IBM, RS-6000, and other UNIX-based systems |
| PC | : IBM PC/AT, PS/2 and compatibles with MS-DOS, OS/2, WINDOWS, and UNIX/386 (XENIX) |
| Local-area networks | : Novell, 3COM, Banyan-Vines, LAN Manager, IBM LAN Manager and TCP/IP |

Development environment

The internal development environment is made up of an integrated network of more than 125 PC workstations running either DOS, OS/2 or Windows. These are linked to UNIX, OS/2, Windows/NT, and VAX/VMS servers over an Ethernet network. All technical staff have access from their desk to any computer in the network. Through the company's telecom network, they can also access IBM, DEC, H-P PRIME, and SUN machines at several customer sites, and universities.

SOFTWARE KINETICS LTD.
Ottawa, Ontario & Dartmouth, Nova Scotia

Systems and software engineering

Computer-aided dispatch product (law enforcement)

Includes geographic database

Uses public packet radio nets.

Geographic Information Systems for municipal and resource applications (Dartmouth Office)



Software Kinetics

65 Iber Road, Stittsville, Ontario, Canada, K2S 1E7

FACSIMILE LEAD SHEET

DATE: Sept 20/94

| TO | FROM |
|---------------------------------|---------------------------|
| NAME: <u>Cliff Aldridge</u> | NAME: <u>Tony Moretto</u> |
| COMPANY: <u>Industry Canada</u> | PHONE NO.: 613-831-0888 |
| PHONE NO. _____ | FAX NO.: 613-831-1836 |
| FAX NO. <u>991-9469</u> | |

PRIORITY ROUTINE

NUMBER OF PAGES - INCLUDING COVER SHEET 7

ORIGINAL TO FOLLOW BY MAIL YES NO

SUBJECT:

COMMENTS: Software Kinetics Corporate Info.

SIGNATURE: [Signature]



Software Kinetics

21 November 1994

Mr. Cliff Oldridge
Industry Canada
Ottawa, Ontario

Subject: Transportation Electronics (Your Fax of November 16, 1994)

Dear Cliff:

Let me begin my response by stating that we have worked on the periphery of the ITS sector, but are not strictly speaking in the transportation business. We have carried out related work and have developed technologies that might be of interest. These are as follows:

- Development of a Case Based Manning System for Spacecraft Operations. Case Based Planning (generally accepted as an Artificial Intelligence Technology) should be applicable to any transportation planning problem.
- 3D sensor data visualization: we have been building systems that produce 3D (animated) reconstructions of aircraft flights from flight recorder data and can produce similar reconstructions from other sensor data to analyze driver performance, display vehicle position/location and dynamically display vehicle velocity, acceleration and movement.
- We are currently building a mobile data/packet radio system for a Police Communication application. This includes designing a specific Mobile Workstation application and a communications server to handle radio interfaces.
- Finally, I should also mention our extensive experience in enabling technologies such as Fault Tolerant Systems, system simulation (including the human) and performance analysis and sensor/intelligence data fusion.

Software Kinetics Ltd.
65 Iber Road, Stittsville, Ontario, Canada, K2S 1E7
(613) 831-0888
Fax # (613) 831-1836

21
November 1994

Page 2

We would entertain any queries you may receive and if you need additional details please let me know.

Sincerely,



T. A. Moretto
Director,
Sales and Marketing

TAM:bl

CORPORATE OVERVIEW

Software Kinetics' mission is to attain national prominence as a leader in systems and software engineering solutions and services. The Company was incorporated in 1981 and continues to be privately owned and controlled by its Canadian employees.

Corporate Organization

The Ottawa Operation, located in the Canadian National Capital Region, specializes in defence, aerospace, network communications, and public safety markets. The Atlantic Operation, based in Dartmouth, Nova Scotia, focuses on informatics and defence systems markets. A sister company, NSTN Inc., is a computer network services organization that provides Internet connections in Nova Scotia and Ontario. An independent Quality Group reporting to the president of the Company manages Software Kinetics' Quality Assurance programs.

Facilities

Software Kinetics' Headquarters and Ottawa Operation are housed in a 21,000 square foot company-owned building in Stittsville, Ontario. The Atlantic Operation and NSTN Inc. share a new 10,000 square foot facility in Dartmouth, Nova Scotia. Within these facilities exist modern, distributed software development environments comprised of networked workstations, communications services, file servers and a host of project specific computers.

Business Volume

The Company achieved a major milestone last fiscal year (93/94) with sales exceeding \$10-million. Current fiscal year sales (ending September 30/94) will be over \$12-million. Software Kinetics has remained consistently profitable and has financed its operations entirely from within.

Employment

Together with NSTN Inc., Software Kinetics employs over 150 people. Most of the staff are professionals with experience and qualifications in both systems and software engineering. Of this number over 91 people are resident in Ottawa with the balance employed in the Atlantic region.

Core Technologies

Software Kinetics' success has been built on the development and application of core technologies in OSI standards, Ada software environments, 3-D modeling, Artificial Intelligence, Graphical User Interfaces and modern Object-Oriented methods.

Market Areas

Software Kinetics' extensive defence applications experience includes the development and support of systems for Electronic Warfare, Command and Control, Trainers and Simulators and Military Message Handling. In the aerospace sector the Company has developed expertise in Air Traffic Control, Avionics and Flight Safety. Projects in civil and communications applications include Distributed Systems, Network Research and Design, Public Safety, Library Networks and Computer and Network Security.

Client Base

Among the Company's clients are major Federal and Provincial Government departments and research institutions and defence contractors such as Computing Devices Company, Canadian Marconi Company, Litton Systems Canada, Lockheed Canada, Hughes Aircraft and EDS Defence Limited. Commercial clients include Gandalf Data Systems, Digital Equipment Corporation, Honeywell, Tandem Computers, Systemhouse and many others.

Project Profile

Computerized Integrated Information Dispatch System

Overview

Software Kinetics has developed a state of the art Computerized Integrated Information and Dispatching System (CIIDS) for the Royal Canadian Mounted Police (RCMP). The CIID System is a technologically advanced communications, dispatching and database tool that provides integrated access to all police systems. This allows for a more effective response with more complete information to the officer in the field. The CIID System combines into one system, functions such as:

- status keeping
- occurrence handling
- external on-line access (e.g., SNA/SDLC and X.25 interfaces)
- local databases
- records management systems
- communications and systems control (e.g., radio, telephone, intercom, alarm, door access, etc..)
- MDT support

Each CIID System is configured with one or more intelligent workstations. The workstations can be located within the same room or in remote operation centres. Access can be gained to all communications and records systems through each of the CIIDS workstations.

The CIID System has easy-to-read user friendly screens with a user interface that provides quick and easy access to the CIIDS functions. All information is available at a single glance and is displayed in colour windows on one or more monitors at each workstation.

While the CIID System is currently being developed specifically for the Royal Canadian Mounted Police, its modularity allows it to be easily adapted for smaller communications districts or police departments with different demand loads. The CIID System can be configured to meet the challenges presented by any Police Organization to ensure effi-

cient and effective communications, information and dispatching services in a cost effective way.

CIIDS Functions

Status Keeping

This is the heart of the CIIDS and allows Operators to maintain, display, and print the current and past dispositions of patrol unit(s) working within a communications district. The Status Keeping function is broken down into two major sub-functions; Status Update and Status Query.

Status Update

Through this function the CIIDS is able to add, update and remove Patrol Unit Records. The operators can set timers against the units for individual occurrences. Central database information may be called up for specific ten codes when performing the Update Patrol Unit Status function. Support for Mobile Data Terminal initiated status updates is also provided.

Status Query

This sub-function allows any CIIDS operator to view the current or past status of one or more patrol units within the communications district. Specific screen displays allow the operator to monitor the current status on an ongoing basis, view the status history for all or specific units and view an entire Patrol Unit Record. To aid in the analysis of the various activities, a statistics reporting function is included.

Occurrence Handling

The Occurrence Handling function provides all CIIDS operators with the facility to record occurrence related information and to monitor dispatched units.

Occurrence related data may be entered into the CIID System via a pre-formatted full screen display or via the command line. The fields can either be completed manually or automatically to pre-defined default



Software Kinetics

values. All CIIDS files are accessible to the operators for processing and examination. While processing an occurrence, CIIDS operators also have access to central databases through various programmatically controlled wide area network (WAN) interfaces. The occurrences can also be transferred to any other CIIDS Workstation.

Dispatching

Any CIIDS operator may dispatch any number of patrol units to an occurrence via the occurrence dispatch screen or via the command line. The CIID System will recommend units by searching the Patrol Unit Records for units that can be considered for assignment to that occurrence.

Communications and System Control

The Communications and System Control function within the CIIDS provides complete and flexible control of the Radio and Telephone audio communication subsystem. The design also allows for control over various systems that may terminate in the Communications Centre (e.g., Door Access Control, Video Camera Control, Building Alarm Control).

The Systems Control function offers advanced telephone system capabilities including monitoring, patching, muting, transferring, forwarding and placing calls, as well as radio functions such as channel changing and radio alarms.

All of these functions are integrated into one CIID System which are accessible from any single operator workstation. This integration allows for more effective control of all of the systems via consistent and easy to use interface screens.

External Information

A CIIDS operator may also use the workstation as an interface to the Canadian Police Information Centre (CPIC) network and records systems. The transactions can be used immediately or saved for future use. A CIIDS Workstation in effect may replace CPIC Intelligent terminals. With this function any number of Workstations may operate using a limited number of available network resources. Similarly, any number of Workstations may communicate with specific local records management system.

Local Information

This function allows different locations to maintain local information in either pre-defined files or user-defined files. These files can be used to create reports in the form of Specific Addresses, Division Directory, Tactical Plans, Canned Messages and any other information desired.

CIIDS Technical Features

The CIIDS software is written entirely in the "C" programming language and is based on the powerful industry standard, UNIX System V Operating System. This common platform provides a flexible and convenient environment upon which the CIIDS application software can execute. The software design permits the CIIDS to run on any hardware platform supporting UNIX System V; from a Personal Computer to a Super Computer.

One implementation offered utilizes a Tandem CM1300 Integrity Non-Stop Unix system. This system guarantees 99.9% availability; a feature demanded by mission critical applications.

The UNIFY relational database system offers an easy-to-use friendly interface for display management and report generation. Human ergonomic features such as on-line help facility, menu driven interface, explicit error messages and a consistent user interface across all applications are fully integrated into the CIIDS design.

The CIIDS Application Software design minimizes inter-process communication to reduce complexity and overhead. A modular design provides the capability for easy expansion or re-configuration as the load increases on the system.

The system architecture is client-server thereby distributing the demanding processing among 486 PC's connected to the main processor over an Ethernet LAN.

The flexibility and ease of maintenance provided by the Software Kinetics CIIDS software design guarantees a long service life. Portability, the use of industry standards and a careful design emphasizing user friendliness, modularity and reliability will ensure the CIID System is operational and fully maintainable for many years.

Software Kinetics Ltd.

Capability

Geographic Information Systems

Software Kinetics is a Canadian systems and software engineering company specializing in defence and aerospace applications, data communications, information systems, and advanced software technologies.

The term "geographic information systems" (GIS) refers to a wide-range of databases and products serving spatially located information. GIS has become a critical component of natural resource, land and facilities management for the private and public sectors.

Software Kinetics provides computer technology expertise to develop and support geographic information systems in conjunction with resource, engineering and land management experts.

Software Kinetics' GIS-specific Expertise

Vendor-independent Off-the-shelf GIS and CAD Experience

Software Kinetics has operational and application development experience using leading GIS and CAD software including ARC/Info, SPANS, Geo/SQL-Spatialist, CARIS and AutoCAD. The company's work with combat systems and simulators has also involved other high resolution digital mapping systems. Software Kinetics employs its product experience to support all phases of the GIS project or software engineering life-cycle from conceptualization to implementation and maintenance.

Software Kinetics is vendor independent: ready to work with the client's products of choice or assist in identifying appropriate GIS products or environment.

Spatial Data Management

Software Kinetics information systems work has included many databases which rely on coordinate-based (vector) and grid-based (raster) data. Spatial data has storage, maintenance and retrieval requirements which exceed standard relational DBMS functionality. Software Kinetics' work to address spatial data management issues ranges from specialized database maintenance and application development to artificial intelligence applications for automated information extraction from satellite imagery.

To support existing clients, Software Kinetics continually evaluates new processing, database and archival technologies to better support management of very large spatial databases.

Image Processing, Analysis and Display

Digital images are an increasingly important class of spatial data. Geographically rectified digital images include remotely sensed (RS) data products derived from RS such as classifications and orthophotos, and scanned maps and drawings. Digital images important to GIS also include scanned photographs and documents.

Software Kinetics has developed software to manipulate and display digital images for meteorological and other satellite information and naval electronic warfare. Software Kinetics has a long history of involvement with electronic document interchange and delivery, regularly serving on national and international standards committees.

Supporting Technologies

Database Management and Database Application Development

Databases and database applications are a critical component of GIS. Software Kinetics has extensive experience with database design, development and maintenance for information systems and real-time systems. Software Kinetics' experience includes SQL-based products (e.g. Oracle), 3rd and 4th generation development environments, and object-oriented design and development methodologies.

Examples of GIS-related database applications developed include: groundwater, toxic chemical, sedimentation and other geoscience databases; various fisheries databases; police dispatch systems; GIS-linkage for a municipal infrastructure information system; and databases supporting electronic warfare systems.



Software Kinetics

- allowing for better decision-making
- achieving efficient staff utilization and keeping training costs low

(a 4GL programming language) with an MS-DOS operating system. It can be run on most local area networks, including Novell Netware, Banyan Vines, and Lantastic.

Technical Features

NOVA is available in either English or French.

NOVA runs on any IBM-compatible computer with VGA graphics. The system is programmed in Clarion

For more information contact:

Barry Mooney

Software Kinetics, Atlantic

Tel: (902) 481-3680

Fax: (902) 468-3679

201 Brownlow Ave.

Dartmouth, Nova Scotia

B3B 1W2

GEOPLAN CONSULTANTS INC.

Fredericton, New Brunswick

Geographic Information Systems Capabilities

Information Databases:

- **Company has assisted N.B. Department of Transportation in creation of digital road inventory.**

Management Information Systems Software:

- **Expertise in application of GIS software to analysis of transportation networks.**
- **Expertise in use of linear referencing systems and G.I.S. dynamic segmentation capabilities.**
- **Currently under contract with Transportation Association of Canada to produce initial Canadian data standards for GIS-T. Part of this includes assessment of IVHS annuity requirements.**

Description of Company Services

TRANSPORTATION PLANNING/ECONOMIC ANALYSIS

- Transportation planning studies for all modes
- Transport policy studies
- Benefit-cost analysis
- Financial analysis
- Socio-economic impact studies
- Transportation systems analysis
- Market surveys and analysis
- Economic feasibility studies
- Forecasting and demand modelling

HIGHWAY DESIGN/TRAFFIC ENGINEERING

- Right-of-way surveys
- Lay-out and control
- Route location studies
- Functional and preliminary design
- Geometric design
- Inspection and contract supervision
- Construction plans and specifications
- Traffic impact evaluations
- Parking utilization studies
- Pavement management

GEOGRAPHIC INFORMATION SYSTEMS

- User requirement definition
- System specification and evaluation
- Design and implementation
- Economic and operational evaluations
- Full digitizing services
- Customized applications
- DTM preparation and analysis
- Systems integration

SURVEYING ENGINEERING

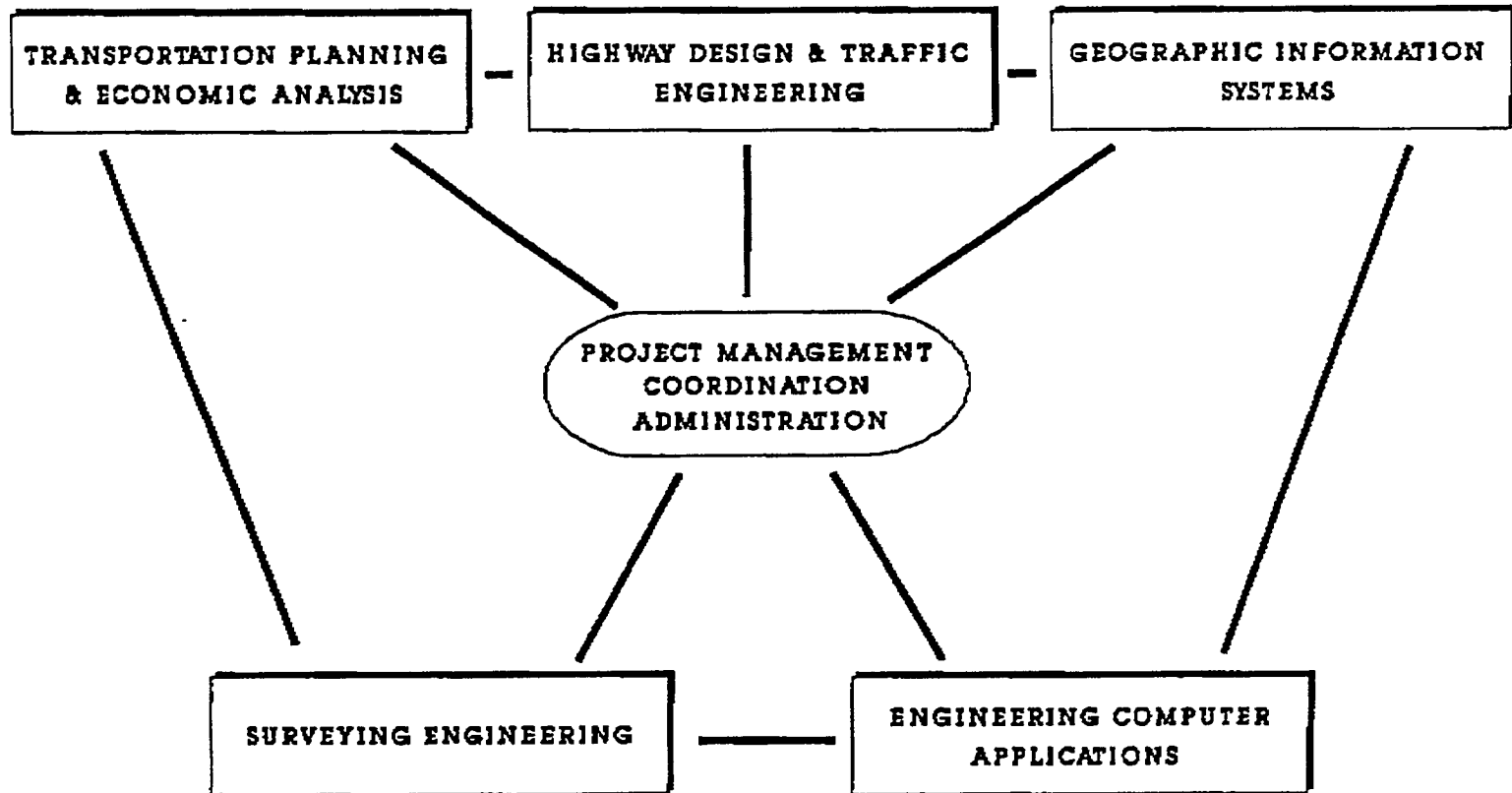
- Engineering studies
- Boundary retracement
- Subdivision surveys (planning, design, legal plans)
- Marine surveying
- Aerial photography and mapping

ENGINEERING COMPUTER APPLICATIONS

- Strategic information systems planning
- Feasibility studies
- Custom software development
- Software package evaluation
- Systems integration

Geoplan

GEOPLAN CONSULTANTS INC.



Geoplan

TRANSPORTATION APPLICATIONS

- ***Canadian GIS-T Standards***

Geoplan was awarded a contract by the Transportation Association of Canada to develop Canadian standards for GIS in Transportation (GIS-T). The project encompassed a survey of Canadian Transportation agencies, database suppliers and GIS vendors. Standards areas to be covered include digital map files, attributes, linkages and data exchange. The project is expected to be completed in January, 1995.
- ***Road Inventory Digital Mapping Pilot Project***

Geoplan was retained by the New Brunswick Department of Transportation to conduct a pilot project to demonstrate the benefits to be gained through automation of the Road Inventory Map Series using existing LRIS 1:10 000 Digital Enhanced Topobase files and the CARIS GIS software. A set of custom data conversion specifications was developed, along with specific recommendations for proceeding with automated mapping.
- ***Road Inventory Mapping Program Review***

The New Brunswick Department of Transportation contracted with Geoplan for a complete review of their existing data structuring specifications for the digital Road Inventory Map series. As part of this contract, Geoplan also developed automated quality control procedures and customized GIS software tools to assist departmental staff in checking the content of existing digital files.
- ***GIS Highway Inventory Application Development***

Geoplan was awarded a project under the Atlantic Canada Opportunities Agency (ACOA) Geomatics Alliance initiative to develop a GIS based highway inventory software application. The New Brunswick Department of Transportation has also contributed project funding in order to have the resulting products tailored to meet their specific requirements. Geoplan is also assisting Universal Systems Limited of Fredericton in the development of dynamic segmentation capabilities for their CARIS GIS software as part of this initiative.

RELEVANT GEOMATICS PROJECTS

Page 3 of 11

- ***Road Inventory Map Structuring***
Geoplan has carried out data structuring of Road Inventory Map digital files under contract to the New Brunswick Department of Transportation for various project areas within the province.
- ***Trans Canada Highway Corridor Study***
The New Brunswick Department of Transportation engaged Geoplan to undertake an extensive evaluation of routing alternatives for the Trans Canada Highway between Fredericton and Moncton. A key component of this study was an evaluation of the physical and environmental impacts for the proposed routes. Geoplan made extensive use of both existing digital files and custom data conversion techniques to prepare constraint mapping for the project area which was then analyzed using the CARIS GIS package. This innovative use of GIS technology added considerable value to the project deliverables.
- ***Champlain Institute GIS-T Workshop***
The Champlain Institute contracted with Geoplan for the development and delivery of a one day introductory workshop for transportation agency managers on the use of GIS technology for transportation applications. The workshop was held in Fredericton, N.B.
- ***TAC GIS in Transportation Workshops***
Geoplan was retained by the Transportation Association of Canada (TAC) to participate in a series of one-day introductory workshops on transportation specific applications of Geographic Information Systems. The workshops were held in six Canadian cities in the winter of 1992. Additional workshops on GIS-T are being planned.
- ***Arterial Highway Planning Study***
The New Brunswick Department of Transportation contracted with Geoplan for the development of GIS based Arterial Highway Planning analysis tools. A demonstration project was conducted in the Nerepis to Welsford area along Route 7. Extensive use was made of existing digital mapping from various sources. The project also demonstrated the integration of the CARIS GIS package with the EMXS highway design system.

HERMES ELECTRONICS LIMITED

Dartmouth, Nova Scotia

- **Over 35 Years Experience**
 - **Military ASW Products**
 - » Sonobuoys for Canadian Forces, USN, France & Britain
 - » Towed arrays for Canadian Submarines, Research Labs
 - » HF Antenna Loops for U.S. Army
- **Dartmouth, Nova Scotia Facility**
 - 400 Employees
 - 150,000 sq. ft. of “NO FRILLS” Manufacturing
 - ISO 9001 Certification
 - Design/Manufacturing to Cost Methodology
- **Diversification with Partnerships**
 - **Multi-Resonant Technology Power Supplies**
 - » Low Weight, Volume, RFI, EMI and \$
 - » Commercial Video Terminals
 - » Commercial Aviation Power Supplies
 - **SEMECS Mobile Satellite Antenna**
 - » INMARSAT/MSAT Vehicles Communications & Control
 - **Acoustic Sensor Applications**
 - » Security Systems, Vehicles, Structures

In the past twenty years, Hermes has developed and produced more than one *million* sonobuoys in different models for Canada, the United States and other NATO countries.

In addition to sonobuoy programs, Hermes has developed other ASW concepts, technologies and experimental hardware such as microbuoys, towed arrays and active transducers. Unique microbuoy technology includes launch concepts, remote buoy programming concepts, RF transmitters, in-buoy signal processors and hydrophone preamplifiers.

Hermes' commercial products include long-life, open-ocean drifting buoys, transmitters for use with ARGOS satellites, ice beacons, remote weather stations, and active-loop HF receiver antennae.

Hermes has annual sales of 37 million dollars and has a current 48 million dollar backlog.

Plant Facilities.

The Hermes facility is approximately 150,000 square feet which includes 100,000 square feet for manufacturing, 26,000 square feet for warehousing, 11,000 square feet for labs, the remaining 13,000 square feet is office space.

Some of the specialized equipment and processes include thru-hole electronics assembly, computer-controlled, automatic electronics test systems, a compass alignment test set, programmable toroid coil winders, precision fluid dispensers, PLC controlled impulse heat sealers, hydraulic punches, ultrasonic welders, Eubanks cut/strip machines, dip cleaning and metal plating, epoxy mix/metal/dispense systems, an IBM assembly robot, compliance winding systems, programmed sequence argon test equipment, USON automatic pressure test system, automatic bi-cell battery assembly machine, cathode extrusion system, and a model shop with precision mills, lathes and cylindrical and surface grinders.

Personnel

Hermes average work force includes 250 production workers, 60 engineers, technologists, draftsmen and support staff. General management and

administration, Marketing, Accounting, Contracts And Human Resource personnel number 40. All production is fully supported by an integrated team approach that consists of members of the Design Technology, Manufacturing Engineering, Quality Assurance, and the Materials Management/Purchasing groups.

Hermes' workmanship standards meet the requirements of MIL-STD-2000 and MIL-STD-454.

Product Quality

Hermes Quality Assurance Department has developed and implemented a quality assurance program in accordance with DND 1015, MIL-Q-9858A, SPD-16C, and AQAP-1. The Hermes quality system is based on the philosophy of Total Quality Management (TQM). The primary goal of all employees is the satisfaction of the customer's requirements. Hermes management has established a framework within which all employees contribute to the continuous improvement of product and service. The tools which are made available to do this include monitoring systems such as program reviews, design reviews, statistical process control (SPC) systems, and 100% operator verification (OV) of product quality at each stage of production. Continuous analysis of data from these systems yield early indications of possible problems. Any possible problems are addressed with a team approach to problem solving.

ISO 9001 quality certification will be achieved by the end of 1994.

Material Requirements Planning (MRP) II

Hermes utilizes a modern MRP II system. The system is part of an integrated financial and manufacturing control system (INFIMACS) which allows complete planning, monitoring and analysis of the production engineering, sales, materials, manufacturing and financial activities at Hermes.

Hermes' MRP system is run on an IBM RS/6000 model 530 with 80 Megabytes of RAM and a 1.2 Gigabyte hard drive with a 2.4 Gigabyte tape backup. There are 57 work terminals with four printers networked in the system.

Test Equipment Calibration

The in-plant calibration and standards department ensures that all instruments are calibrated and that standards used are traceable to the National Research Council (Ottawa, ON) and the National Bureau of Standards (Washington, DC)

Environmental Laboratory

Hermes environmental laboratory contains vibration equipment, humidity and temperature chambers, shock and tensile testers, and high-pressure test tanks. The equipment meets or exceeds the requirements of MIL-STD-810 for environmental testing.

Computing Facilities

Computing power for numerically intensive tasks, such as finite element analyses, is provided by a multi-user HP 9000/550. Documentation preparation and other general computing needs are met by HP 9816s, HP 9000/310s, Macintoshes and IBM PCs. Macintosh IIs, interconnected as a local area network, provide electrical and mechanical CAD. Hermes also has access to the computing facilities and software programs at local universities and research facilities for microprocessor design, circuit design and CAD.

TEMPEST Facility

Hermes has a TEMPEST facility that enables the company to perform Electronic Data Processing and prepare documentation to the SECRET level.

Acoustic Calibration

Acoustic calibrators are used to measure and calibrate hydrophones. Hermes has three types of calibrators, two for development and one for production. One system provides a capability to calibrate hydrophones at pressures ranging from 50 to 1000 psig, frequencies to 5 Hz to 200 Hz, and temperatures from 3 to 30 degrees C. This device can generate an acoustic plane wave or a pressure field for calibrating different types of hydrophones. A fresh-water tank provides a 25' by 28' by 30' volume of water for acoustic and mechanical tests.

Its calibration frequency range is 100 Hz to 40 kHz. In-air calibrators provide low frequency calibration of production hydrophones.

Hydrophone Design Technology

As a supplier of ASW products, Hermes has designed, developed and manufactured hydrophones for passive omni directional, directional and vertical line array sonobuoys. Extensive use is made of finite element programs for analyzing underwater sound transducers.

Hydrophone Array Technology

Analysis of array performance is achieved using computer software programs developed by Hermes. These programs simulate the performance of arbitrary linear arrays in isotropic and vertically directed low frequency noise. Used in conjunction with the Canadian Defence Research Establishment Atlantic (DREA) Integrated Command ASW Prediction System, they provide a wide range of array gain analyses.

Hermes has extensive experience in the development of towed arrays for the Canadian Navy. Work in this area began in 1983 when Hermes built two array modules, H1 and H2, for DREA using three inch technology. Hermes has recently completed manufacturing three production towed arrays for the Canadian submarines under a subcontract to Marconi Underwater Systems Limited. Hermes is also conducting research into vibration isolation module improvements and enhanced directivity in towed arrays.

As a full-service, global partner, Hermes Electronics Limited has significant strengths to offer in product development, production engineering, manufacturing and marketing. These strengths include: electrical and mechanical product design within stringent cost, performance, delivery and reliability targets; testing capabilities; documentation support; complete manufacturing and assembly; and ISO 9001 facility; after-sales service; and international marketing support through offices in Ottawa and Washington and European partners.

Hermes' distinctive mindset is focused on providing cost-effective, integrated solutions. With a background in product design, remote sensing data acquisition and communications, remote deployment platforms, and a proven manufacturing record, Hermes' seeks opportunities through license, joint venture or manufacturing agreements to apply its specific skill sets to new programs.

Commercial partnering projects include multi-resonant power supplies and mobile satcom transmitters. In both cases, the partners' proprietary technologies have been transitioned into production with Hermes providing volume manufacturing within cost competitive targets.

An example of this transaction is the SEMECS mobile satellite antenna. Hermes took a research lab design that was projected to a \$1,000 product and derived a production-oriented design to meet the \$100 requirement of the automotive marketplace. This antenna technology will be a fundamental component of future vehicle and transportation control systems.

Hermes' diversified products have also included transmitters for ARGOS satellites, ice beacons, remote weather stations, HF receive loop antennas and long-life, ocean drifting buoys.

Hermes' embraces partnership as the sensible approach to growth--both companies are focused on their respective strengths so each has greater probability of building success.

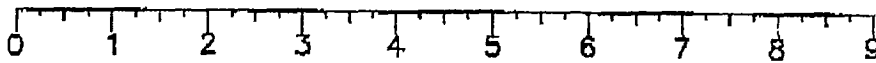
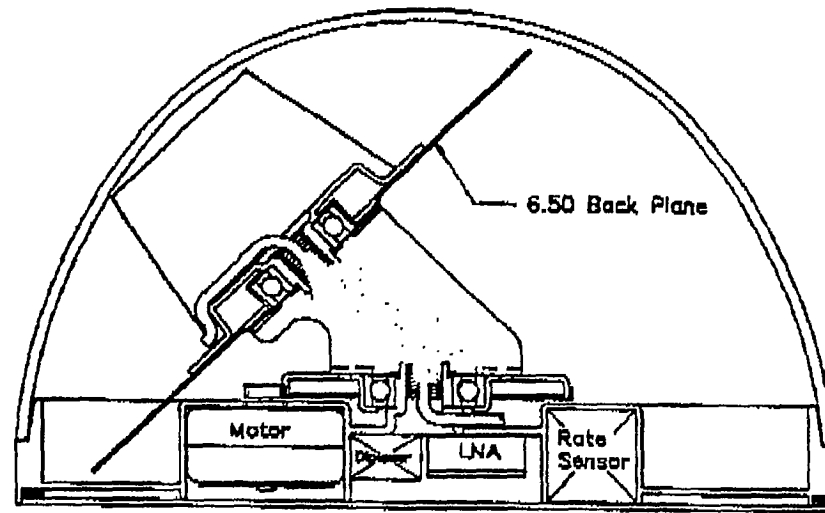
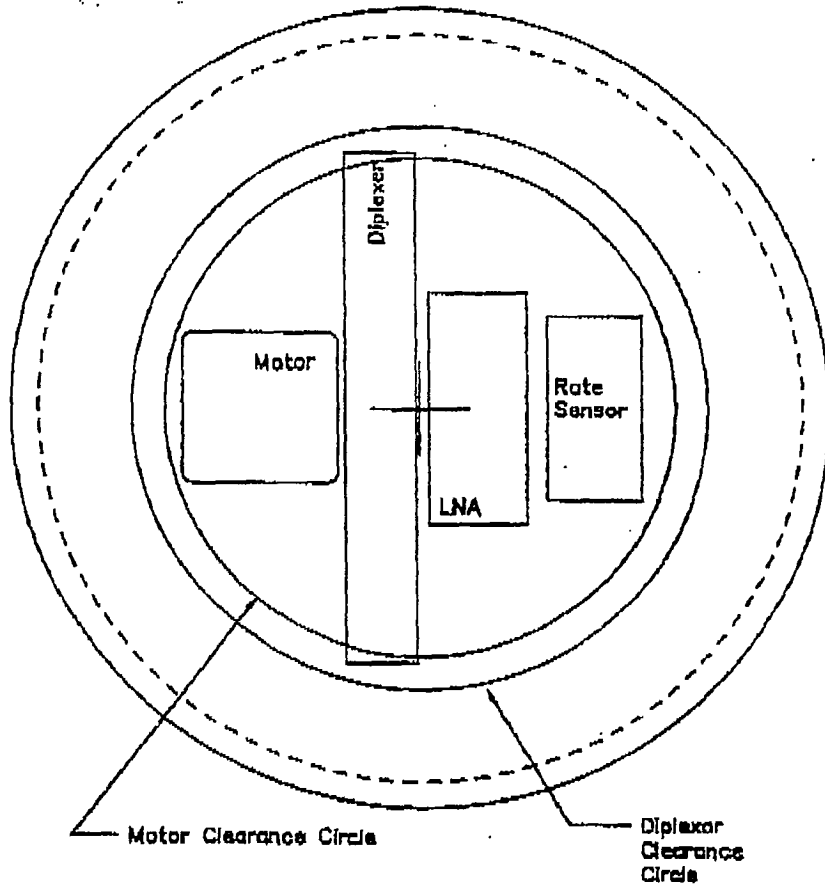
With over 35 years experience in the design and production of electronic anti-submarine warfare (ASW) products and communications components, Hermes specific strengths lie in the design, test and manufacture of hydro-acoustic electronic sensor systems.

In addition to sonobuoy programs, Hermes has developed other ASW concepts, technologies and experimental hardware such as microbuoys, towed arrays and active transducers. Hermes' unique microbuoy technology includes launch concepts, remote buoy programming, RF transmitter, in-buoy signal processors and hydrophone preamplifiers.

Hermes' acoustic engineering background in military ASW systems is applicable to automotive technology. Acoustic monitoring and analysis of vehicle operation is one example of future potential of transitioning hydrophone technology to the commercial transportation field.

Other capabilities include mechanical, electronic, analogue, digital and RF products and circuits. Hermes also has proven proficiencies in the design and production of water-activated batteries, remote deployment platforms and electronic miniaturization with surface mount components, hybrid circuits and application specific circuits (ASICs).

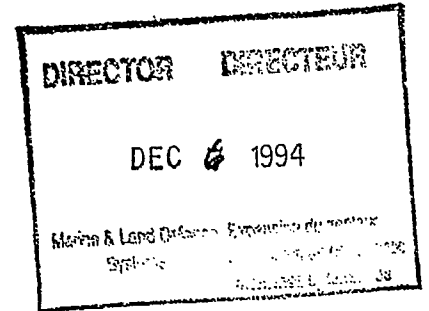
With many years of experience fulfilling major military and government contracts, Hermes' expertise in large-scale program management is well-known. Program managers oversee all stages of the process to ensure that customers' commitments are met through cost- and time-efficient control of parallel design teams and detailed production schedules. All aspects of the process, including client progress reviews and interim design reviews, are fully integrated. Client contact is maintained through full-time marketing personnel in Ottawa and Washington.



HERMES SEMECS ANTENNA
MSAT 1.4 GHz



CAE Electronics Ltd.
CAE Electronics Ltee.



Facsimile Cover Sheet

CONFIDENTIAL

To: Cliff Oldridge
Company: Industry Canada
Phone: 613-954-3326
Fax: 613-991-9469

From: Mr. Cary Leclaire
Company: CAE Electronics
New Business Development
Phone: 514-341-6780, ext 3782
Fax: 514-734-5635

CAE Electronics Ltd.
8585 Côte de Liesse
C.P. 1800 Saint-Laurent
Québec, Canada
H4L-4X4

Telephone : (514)-341-6780
Facsimile : (514)-734-5617

Contacts : Mr. Max Rutherford, Vice President Business Development
Mr. Cary Leclaire, Business Analyst

Business Description :

CAE Electronics applies sophisticated real-time computer-based technology to complex training, simulation and control tasks across a broad spectrum of civil and military aviation; hydro and nuclear power generation, transmission and distribution; air space management; marine applications; space exploration and submarine detection systems.

Interest in IVHS :

CAE is interested in alliances and partnerships in technologies and applications relevant to IVHS. Areas of interest are systems integration, real-time simulation (including scenario observation), training applications using simulation, and information and management systems.

Capabilities/Products relevant to IVHS :

IVHS leverages CAE's capabilities in developing, manufacturing and integrating complex systems. Specific technologies and capabilities relevant to IVHS :

- real-time simulation
- image generation and display systems
- data acquisition
- communications
- controlling dynamic systems
- co-ordinating separate systems
- network analysis and control software
- network computer systems integration
- air traffic management

Major Clients :

Service a large variety of civil and military aerospace establishments, hydro and nuclear generation authorities, electrical power utilities, and various levels of government worldwide.

Number of Employees : approximately 3,400

Plant Size : 645,000 sq. ft.

OBS Subscriber : Yes

CAE ELECTRONICS LTD.

CAE ELECTRONICS LTD.
C.P. 1800
Saint-Laurent, Quebec
H4L 4X4

Phone: (514) 341-6780
Fax: (514) 341-7699
Telex: 05-824856

President:
K. L. Hansell

**Vice-President
International Affairs:**
R. F. Kemerer

**Vice-President
Government Relations:**
G. Weintraub

**Vice-President
Sales:**
A. N. Cundy

**Director Public
Relations:**
J. W. Paterson

CAE ELECTRONICS OF SAINT-LAURENT, QUEBEC, IS ONE OF Canada's largest high technology companies. Canadian owned and operated, CAE was founded in 1947 to provide the military with electronic and electromechanical repair and overhaul services. Today, CAE provides sophisticated computer-based systems for large, complex simulation and real-time tasks across a broad spectrum of aviation, power generation and transmission, air traffic control, marine, space exploration and submarine detection systems. CAE's fully integrated design, manufacturing and test facility houses 3,400 employees, half of whom are engineers, scientists and technicians.

Civil Flight Simulation

CAE's simulators are renowned for their realism and accuracy in reproducing all of the operational characteristics of specific aircraft. Every normal and abnormal parameter, including all environmental conditions encountered in actual flight, are simulated with precision and accuracy. CAE manufactures a complete range of full flight simulators, flight training devices, computer-aided training systems and computer-based trainers. Customers — in 40 countries — include more than 50 major airlines, five manufacturers, various training institutes and the U.S. Federal Aviation Administration (FAA). CAE has supplied simulators for every major aircraft type produced by Boeing, McDonnell Douglas and Airbus.

Military Simulation

CAE Electronics leads the industry in the evolution of digital flight simulation technology. The company produces a wide variety of flight, tactics and mission simulators for both fixed- and rotary-wing aircraft. These range from today's most advanced fighters and helicopters to heavy transport and patrol aircraft. CAE simulators are renowned for their realism and accuracy in reproducing all of an aircraft's operational characteristics including on-board computers, head-up displays (HUD), radar, weapons guidance and electronic warfare systems. Aircrews are trained in every aspect of day/night, all-weather flight, air-to-air and low-level air-to-ground combat, as well as every aircraft performance capability, system malfunction and recovery technique.

CAE MAXVUE™ Visual System

CAE's MAXVUE™ visual system, introduced in 1991, is the result of more than five years of research and development by CAE Electronics into image generator technology, display systems and data base utilities. MAXVUE™'s modular architecture, in various configurations, allows CAE to provide a range of competitively priced high-performance systems, and to facilitate future upgrades as training programs develop and system technologies advance. Using techniques and philosophies which have made CAE a world leader in flight simulation, the system design combines superior performance with high reliability and ease of maintenance.

Space Technology

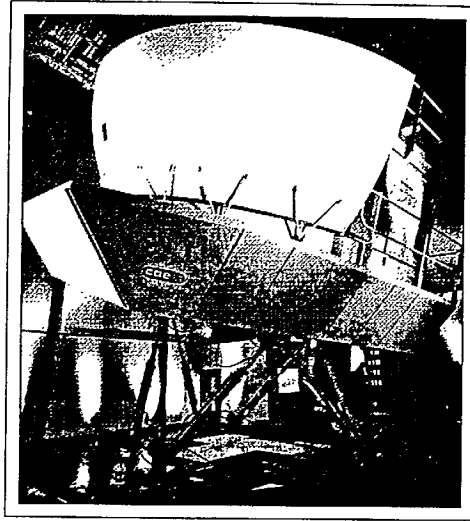
Each of the remote manipulators for the famed Canadarm aboard NASA's Space Shuttles is controlled by a system designed and manufactured by CAE. For the multi-national space station, CAE is producing a multi-dynamic simulation facility to design and develop the Mobile Servicing System used to train astronauts to use its controls and remote manipulators. CAE is also responsible for the management and procurement of all the electric, electronic and electromechanical parts for the space station.

CAE Aviation

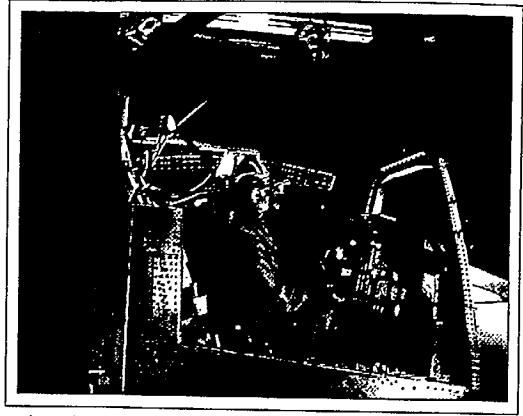
CAE Aviation is one of Canada's largest and most experienced maintenance, repair overhaul and modification centres for military and commercial aircraft. These include the Canadian Armed Forces' fleets of T-33, CT-114 (Tutor) and C-130 aircraft, as well as C-130 transports for international, civil and military customers. The company's large and modern hangars at the Edmonton International Airport provide a total working space of 23,715 m² (250,000 sq. ft.). CAE Aviation provides a comprehensive aircraft maintenance service, including non-destructive testing, airframe and electrical systems life extension and corrosion control, airframe components manufacture, electrical wire harness fabrication, instrument repair, design and installation, and the production of technical publications, including translation services.

CAE Electronics and CAE Aviation are wholly owned subsidiaries of CAE Industries Ltd., Toronto, the world leader in the development and production of electronic simulation training systems and devices for civil airlines, the military and space agencies.

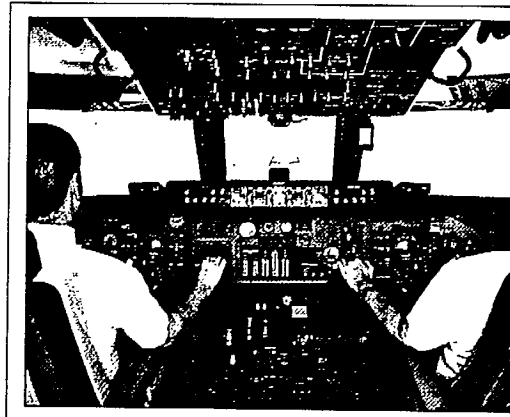




Canadair Regional Jet flight simulator exterior.



The pilot station aboard the Simulator Complexity Test Bed (SCTB) with Fiber-Optic Helmet Mounted Display (FOHMD) manufactured for the U.S. Army Research Institute at Fort Rucker, Alabama.

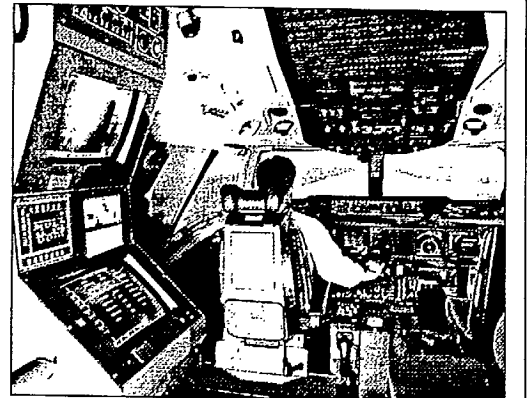


ABOVE LEFT: Interior cockpit view of a Lockheed C-5B full flight simulator manufactured for FlightSafety Services Corporation. The simulator features a unique vertical tilting visual system which enable flight crews to learn mid-air refuelling procedures. Another special feature of the simulator is CAE's exclusive new-generation six-degrees-of-freedom motion system.

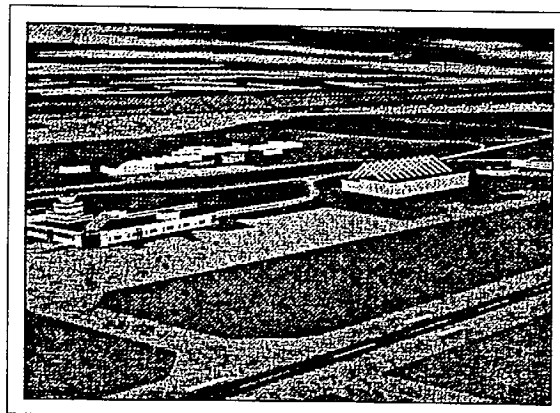
The simulator is located at the Westover Air Force Base, Massachusetts and is used to train the US Air Force Reserve Guard to operate the giant four-engine jet transports.

This is the seventh C-5B simulator manufactured by CAE Electronics. The other six simulators are used by the U.S. AirForce and are in service at Altus Air Force Base, Oklahoma, Travis Air Base, Colorado, and Dover Air Force Base, Delaware.

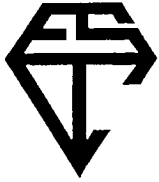
ABOVE RIGHT: MD-11 Flight Deck and Instructor facility manufactured for Delta Air Lines. This simulator is located at the Delta Training Center in Atlanta, Georgia.



CAE Electronics Ltd.
C.P. 1800 Saint-Laurent
Québec, Canada
H4L 4X4



Nighttime capability of CAE's MAXVUE™ visual system. MAXVUE™ narrows the gap between a synthetic image and the real world offering superior performance and demonstrable advantages including greater reality from true, full-colour photographic images, lower throughput delay and superior three-dimensional content.



APPLIED SILICON

COMPANY PROFILE

Applied Silicon is an electronics and communications company specializing in custom hardware and software solutions. We have developed unique expertise in a wide range of technologies, including chip design, data acquisition, interfacing, real-time software and embedded applications. Our technology base includes: audio, video, radio, radar and fibre optics. This expertise is available for your R&D programs, short time development cycles and highly specialized projects. Our engineering team can support you in the development of new products and in finding innovative solutions to your special requirements.

Applied Silicon develops and offers products to support its activities and implement custom solutions to its clients. Off-the-shelf, high performance products are presently available for audio, video, and data, for acquisition, processing and logging. At Applied Silicon, we believe that when it comes to special applications, only our team can give you the support you need.

Our three corporate divisions are:

ENGINEERING & TECHNOLOGIES - "Innovative Custom Engineering Solutions"

HIGH SPEED DATA ACQUISITION, PROCESSING & LOGGING SYSTEMS

- ◆ Custom Development for Digitizing, Processing & High Speed Data Recording
- ◆ VME Based Data Recorder
- ◆ High Speed Logging for Radar & Video Signals
- ◆ Real-Time Processing
- ◆ Distributed Architecture

ASIC DESIGN

- ◆ Complete Turn Key ASIC Design & Programmable Array Services.
- ◆ ASIC Implementation from Specification to Design.
- ◆ Wide Range Familiarity of CAD Tools - Design, Simulation & Verification
- ◆ Experience with VHDL, Test Generation & Design for Testability, including SCAN, BIST & JTAG

INTERFACE BOARDS FOR VME, SUN, PC & PROPRIETARY BUS STANDARDS

- ◆ High Speed Digital Buses
- ◆ Analog to Digital (A to D) & Digital to Analog (D to A) Conversion

RF & MICROWAVE

- ◆ Supporting Defence, Scientific and Engineering Communities.
- ◆ Target Tracking, Jamming, Communications Signature Analysis, Sidelobe Cancellation, Direction Finding, Upconverters, HF & VHF Communications

REAL TIME SOFTWARE ENGINEERING

- ◆ DSP Firmware, Embedded Applications
- ◆ Multi Tasking & Distributed Processing
- ◆ Graphical User Interface (GUI) Development
- ◆ System Architectural Design

Applied Silicon Inc. Canada

220 - 2427 Holly Lane, Ottawa, Ontario K1V 7P2 • Tel: (613) 738-2434 • Fax: (613) 738-0750

DIGITAL VIDEO & IMAGE PROCESSING - "Hardware & Software DSP Solutions"

FRAME GRABBER/IMAGE PROCESSING SYSTEMS

- ◆ **Megalmager** - PC/AT Bus Image Acquisition & Processing
- ◆ **XR-30** - Stand Alone Image Acquisition, Processing & Display
 - Machine Vision
 - Scientific Image Analysis
 - Medical Analysis

DIGITAL VIDEO MONITORING & LOGGING

- ◆ Video Logger/Server
- ◆ Video Compression
 - Surveillance & Remote Video Monitoring
 - Multimedia & Video Conferencing

FIBRE OPTIC VIDEO TRANSMISSION SYSTEMS

- ◆ Multi-Channel FM/FDM Video Communication
- Remote Monitoring

LAW ENFORCEMENT & SECURITY - "Turnkey Solutions"

AUDIO ACQUISITION & LOGGING EQUIPMENT

- ◆ **AudioDisk™** - Telephony Monitoring System
- ◆ **Observer™** - Telephony Monitoring System
- ◆ **DVL** - Digital Voice Logging
- ◆ Signal Classifier & Switcher
- ◆ Air Traffic Recording & Reconstruction

LAW ENFORCEMENT PRODUCTS

- ◆ **LISSNA** - Spread Spectrum Transmitter
- ◆ **DST-100** Digital Stereo Transmitter
- ◆ **Datong** - Vehicle Surveillance Systems
- ◆ Countermeasure Equipment
- ◆ Customization Services

FIBRE OPTIC PRODUCTS

- ◆ Communication Systems & Hardware
- ◆ Local Area Networks
- ◆ High Speed Multiplexers (Military Specification)

SECURE SYSTEMS INTEGRATION

- ◆ Trusted Computer Bases
 - ◆ Trusted Networking
 - ◆ Centralized Key Management
 - ◆ Encryption
 - ◆ TEMPEST
-



Video Vise

Video Logging and Monitoring System

The Video Vise is a PC based system capable of continual logging of video data from one or many camera sources. It provides the ability to capture, digitize and compress real-time video images for processing, storage and transmission purposes. Some typical applications include remote monitoring and playback capability for:

- Security and Surveillance
- Medical Imaging
- • Road Traffic Management
- Quality Control

The Video Vise is a video monitoring and logging system with its own database management capability. It can store and retrieve video sequences as simply as a selection can be made from a database query.

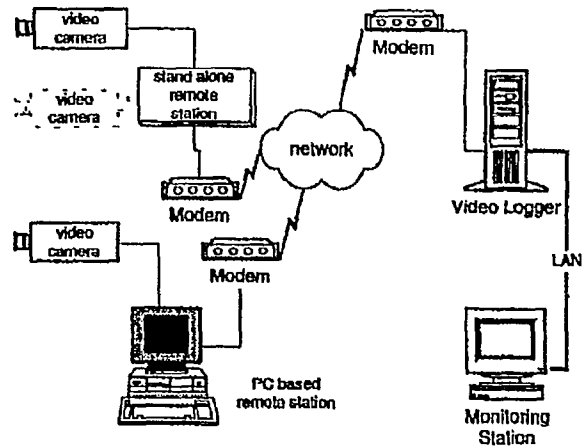
INTEGRATED SYSTEM

Video Vise is a video logger combining some of the latest technologies presently available on the market. It consists of a frame grabber acquiring images from one or multiple cameras and digitizing the images in real-time, up to 30 frames per second. It is a video compression system that reduces the data rate to accommodate the transmission bandwidth and storage capacity. It stores the compressed images on hard disk for playback purposes. It is also a database to find and sort video sequences for convenient retrieval of the information.

VIDEO TRANSMISSION

The system is capable of processing color or black and white video and interfaces with various off-the-shelf modems for video transmission over standard analog phone lines, as well as switched 56, ISDN and T1 cards for operation at higher bit rates. Video Vise also interfaces with RF data modems for video transmission over cellular and RF networks.

*A Company
of
Intelligent
Technology*



CONFIGURATION

Video Vise is available as a stand alone system or a two board set for the PC/AT environment. The stand alone system consists of a remote video compression unit (RV-2020) and a video decompression unit (MV-2001) at the receiving site. The remote and receiver units connect into the telephone system with an interface of your selection.

LOGGING

The data is transferred from the remote site to the local logging server in a compressed format. Depending on the size and quality of the images required, fixed or variable frame rates can be obtained and all the information is stored to disk. When the system is switched to playback mode, the video data is recovered from the database and is displayed on the computer screen. The control functions are similar to those of a VCR.

MONITORING

Video Vise is also an interface for monitoring video data. The monitoring workstation is connected to the logging server. Monitoring can be performed in two modes: live or playback. In live mode, the output of a remote camera can be directed to the operator display in real-time. While viewing in live mode, the operator can control the remote camera's pan, tilt and zoom mechanism.

FEATURES

Remote Station

- Real Time video compression
- Four selectable cameras per remote compression unit
- Transmission of digital video images at various frame rates, resolution and compression thresholds
- Accepts NTSC, PAL and NTSC inputs
- Color or monochrome
- RS-232 interface for remote control of pan, tilt, zoom, enclosure, power
- Optimized algorithm provides high quality frame to frame resolution with minimal artefacts
- Two conditioned alarm inputs and four video inputs
- Full remote diagnostic/reset capabilities

Server

- Real-Time video decompression
- Capable of serving up to 16 cameras simultaneously
- Complete database management system
- Client/server architecture
- VCR like controls for playback of data from database, including play, stop, pause, fast forward and rewind.
- Additional functionality such as random access forward and backward, loopback, queries, image processing, etc.
- Access to decompressed video data for post processing

Monitoring Station

- Control of the remote cameras in real-time from the monitoring station
- Full Graphical User Interface with windows based image display and control function menus
- Viewing of data from up to four cameras; one on the screen and three outputs to video monitors.
- Full control of camera selection, frame rate, resolution, and image logging

SYSTEM DESCRIPTION

The Video Vise board set is intended for the PC/AT family and each board requires a 16-bit ISA bus slot. The video compression board (VCB-200) compresses video in real-time at software selectable compression levels, and the video decompression board (VDB-100) decompresses video in real-time and operates in conjunction with or independently from the video compression board. The board can achieve full motion video transfer while allowing the PC to handle high data rate interfaces such as high bandwidth communications and mass storage peripherals.

The stand alone version of the compression board has the same functionality as the VCB-200. Its main application is for sites requiring compact acquisition units standing close to the cameras.

The Video Logger is also PC based and intercepts the video data being transferred between the compression and decompression boards over a telephone network. It stores the compressed images and each time will update its database. The monitoring station can access the database whenever there is a need to quickly playback a sequence that was recorded previously.

SPECIFICATIONS

Video Inputs:

- 4 camera inputs, 1 Vp-p, 75 Ω
- EIA RS-170, NTSC or PAL
- digital sampling @ 640 x 480
- 5 bits per color (32k colors)

Alarm Inputs

- 2 externally triggered alarm inputs

Connectors

- video: BNC
- alarm: terminal strip

Interfaces

- RS-232, DNIC, RJ-11

Network

- T1/E1, ISDN, PRI ISPN, SW 56, PITS



Applied Silicon Inc. Canada

220 - 2427 Holly Lane, Ottawa, Ontario K1V 7P2 • Tel: (613) 738-2434 • Fax: (613) 738-0750

VIRTUAL PROTOTYPES INC.
4700 de la Savanne, Suite 300
Montreal, Quebec H4P 1T7
Tel: (514) 341-3874
Fax: (514) 341-8018

FAX

To: Cliff Oldridge
Industry Canada

cc: Neil Gordon

Fax : 613-991-9469

From: Mark Schwartz

Date: September 21, 1994

Subject: IVHS

(Transmitting 4 pages(s) including cover page)

=====

Further to this morning's telephone conversation the following three (3) pages of text are for your information.

Let me know if you are on e-mail in which case I can forward the same document to you in text format to save having to re-type.

BACKGROUND

"Smart" vehicles navigating automatically on intelligent vehicle highway systems is the solution to the problem of highway congestion in Europe and the US where progress in controls, communications, and computers has made IVHS possible. For "smart" vehicles and highway systems to become a reality will require complex, but easy to use driver and operator controls. These advanced systems will require more and more information to be exchanged between vehicles and their drivers, and centralized highway control systems and their operators. The success of these systems is directly linked to the effectiveness of their human-machine interfaces (HMI) which display complex real-time interactive graphics.

The task of developing an effective HMI can take up to 60% of the entire software development effort of a new system or product. This consumes a lot of resources that could otherwise be spent on the more challenging aspects of product development or on other projects.

THE COMPANY

Virtual Prototypes Inc. (VPI), a Montreal-based software vendor, is a leading supplier of software tools for developing real-time graphical HMIs. The company was founded in 1985 and in 1987 introduced a breakthrough technology called "VAPS". Because of its power and flexibility, VAPS is now used by hundreds of companies worldwide (including Aerospatiale, Boeing, General Dynamics, Hughes, Lockheed, Loral, Martin Marietta, McDonnell Douglas, NASA, Northrop, Raytheon, and Rockwell to develop and deploy HMIs for a variety of systems and products in avionics, air traffic control and C³I. With the VAPS object based approach, users can easily build, test, evaluate and deploy next generation virtual controls.

→ A number of companies are using VAPS as a prototyping tool in IVHS applications for in-board displays for "smart cars". Vehicle manufacturers such as BMW, Daimler Benz, Fiat, Fraunhof, Ford, and Robert Bosch, are using VAPS for evaluating driver/vehicle interfaces through simulation. Federal and State authorities such as the Arizona Department of Transport and Transport Quebec use VAPS to deliver advanced IVHS Traffic Management Systems. Transportation Research Centres such as Georgia Tech Research Center and MITRE are using VAPS to design and evaluate operator interfaces and make recommendations on HMI standards for government and industry.

THE PRODUCT

VAPS provides a set of powerful editors supporting an object-oriented development approach. This allows users to intuitively draw objects, specify data-driven animation, connect objects to application data, and specify event/response behaviour. And all of these tasks are done in a visual environment that is easy to learn and easy to use.

For "smart" cars, VAPS allows users to rapidly prototype virtual instrumentation, whereby dashboard controls are actually on-screen graphics that respond to touch, physical input devices such as trackballs, or voice.

Heads-Up Displays (HUDs) for "smart" cars can be easily designed and built with VAPS to allow drivers to view information on a windshield without taking their eyes off the road. VAPS can permit HUDs to include moving text, pictures and maps with different appearances and colours. By creating the displays and instruments with VAPS objects, the look, feel and behaviour are built in. You can then test the displays and easily reconfigure an interface until the layout meets requirements. All this is done without programming.

Driver Information Systems can also be designed with VAPS. VAPS Moving Maps combine easy integration of digital map data and the ability to dynamically display data. This can help drivers navigate through crowded highway networks or find key geographic landmarks.

VAPS provides the ability to visually represent a highway network with the visuals reacting to real-time and simulation sensor data. The HMI built with VAPS can display on-line video provides additional information that permits the controller to know exactly what is going on from a remote location. On-screen selection and direction of cameras, signals, and sensors give the necessary control to manage the traffic system. Traffic density and speed can be shown by colour changes.

A multi-layer perspective on the traffic situation allows the user to see the big picture then zoom in for greater detail at an individual traffic lane. The user can then communicate to the drivers by sending text to variable message signs for display along the roadside.

The price for the VAPS product is in the Cdn \$30,000 range and the price for the VAPS/CCG product is in the Cdn \$20,000.

HOW VAPS AND VAPS/CCG MEET THE NEEDS OF THE CLIENT

By automating the HMI design process, VAPS allows users to reduce the time to market and VAPS/CCG eliminates the need to hand code and debug a massive portion of the system.

Generating error-free source code is often the most costly and time-consuming stage in the development life cycle. By automating much of this labour-intensive task, VAPS/CCG reduces this cost and lets the client attain tremendous productivity gains.

Once an application is designed and tested, VAPS/CCG automatically translates the ATMS graphical interface into fully functional production quality ANSI C code. This includes the graphics, animation properties, interaction behaviour and connections to other applications. This C code can be re-targeted to other UNIX applications, PC/Windows, or embedded systems for multiple control panels or in-vehicle displays.

This unique technology gives VPI a significant advantage over other software products. VAPS/CCG generated C code can be compiled and executed on a variety of target platforms such as UNIX workstations, PC's running Microsoft Windows, and embedded systems without the need to re-code, revalidate, and reverify the specifications.

Vehicle Simulators can be easily integrated with VAPS. Connecting external simulation software to VAPS prototypes allows the two systems to exchange data. Using Ethernet and TCP/IP communications, VAPS communicates with external software.

In cases where the computing system will be embedded directly into some other product, commercially available computers such as workstations or PCs might not be suitable because of physical space or cost. Custom built systems are created from hardware components then controlled by an application built on top of a real-time operating system.

VAPS/CCG for UNIX is a complete development package for the design and deployment of HMIs on UNIX workstations. Deployment targets include workstations from Sun, HP, IBM, Silicon Graphics, DEC/Alpha, and X terminals.

A re-targeting package is also available for deploying HMIs on PCs running Microsoft Windows. VAPS/CCG for Windows converts HMIs prototyped on UNIX workstations to C code for Microsoft Windows.

VAPS/CCG produces operational software automatically from HMIs prototyped with VAPS. The generated ANSI C code contains all HMI appearance and functionality including graphics, animation properties, interactive behaviour and connections to the user's applications. The code can also be integrated with the most sophisticated software environments, including real-time kernels, X/Motif GUI builders, databases and simulation models.

CUSTOMER SUPPORT & TRAINING

A key element to fulfill the strategy will VPI's ability to offer in-depth product support and training through its head office support centre, regional US offices and European and Asian distributors.

VPI's customer support is broad based and includes hot-line and e-mail support, bug fixes and maintenance releases, as well as major version releases. Using the latest equipment and debugging tools, VAPS support specialists provide rapid and effective problem solving.

VPI offers comprehensive training on VAPS and VAPS/CCG. Introductory and advanced courses are regularly available at our corporate headquarters and in selected regional offices. On-site courses are also available. Special training courses on subjects such as rehosting and communications integration are available upon request. VAPS training ensures that the customer derives the maximum benefits from VPI's leading edge technologies.

MINELEC

All of the Control
You'll Ever Need!

M.A.R.I.S

The choice of professionals

Automatic Radio Identification System

M.A.R.I.S

Minelec Limited have developed a unique Automatic Radio Identification System (MARIS) which can be used to provide automatic "next stop" destination announcements on public transport vehicles. The system utilises unique passive (no battery) identification transponders which are electronically imprinted with non reproducible serial numbers.

A valid read of a transponders I.D. by the MARIS reader unit situated on the moving vehicle will provide appropriate RS232 control codes to a digitised speech generator. Programmable announcements of the next stopping point will be issued over the vehicles internal speaker system.

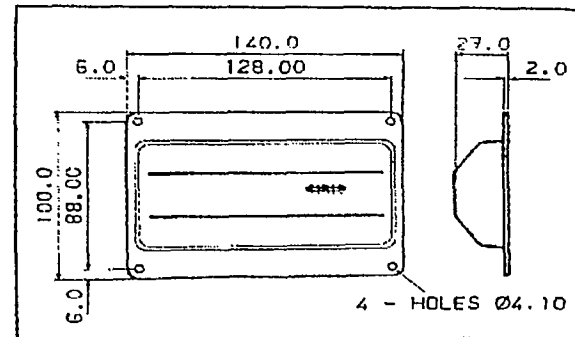
Superior Design

Individual transponders are located at strategic points along the route and as the MARIS reader passes each transponder it automatically receives its unique I.D. number. After verifying a correct read is received the reader checks its database and outputs the code required to initiate the appropriate voice announcement.

I.D. numbers can be easily entered or deleted from the readers database via the built in keypad and LCD display. Alternatively the reader can be programmed via a personal organiser or portable computer and have the database downloaded on-site.

The MARIS unit can store up to 1000+ entries in its database and is provided with a 16 character LCD display and numeric keypad for local programming and password protection. The MARIS

Dimensions



VEHICLE TAG

unit can be powered from a 12v or 24v DC. supply however optional vehicle power supply filtering may be required if the MARIS unit is powered directly from the vehicles own supply.

COMPONENTS

The system consists of the MARIS reader control unit, associated antenna, digitised speech annunciator, vehicle speakers and transponder tags.

System antennas are specifically designed for each application and are based upon customer requirements and the type of transponders being used. Under normal conditions a 3' x 2' antenna can provide a detection range of over 2m. at speeds approaching 40mph. Greater detection distances and speeds can be provided if required.

The transponders can be supplied in many styles and our vehicle transponder (shown above) provide excellent performance.

The MARIS system is designed for automated public transport voice announcements and a full turnkey package can be supplied by Minelec. Our application engineers are always willing to discuss custom design or modifying existing product and software to provide solutions to our customers problems.

This product is CANADIAN designed and manufactured. For further information or a product demonstration please contact your local sales representative or:

CALL US AT:

Tel: (905) 828 1520

Fax: (905) 828 1525

MINELEC LIMITED

2170 DUNWIN DRIVE #3, MISSISSAUGA, ONT. L5L 5M8

Helping our customers succeed through INNOVATIVE products.

Minelec Limited

ACT 1 & 2 READERS

All of the Tracking You'll Ever Need!

CUSTOMER:
ATLANTIC ALARM

Application Note for AVI Tiris Systems

Introduction:

This document describes the AVI Vehicle Identification system utilising an "in-ground" antenna. It should be noted that alternative antenna designs are available i.e. Model RA 00236 Roadside Antenna, however for this application we feel that an in-ground design is more preferable due to full width road coverage.

Concept:

The application objective is to provide a system to automatically recognise authorised vehicles circulating around the outer ring road of a correctional facility. The Reader would provide an RS 232 (or RS 422) output which will be interfaced to a computer (hardware & software supplied by others) to log the presence of the vehicle/s.

Functional description:

The system comprises: A stationary Reader unit c/w RS 232 (RS 422) output, an in-ground antenna and appropriate vehicle tag.

Component parts:

STU: The system uses an ACT 1 (2) reader incorporating a Tiris based STU Read only stationary unit. The Reader(s) are 120v AC 60Hz powered and provide termination facilities for the antenna, RS 232 (RS 422) data link, and relay output(s).

Antenna: The antenna size is dependant upon a number of factors not least the width of the road, where it is to be installed and the intended speed of travel of the vehicles requiring detection. From supplied information it is known that

the vehicles circulate in one direction only, and the road is up to 3m wide. In anticipation of vehicle speeds of between 24-50 kph, we therefore propose a rectangular antenna of approx. 3m x 1.5m. The antenna will be supplied housed in a hexagonal hose type cable in order to provide improved environmental performance for the in-ground installation.

In general the antenna must be laid as shallowly as possible and in any case must not rest (touch) on any metal re-inforcement rods.

Other standard considerations for road antennas are:

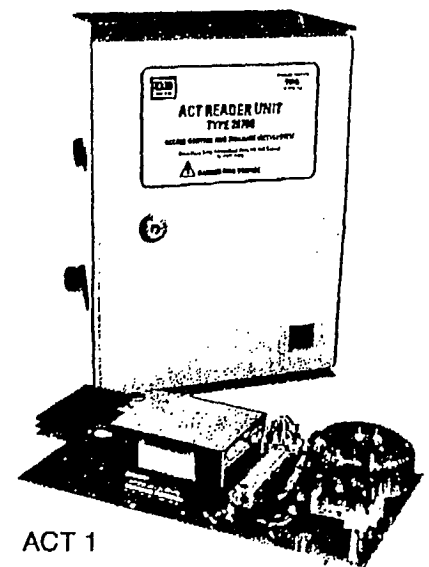
1. The antenna loop must not be placed within or directly adjacent to any traffic light or barrier loops.
2. An in ground antenna should always be tuned when a vehicle is directly over it. This is because the mass of the vehicle detunes the system.
3. Surface water also detunes the in-ground antenna, so a slight loss in range may be observed.

The in-ground antenna would require a duct of approx. 30mm wide to be cut into the road. A suitable sealant must be used to reseal the road surface after the antenna has been laid.

Tag: The tag MIN R 9 TD should be used for this application. This can be attached to the underside of the vehicle in a secondary housing. The housing could be a plastic tube with end fixing holes aligned to match suitable vehicle attachment points. As the radiated

antenna field strength can be affected by the mass of the vehicle, final positioning of the tag/tuning of the antenna should be done in synchronism.

Various mounting methods can be used. The best method should be determined for each vehicle and application. A Minelec Installation Guide is supplied with ALL reader units which provides guidelines on tag/antenna orientation and secondary tag packaging.



ACT 1

For further information please contact MINELEC LIMITED:

Tel: (416) 828 1520

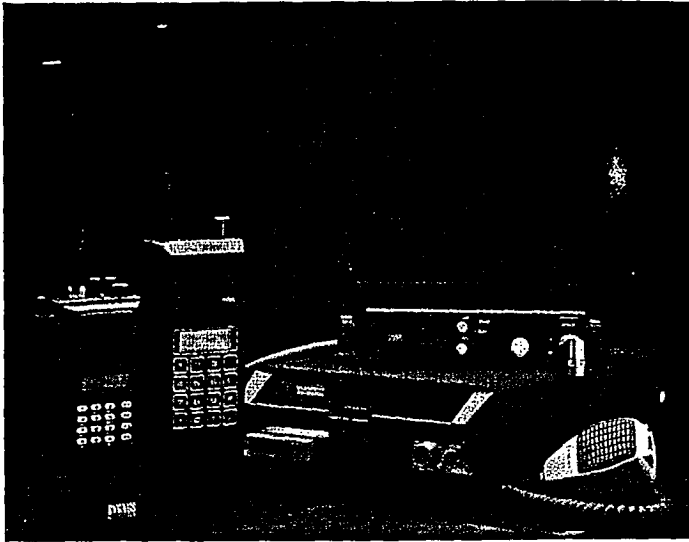
Fax: (416) 828 1525

CygNet™

State of the Art Voice and Data
Communication Networks



CYGNUS
TECHNOLOGY LTD.



DESIGNED FOR FUTURE NEEDS

CygNet™ is designed to evolve with you. As new technologies appear on the market, CygNet™ can incorporate them easily and economically.

• Industry standard components

Our use of industry standard components means high reliability, cost savings, and simple upgrading. We use a standard language — C++, and the MVIP bus which is based on AT-EISA compatible products. We provide software which is off the shelf or customized to suit your specific needs.

• Accommodating technology

A CygNet™ terminal can be locally controlled, or can communicate with other terminals within a large, distributed system. E1 or T1 digital trunks can be connected directly within the CygNet™ controller, eliminating the need for additional connection equipment.



A WIDE RANGE OF BENEFITS

• Easy to Use

Despite its sophisticated electronics, CygNet™ is easy to use. Radios have simple operations. These operations are simplified further by customized programming, so each unit has just the number of controls needed. Re-programming is also easy, since it can be done on the individual radio. Increasing system capability is achieved simply by adding channels and peripheral equipment, or by upgrading computer hardware and software.

• Reliable signals

Digital switching assures crisp, clear, distortion-free signals.

Connections are under software control. Users are never frustrated by "stuck" connections and cross connects.

• Flexible connectivity

CygNet™ provides flexible technology. CygNet™ controllers can be interconnected via leased lines, analog or digital microwave, or satellite networks. A variety of site interconnection methods can be implemented.

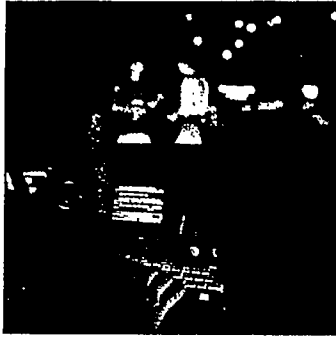
• Maximum efficiency

CygNet™ uses digital technology to maximize communication efficiency. System users are dynamically allocated to available channels. Data calls or voice calls are processed and assigned to an available working channel.

CygNet™ terminals support either simplex or duplex operation, resulting in maximum efficiency. Either mode can match a variety of radio equipment and software.

Cygnus Technology introduces CygNet™ — a state-of-the-art communications system. A CygNet™ system provides a communication network which transmits voice and digital information with efficiency, speed, reliability and flexibility.

Compared to traditional radio systems, CygNet™ offers many benefits such as flexible connectivity, additional options for control and command functions, and accommodates communication with a number of cooperating agencies.



INTEGRATED COMMUNICATION

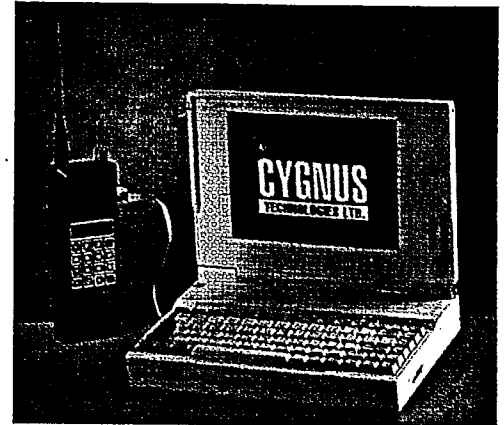
With CygNet™, you achieve a fully integrated network. On a single platform, you can communicate to virtually anybody or any group. You can either speak with them, or send and receive digital information.

For example, from a patrol car, a police officer can use his mobile CygNet™ radio to contact:

- other police units
- public utilities
- emergency medical teams
- computer systems to access databases and networks

Voice & data capabilities

CygNet™ has more than simple voice transmission capabilities. When the mobile radio is connected to a portable computer, the user can send or receive digital information in a secure manner.



In control

You remain in control of who has access. You may wish to restrict wide-reaching access to key personnel. We have therefore designed our radios to be programmed individually. As assignments or requirements change, you can re-program each radio to restrict or enhance access ability.

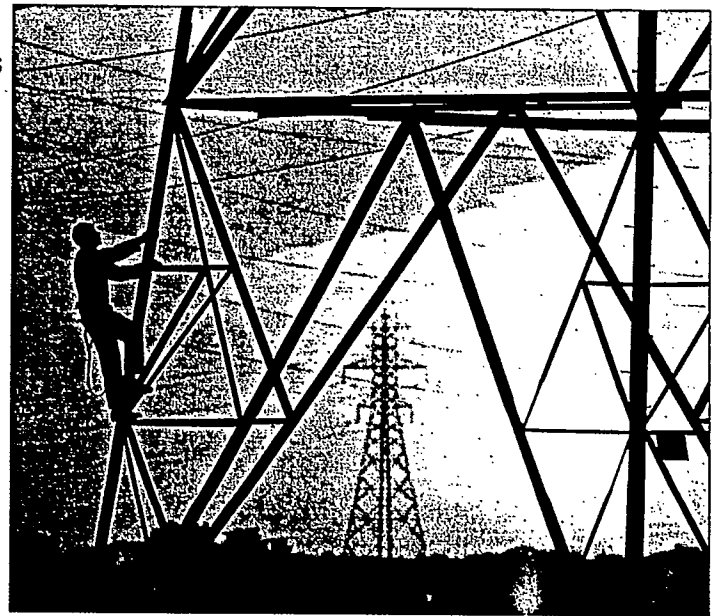
Always informed

You stay informed about who is calling whom. Automatic log-ins also allow you to track the calls and the services used. Reports on all of your users activities can be generated to keep you updated.

Linking networks

Networking with adjacent agencies for emergencies or special events is made possible with our flexible technology. Our system gives you the power to link together:

- conventional and private systems
- special mobile radios



The CygNet™ controller is ideal for remote and unsupervised operation.

CYGNUS TECHNOLOGY...

FAST FACTS:

- › Since its beginnings, Cygnus has established itself as a company capable of finding solutions to any communications challenges. (in fact the company has a growing reputation of developing workable solutions that others say couldn't be done)
- › Cygnus innovative solutions has resulted in a worldwide reputation. It has successfully competed with industry giants and won, resulting in contracts in Canada, the United States, and the Middle East.
- Projects can involve any combination of information movement: voice, data, or image.
- › Current projects range from a sophisticated emergency response communications system in Kuwait, to an interactive desk top video conferencing network for a domestic client.
- › Based in Fredericton, New Brunswick, Canada, Cygnus was incorporated in 1989 as a service company specializing in communications technology.

PROFILE

- › Company principles include Glenn Smith as President. Glenn is an electronics and communications specialist with 25 years experience, much of that time as a globe-trotting trouble-shooter or project manager on sophisticated communications projects from Africa to India, and from what was formerly Russia to the Middle East. Currently, he manages International Operations.

Cygnus Vice-President is Kim Munn. Her expertise in business administration is augmented by her hands-on experience in the electronics industry. Committed to budget and project deadlines, Kim

effectively authors National and International Contracts, directs Domestic Operations, and manages Customer Service.

Dale Wooden is Project manager and Quality Assurance manager. He came

to Cygnus after 17 years service in the Canadian Air Force where he was an electronics maintenance specialist.

- › The management group is supported by a Research and Productivity team of computer scientists and engineering technicians who work interactively on development of communications networks. (in other words they figure out how best to combine hardware and software technology to meet a specific need)

CYGNUS ***The communications solutions company***



Cygnus Technology Ltd.
154 Main Street
Fredericton, New Brunswick
Canada E3A 1C8
Tel: 506-459-4606
Fax: 506-452-9321

CYGNUS Solutions Can Lead to a more Efficient, Safer Accident Response

A chemical spill leaks deadly toxins into the air. A forest fire threatens a village. Oil from a grounded tanker quickly spreads across the coastline. All are emergency situations. And how the communications aspects are handled will determine how quickly and effectively the situation is brought under control. In fact, the right communications system could save lives and money.

That's where Cygnus Technology comes in.

The Fredericton company's communications systems can make emergency response work not only more efficient, but safer.

One example: A Cygnus network can include remote monitoring sensors tied into integrated communications systems, eliminating the need for fire fighters to risk their lives running around volatile environments with hand held monitoring sensors.

In fact, a Cygnus system could allow for the constant monitoring

of any type of pollutants or toxins in mines, settling ponds, waterways, or literally anywhere. Another example: A Cygnus system could effectively interconnect not only the communications systems within a local police, fire fighting, or EMO contingent, but it could also integrate the different agencies systems so these various emergency responders could talk to each other. And not just talk, but exchange any manner of data, helping to eliminate the confusion that so often dominates emergency situations.

In short, Cygnus specializes in finding solutions to any type of

communications problem. And its reputation for doing it well is spreading worldwide. Cygnus is currently in the final stages of a major project in Kuwait, where it developed an interconnective communications network for the country's ambulance and other

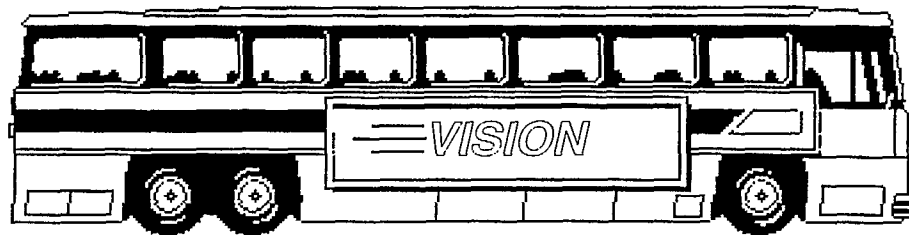
emergency response vehicles. But it doesn't stop there. Cygnus innovation has also led to the development of an electronic personal identification system; a sort of hi-tech picture ID card with an electronic scan strip for quick verification. The card is especially useful for controlling admittance to sensitive areas, such as emergency locations and operations centres.

What separates Cygnus from the rest is its attitude. It is ready and willing to tackle any manner of communications problem. And with the innovative thinkers in the company's research division, it well deserves its reputation as a solutions company. Simply put, when Cygnus tackles a problem, it doesn't stop until it finds the solution.

CYGNUS ***The communications solutions company***



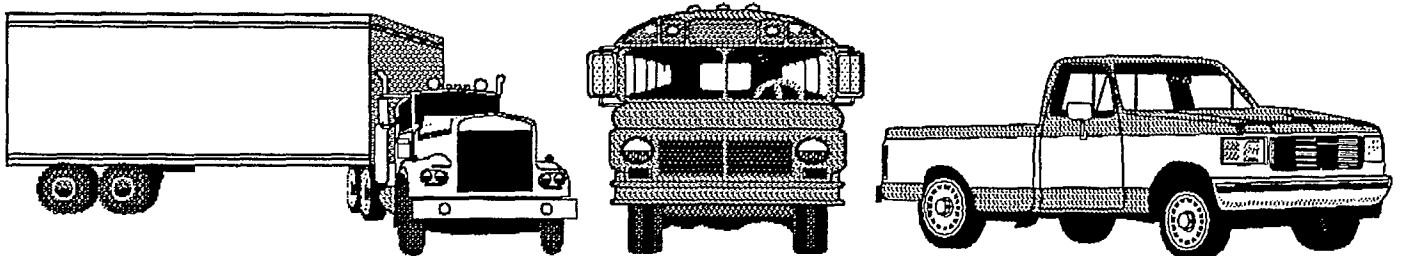
Cygnus Technology Ltd.
154 Main Street
Fredericton, New Brunswick
Canada E3A 1C8
Tel: 506-459-4606
Fax: 506-452-9321



VISION

(Vehicle Information System Integrated On-line Network)

- Provides real-time verifiable vehicle position and status information through the use of graphical displays; vehicle dispatch scheduling and routing information.
- Operates on UNIX Workstations or Intel-based microcomputer systems in a multi-tasking, multi-user environment; also network compatible.
- User-friendly — employs a consistent graphical user interface and mouse and allows for user-definable icons, objects, landmarks, map colours and text options.
- Provides multi-port interface capability.
- Low cost, reliable, serviceable.
- Various upgrade options based on a modular system design, including computer-assisted dispatching and real-time digital mapping.
- Data archiving, reporting, and exporting facilities.
- Compatible with selected GIS software packages
- Adaptable to European markets






Corporate Profile


Compusult Limited, incorporated in 1985, provides computer consulting services to government, business, technical and scientific sectors and markets its own and value-added computer software and systems.

Company products and services include:

- business, technical and scientific applications software;
- vertical market software for medical, service and retail industries;
- vehicle tracking systems utilizing satellite and terrestrial positioning systems, and fleet management software incorporating computer-assisted dispatch and real-time digital mapping;
- geographic information systems;
- standalone and integrated expert systems;
- environmental consulting in marine and atmospheric icing; sea ice, iceberg, meteorological and oceanographic monitoring and data management; ice and environmental data acquisition and analysis; numerical modelling; and target tracking and display systems;
- marine and terrestrial data acquisition systems for monitoring of environmental effects, especially ice and wind loading on structures;
- assistive devices for visually impaired persons for use in the workplace and home;
- value-added resale of microcomputer hardware and software, including needs assessment, system integration, configuration, installation and training;

To develop international business opportunities, the firm has established affiliations in Canada, the United States, the United Kingdom, the Nordic Countries, and the Far East. Compusult is interested in marketing partnerships throughout North America and Europe.

| | |
|---|--|
| BARRY J. O'ROURKE PRESIDENT | 40 Bannister Street P.O. Box 1000 Mount Pearl, Newfoundland |
|  DIRECTOR OF SOFTWARE DEVELOPMENT | Telephone (709) 745-7914 Fax (709) 745-7927 barry@compusult.nf.ca CompuServe 74147.2214 |


40 Bannister Street P.O. Box 1000 Mount Pearl
Telephone (709) 745-7914 Fax (709) 745-7927 Internet



Vapor Canada Inc.

Address: 10655 boulevard Henri Bourassa Ouest
Saint-Laurent
Montreal, Quebec
H4S 1A1

Phone: 514-335-4200

Fax: 514-335-4231

Export Contact: Mr. Mike Hardt, ~~Manager~~, Marketing & Sales *v. P.*

Marketing Profile

Vapor Canada Inc. produces a wide range of products for the transportation industry including electric and pneumatic door operators and controls for mass transit and commuter rail cars, complete door systems for urban buses and advanced train control system components for railroad operations. Vapor Canada Inc. also specializes in heating and ventilation systems with relay logic or microprocessor-based controls for both rail and transit applications. Vapor Canada inc. is an integral part of the Transportation Products Group of Mark IV Industries with its head office and manufacturing facilities located in St. Laurent, Quebec. A sales and service office is maintained in Toronto to serve the company's many clients in that area.

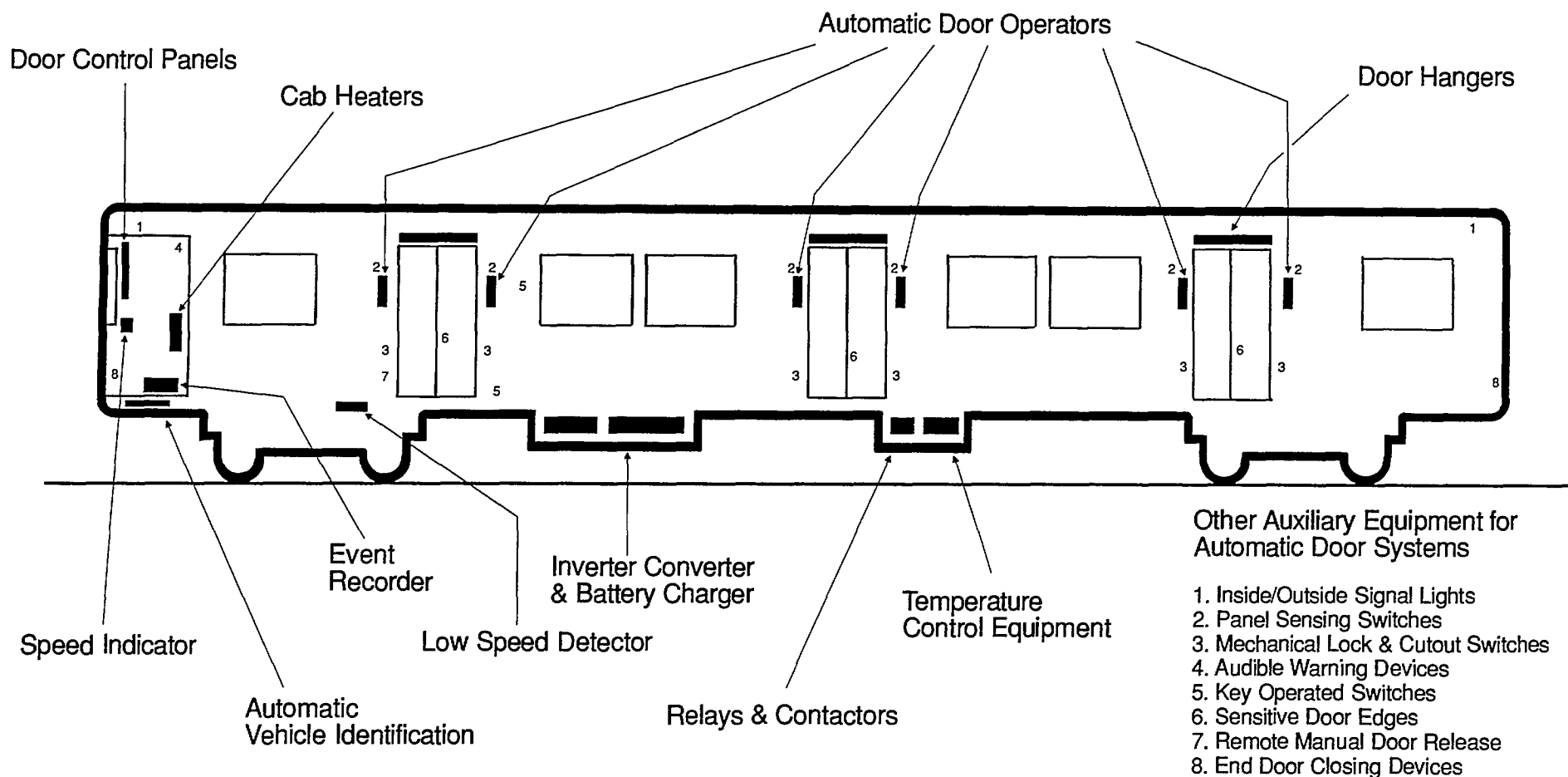
Its fully equipped engineering department keeps Vapor Canada Inc. at the forefront of technology with its research and development programs for new and innovative answers to the transportation industry requirements.

Southeast Asia and the U.K. have been identified as priority markets for mass transit equipment and Vapor Canada Inc. has recently opened an engineering and service office in England to support a major door system contract in that country.

Products/Services Available for Export:

Operators, Door, Automatic
Counters, Digital Electronic
Electronic Equipment Components
Railway Rolling Stock, Parts and Accessories
Safety Control Equipment, Railway, Parts and Accessories
Controls, Relay Logic
Microprocessor Control and Monitor System
Event Recorders, Locomotive
Vehicle Location Systems, Railroad
On-Board Locomotive Computer Terminals
Bonded Door Panels
Aquazone Bus Heat

Vapor Products For Rail Cars



VAPOR CORPORATION • TRANSPORTATION PRODUCTS GROUP

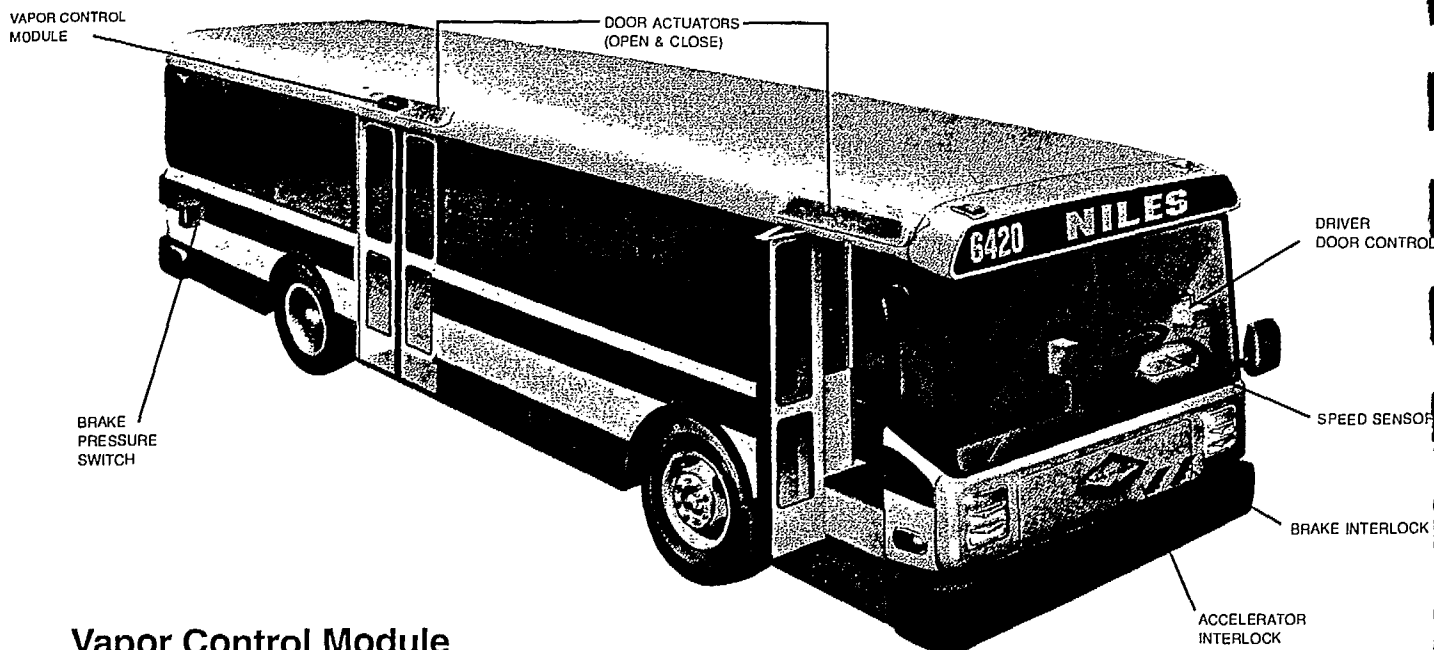
6420 WEST HOWARD STREET • CHICAGO, ILLINOIS 60648

VAPOR CANADA, INC. • 10655 HENRI-BOURASSA WEST, VILLE ST-LAURENT QUEBEC H4S1A1

VAPOR INTERNATIONAL HOLLAND B. V. • ATOOMWEG 496, 3542 AB UTRECHT, THE NETHERLANDS

WORLDWIDE: VAPOR INTERNATIONAL • CHICAGO, ILLINOIS 60648

Vapor Electronic Controls for Bus Systems



Vapor Control Module

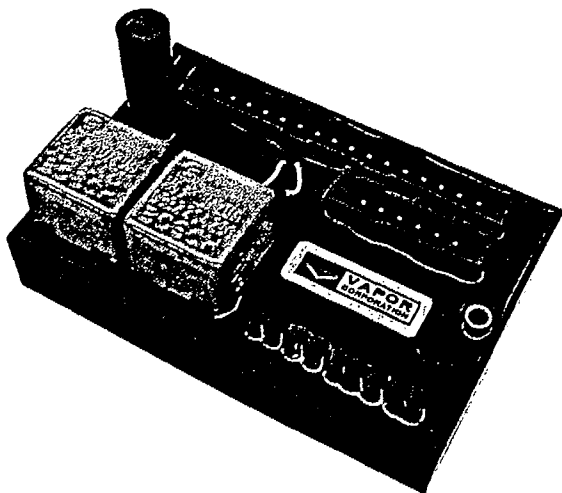
The VAPOR Control Module is a programmable microprocessor based device which can completely manage the operation of the door system, brake and accelerator interlocks, wheelchair lift, and related subsystems. See reverse side for features and benefits.

The VAPOR Control Module incorporates diagnostics and self testing previously unavailable on bus door systems. When a sensor or component fails, the system reverts to a safe, defined condition, and records the failure in memory. Flashcodes indicate what went wrong and where to look for the problem. Operating parameters can be changed on the bus by connecting a portable computer and loading a new program.

The VAPOR Control Module operates on 12 or 24 volt systems. It is as rugged and reliable as the VAPOR door equipment it controls. Electrical outputs are fully protected and can withstand direct short circuits. A finned aluminum enclosure shields the circuit cards from the environment.

Vapor Exit Door Module

The VAPOR Exit Door Module saves space and weight by replacing wire and relay logic. Relays are used only for current switching. Integral light emitting diodes assist in trouble shooting. The module is fully protected against over-voltages of 150 VDC and short circuits to ground. The VAPOR Exit Door Module is in service on hundreds of transit buses.



Vapor Exit Door Module

- Reduced Wiring
- Fewer Relays
- Simplified Diagnostics ... Up to 9 LED's provide an indication pattern that simplifies trouble shooting.
- 12 or 24 volt DC Operation.
- Fully Protected Against Electrical Overloads to 150 VDC and Short Circuits.
- Interlock circuit is checked to insure proper operation. Improper operation locks out exit door.
- Proven Durability ... The Exit Door Module has been successfully applied to hundreds of buses.



 MARK IV TRANSPORTATION
PRODUCTS GROUP



Vapor Control Module

Fully programmable to meet application requirements.

Advanced Control Capabilities ...

- Door Controls
- Vehicle Diagnostics
- Wheel Chair Lift Control
- Relay Logic Replacement
- Sonic Sensor Controls
- HVAC Control

Memory and I/O

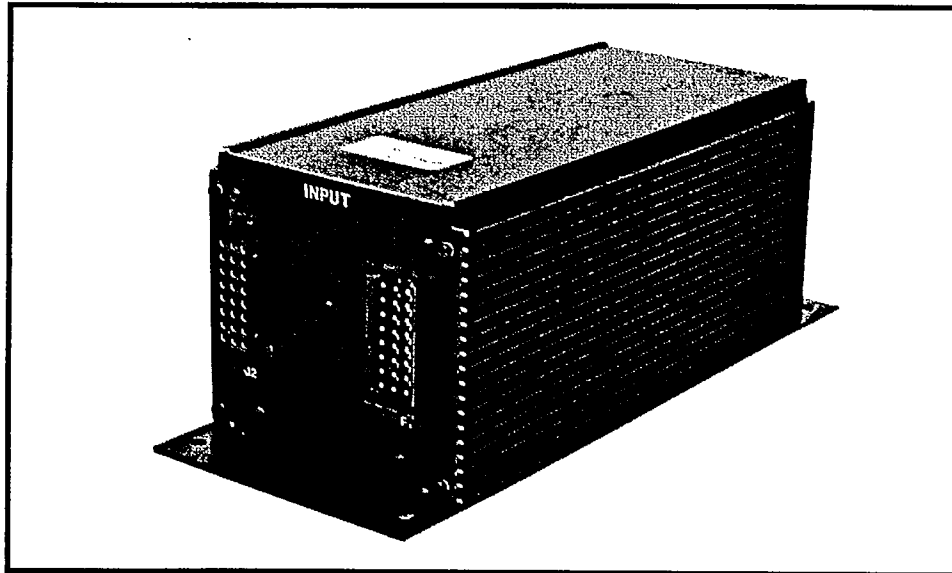
- 32 Kbytes EPROM (System Program)
- 32 Kbytes FLASH ROM (Application Program)
- 128 Kbytes STATIC RAM (Memory)
- Up to 48 Inputs
- Up to 30 Output Drivers
- RS232 and RS485 Interfaces
- J1708 Capability

Diagnostic Capabilities

- Auto Self Test at Turn On
- LED Flash Codes with Fault Storage and Display
- Laptop Diagnostic Program Available
- Electrical 8 to 29 VDC Supply Voltage
- Current sink capabilities from 50 mA to 900 mA per output. Outputs may be paralleled for increased load
- Inputs protected to 75 VDC
- Outputs will withstand direct shorts
- Power supply protected against reverse polarity and load dump transients

Physical

- Rugged, finned aluminum housing
- Locking plug-in connectors
- Flexible mounting
- Operating temperature range: -40°C to +75°C
- Withstands up to 95% Relative Humidity



SERVING THE TRANSPORTATION INDUSTRY SINCE 1903 ...

Vapor's commitment to serving the Transportation Industry with innovative, reliable products is supported by creative engineering, on-going

investment in state-of-the-art manufacturing capabilities, and a dedication to the aggressive pursuit of quality in all aspects of its business.



for more information call or write ...

VAPOR

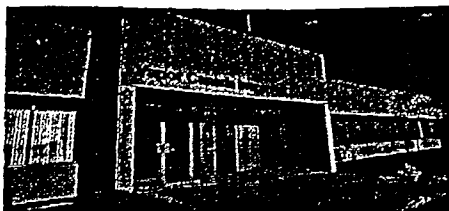
6420 West Howard Street, Niles, Illinois 60714 • Telephone: 708/967-8300 • Fax: 708/470-7800

Regional Offices:

Dunedin, FL - 813/787-8519 • Philadelphia, PA - 215/993-9630 • Linden, NJ - 908/862-3500
Woodland, CA - 916/666-0989

Worldwide:

Vapor International - Niles, IL 60714 • Telephone 708/967-8300 • Fax: 708/470-7800
Vapor International - Holland B.V., Utrecht • Telephone 011-31-30-414002 • Fax: 011-31-30-410087



The high quality of VCI's products and services is ensured by headquarters and field staff of the finest calibre. Knowledgeable personnel provide back-up and top notch technical help.

By taking advantage of the latest technology to improve existing products and to design new ones, VCI keeps pace with the ever-changing transportation industry.

Whether updating existing systems or creating new ones, VCI designs time and labour saving devices to make tomorrow's products safer and more effective.

VCI has headquarters in Montreal, Quebec with field offices in Toronto, Ontario and Derby, England.



**MARK IV TRANSPORTATION
PRODUCTS GROUP**

VCI is part of the Transportation Products Group (TPG) of Mark IV Industries, Inc.

A Fortune 500 company with corporate headquarters in the Buffalo suburb of Amherst, New York, Mark IV is a diversified manufacturer of products and systems for Power Transfer and Fluid Handling; Professional Audio; and Mass Transit and Traffic Control markets.

A group of companies with a common interest in the growing transportation market, Mark IV Transportation Products Group (TPG) is headquartered in Plano, Texas.

Mark IV TPG companies are totally committed to the manufacture of products that offer the public more ease and comfort when using airlines, roadways, highways and public mass transit systems.



MARK IV TRANSPORTATION PRODUCTS GROUP

A Mark IV Industries Operating Company Group
1200 E. Plano Parkway
Plano, Texas 75074-8522
(214) 424-6511 Fax (214) 423-1540



A Mark IV Industries Company
VAPOR CANADA INC.
Transportation Products Group



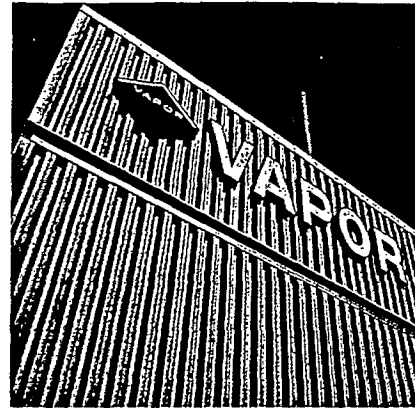
MIKE HARDT
Director
Sales and Marketing

9 Royal Crest Road, Unit #1
Rexdale, Ontario M9V 2L6
(416) 743-7200
Fax (416) 743-7204

10655, Henri Bourassa ouest
St-Laurent, Québec H4S 1A1
(514) 335-4200
Fax (514) 335-4231



**MARK IV TRANSPORTATION
PRODUCTS GROUP**



Meeting the challenges of the Twenty-first Century

**VAPOR CANADA
and VAPOR U.K.**

Vapor Canada is part of the Transportation Products Group (TPG) of Mark IV Industries. A Fortune 500 company with corporate headquarters in Buffalo, New York, Mark IV operates 65 separate manufacturing facilities in 10 different countries, employing more than 11,000 people.

The companies which form Mark IV TPG manufacture products such as interior lighting, door controls and passenger information systems for buses, trains and aircraft; as well as highway directional signs, traffic signal controllers and traffic signals to manage the flow of vehicular and pedestrian traffic.



Vapor Canada
10655 Henri Bourassa West, St-Laurent, Quebec H4S 1A1 (514) 335-4200 fax (514) 335-4231
9 Royal Crest Road #1, Rexdale, Ontario M9V 2L6 (416) 743-7200 fax (416) 743-7204

Vapor U.K.
28 Springdale Court Mickleover, Derby, DE3 5SW, England, U.K. (44) 332 518 788
fax (44) 332 519 071

PHOTO © CANADA 1991 BY GUY WATSON

Commuter & Heavy Rail

Enhancing comfort and productivity ...

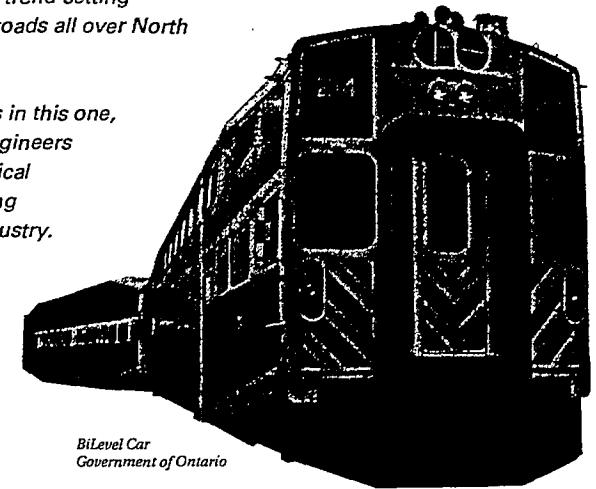
Since the days of steam-driven locomotives, Vapor Canada has ensured the comfort and safety of passengers by producing efficient and reliable Commuter and Heavy Rail products. Vapor has gained the respect of the industry by designing trend-setting products used by railroads all over North America today.

In the next century, as in this one, Vapor's innovative engineers will initiate technological developments affecting the entire railroad industry.

The high quality of Vapor's products and services is ensured by headquarters and field staff of the finest calibre.

Knowledgeable personnel provide back-up and top notch technical help.

Drawing on almost one hundred years of experience, Vapor Canada will continue to help keep railroad travel safe and efficient in the twenty-first century.



*BiLevel Car
Government of Ontario*

Mass Transit: Bus & Rail

Designing transit solutions for the next century...

In March of 1993, Vapor Canada was awarded a contract for the supply of door operators and controls for the Toronto Transit Commission's new T1 subway cars to be built by Bombardier Inc. in Thunder Bay, Ontario.

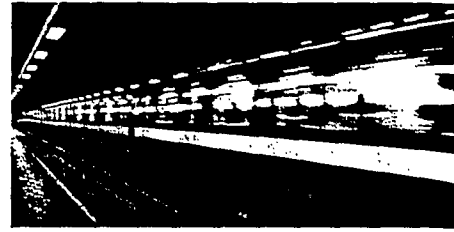
The contract is for 216 cars and includes an option for an additional 286. Production is scheduled to begin in 1995 on a project that promises to continue into the 21st century.

Designed and engineered by Vapor Canada at its facilities in Ville St-Laurent, Quebec, the operators and controls incorporate state-of-the-art safety features specified by the Toronto Transit Commission.



Vapor Canada's headquarters and manufacturing facility was built in 1986.

Montreal Metro

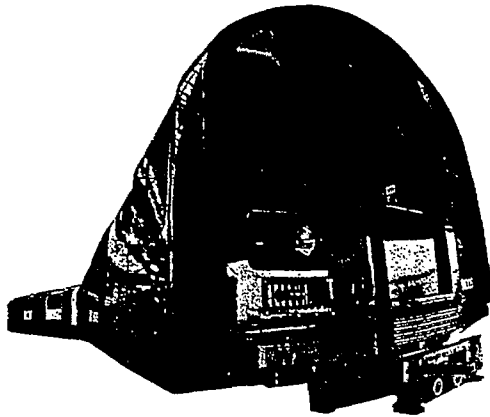


Vapor's rapid transit products include door operators, door panels, door controls, temperature controls and subway station doors.

OBI Orion V



Vapor's door and heating systems are integral parts of buses made for the domestic and US markets.



London Underground Ltd.

Canada is a world leader in the design and manufacture of equipment for rapid transit systems and Vapor Canada has always been a major player. Vapor is currently supplying ABB Transportation Ltd. of Derby, England, with complete door systems for the 680 cars being built for London Underground's Central Line.

By taking advantage of the latest technology to improve existing products and to design new ones, Vapor keeps pace with the ever changing transportation industry.

Whether updating existing systems or creating new ones, Vapor designs time and labour saving devices to make tomorrow's products safer and more effective.

Vapor Canada supplies door and heating systems for all types of rolling stock and has earned a solid reputation for quality in the design, engineering and manufacture of transit products.

Vapor Canada also helps keep the bus industry on the road with economical, durable and energy efficient products.

After building a name synonymous with quality and reliability as a supplier to the transportation industry throughout most of this century, Vapor is ready for the challenges of the next century.



British Columbia's SkyTrain

M3i

ROADSOFT SOLUTIONS

ROADsoft Solutions Inc.

Suite 135
1111 St. Charles Street West
Longueuil, Québec
J4K 5G4

Tel.: (514) 928-3332

Fax: (514) 442-5076

Contact:

Director, Marketing

Company founded: 1986

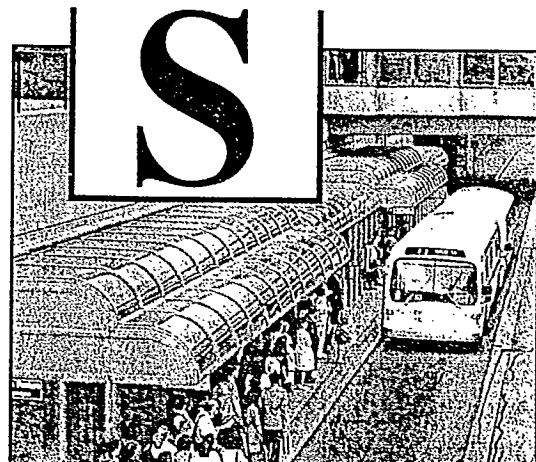
SECTORS OF SPECIALIZATION:

Public Safety, Transportation,
Utilities, Oil & Gas distribution, etc.

PRODUCTS:

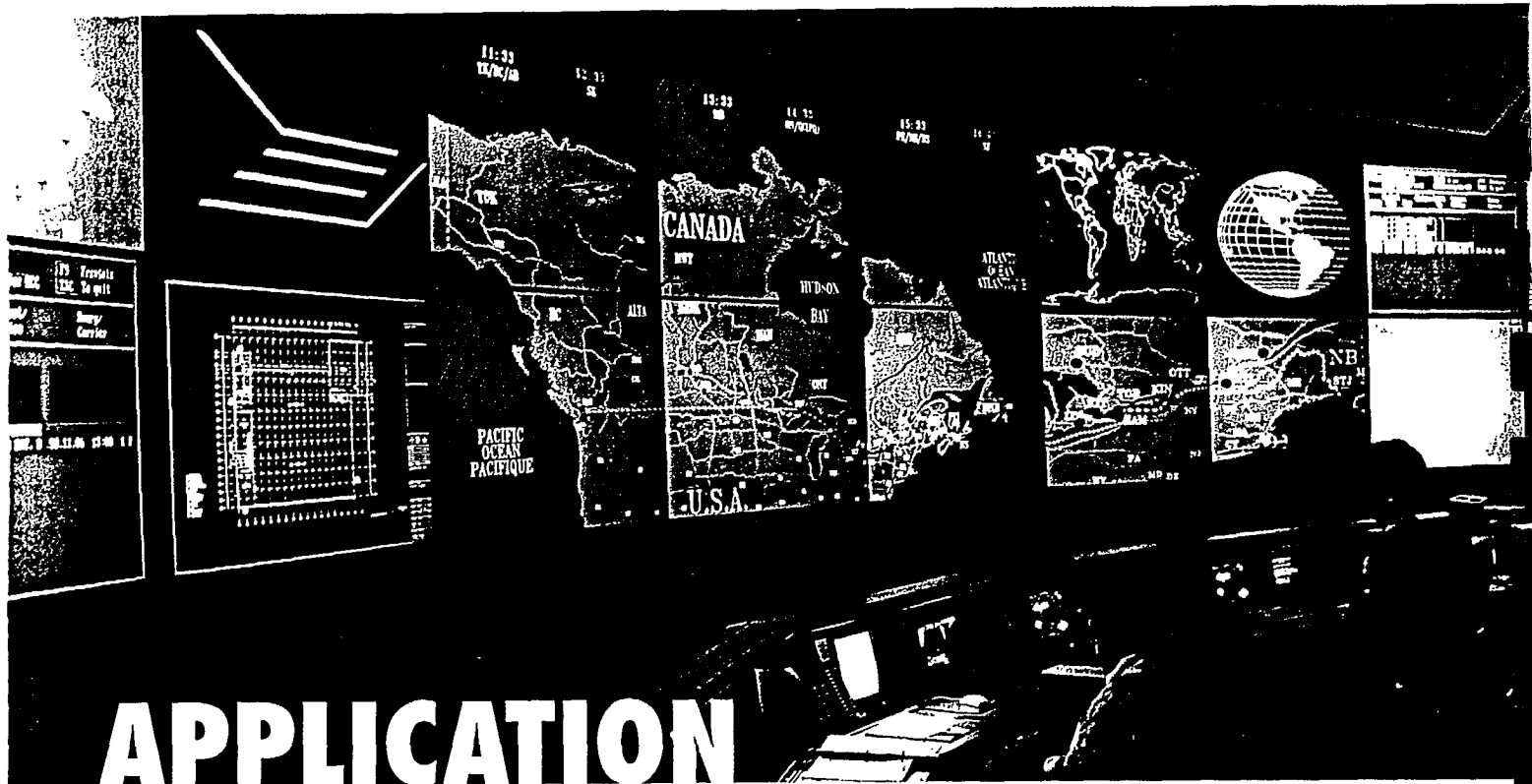
ROADsoft Solutions Inc. is a leading provider of fully-integrated fleet management systems through the integration of advanced Computer Assisted Dispatch (CAD), Differential Global Positioning Systems (DGPS), Automatic Vehicle Location (AVL), Numeric Radio Communication (Radio Link), Geographical Data Base Systems (GEOBASE) and Optimization Allocation Algorithms. Large area screen viewing and display capabilities complement the integrated ROADsoft Solutions Inc. offerings.

ROADsoft Solutions Inc. is a Group M3i Company.



CANADA POST CORPORATION

M3i MOSAIC



APPLICATION PROFILE

THE NATIONAL CONTROL CENTRE
OF CANADA POST CORPORATION,
OTTAWA, CANADA.

“ The M3i Graphic Display System was developed within the time and fiscal budgets we had. The result of the work involved—especially the integration of our existing data bases—is a first class, fully-functional system with growth potential. ”

Sylvain Marchand, Project Authority,
Canada Post Corporation

THE APPLICATION CHALLENGE

With a service area in excess of 9,000,000 square kilometers and some 40,000,000 pieces of mail to deliver to 11,000,000 destinations every business day, Canada Post Corporation's National Control Centre Operators in Ottawa faced a unique challenge of monitoring and supporting mail operations across Canada. Data such as worldwide weather, equipment status and ground and air transportation information, must be rapidly available and presented in "real-time", highly functional form to place NCC Operators in control of any situation.



THE M3i SOLUTION

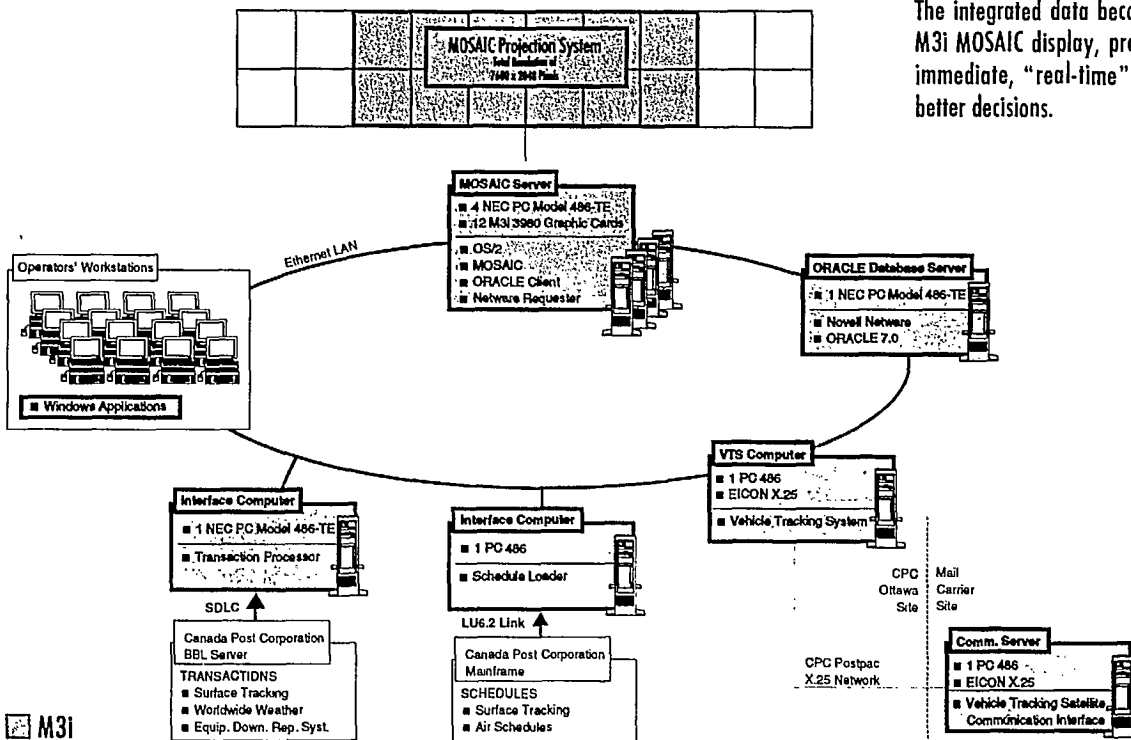
While some of the necessary data was available from a variety of different sources, it was necessary for M3i to develop a data base system which could interface with and integrate all of the data for instant, interactive imaging in a multi-screen display environment. Airline schedules and equipment status information, for example, was available from existing Canada Post Corporation mainframe computers, and worldwide weather was available on the system as well.

Advanced technologies were utilized for local area networks, the creation of a data base file server and external interface servers. All were integrated into the M3i MOSAIC System to develop a dynamic, interactive Graphic Display System. M3i Systems Inc. assumed turnkey responsibility for the entire project—and delivered within 14 weeks.

In addition, it was necessary to develop a Vehicle Tracking System in order to improve service performance and to monitor the positioning of major Canada Post contract road carrier trucks. The system, using sophisticated Global Positioning System technology and commercial communications satellite links, was integrated with the data from other sources to develop a data base.

Information such as major equipment failures, airline schedule deviations, vehicle departure points, including destinations and cargo contents are readily identified, and, using client-defined threshold points, may be interrogated.

The integrated data becomes instantly accessible on the M3i MOSAIC display, providing multiple Operators with immediate, "real-time" data, and the ability to make better decisions.



M3i Systems Inc.
1111 St-Charles Street West,
Suite 135, East Tower
Longueuil, Quebec
J4K 5G4
Tel.: (514) 928-4600
Fax: (514) 442-5076



ROADSOFT SOLUTIONS

ASSISTANT

Introduction

ROADsoft Assistant is an information management system designed to optimize the information processing efficiency of law enforcement agencies and other emergency services. The modular, client/server architecture is designed to adapt easily to the specific needs of every public safety application.

ROADsoft Assistant improves and accelerates the call-taking process including telephone requests, walk-in calls, radio calls or calls from central alarm systems. ROADsoft Assistant also offers dispatchers excellent control over human resources and fleet movement during call-answering. Complete statistical reporting functions aid day-to-day organization management.

Systems Functions

ROADsoft Assistant is composed of several integrated modules. The principal elements are:

- Computer-Aided Dispatch System
- Incident Reporting/Record Management System
- Computer Assisted Communications System
- Interactive Mapping System

Computer-Aided Dispatch (CAD)

The Computer-Aided Dispatch system is designed to significantly reduce response time

for emergency calls and to enable dispatchers to better support officers in the field. This is achieved by facilitating the entry of service requests (Call-Taker) and by the dispatch of the most appropriate response resources.

The CAD system includes four modules:

- The *Service Module*, which controls base system parameters, system access and validation tables.
- The *Geographical Data Base or GEOBASE Module* which provides geo-referencing of locations such as streets and intersections and of objects such as telephone booths, hazardous material locations, patrol sectors and other information.
- The *Resource Module* which tracks duty rotations for emergency personnel as well as for external services such as Public Works and utility response teams and their appropriate rotations.
- The *Deployment Plan Module* provides identification of personnel teams, mobile units, daily rosters, and details of emergency and contingency plans.

Records Management System (RMS)

To satisfy the growing information demands of modern public security agencies, ROADsoft Assistant provides a comprehensive Records

Management System which is entirely on-line and interactive. The RMS module collects, stores, retrieves and safeguards information that is essential for efficient management and effective operations.

Query language, data base techniques, report writing, table-driven and parameterized software are all available in RMS. This ensures that the system can be tailored to the requirements of nearly every public safety agency.

The principal feature of the RMS module is a program which provides for a logical relationship of all related fields whenever a query is made. A search menu permits access to all RMS data and searches can be made on all files linked to a specific event.

This ability to research multiple files simultaneously is particularly effective for analytical functions, such as the recognition of patterns of reported incidents and the ability to match suspects with precise criteria.

Entries to the Records Management System are performed using Computer-Aided Dispatch following initial incident recording. ROADsoft Assistant is designed so that the dispatch function can take place at the earliest possible moment after incident reporting. Additional information can then be added as it becomes available, by using the RMS.

Computer Assisted Communications System

Because of the modular design of ROADsoft Assistant, additional modules can be added as agencies' requirements change.

Communications System options include the integration of Mobile Data Terminals or mobile computers, such as the M3i Technologies' PCMOBILE.

Other elements are available to augment and compliment the ROADsoft Assistant installation. Elements such as ROADsoft Solutions' RadioLink technology for access to data radio communications over private or public RF networks, sophisticated routing system algorithms based on GEOBASE data, and Vehicle Tracking Systems using Differential Global Positioning techniques and satellite technologies, are all available to augment and compliment the Roadsoft Assistant installation

Interactive Mapping System

The Interactive Mapping System provides a central dispatch control room tool which makes effective use of M3i MOSAIC large area screen displays. The management of graphic data from a variety of sources, including remote video signals, contributes immeasurably to dispatch efficiencies and field personnel security with improvements to agency response as well.

**ROADSOFT
SOLUTIONS**

ROADsoft SOLUTIONS INC.
1111 St-Charles West
Suite 135
Longueuil, Québec
Canada J4K 5G4
Tel: (514) 928-4600
Fax: (514) 442-5076

ROADsoft SOLUTIONS

RadioSNA SNA Terminal Emulation

Introduction

The RadioSNA product is a 3274 controller with terminal emulation which has been optimized to perform in a radiocommunication environment. This product has been designed to run within the RadioLink client/server environment. It requires a SCO UNIX engine equipped with a 3274 emulation card for the fixed side and a MOBILE PC operating under Windows for the mobile side.

Systems Functions

The RadioSNA product is composed of two elements. The server component is a UNIX-based machine equipped with an emulation card to interface with a mainframe computer. The second component is terminal emulation software running on a MOBILE PC.

The server performs multiple types of compression on the screens sent to the mobile via RadioLink communication software. One of the screen compressions effected by the server is screen ghosting. Any screen, or part of the screen, already being seen by the server is discarded. This information will be stored on both sides of the link and will disappear from all subsequent transmission between the applications. This compression does not have to be made for subsequent connections.

For the remainder of the screen, which is usually variable information, a general text compression algorithm is applied to reduce data size to a minimum.

The terminal emulation is fully-configurable to fit the needs of all users, in group or individual situations. An optional password screen is built into the server to control unauthorized access to the mainframe.

The terminal emulator has a keyed help screen feature which can increase user productivity. Every key of the 3278 terminal has an equivalent keystroke on the PC keyboard. Individual comments or symbols can be added to key descriptions so users remember commands instead of keystrokes.

A significant feature of the RadioSNA product, used in conjunction with RadioLink, is the capability of multiple sessions on the same screen. This permits the user to, for example, fill out a form with information taken from another screen without switching screens.

ROADsoft SOLUTIONS INC.
1111 St-Charles West
Suite 135
Longueuil, Québec
Canada J4K 5G4
Tel: (514) 928-4600
Fax: (514) 442-5076

ROADsoft
SOLUTIONS

ROADsoft SOLUTIONS

VTS

VTS—Vehicle Tracking System

A perennial problem for fleet management personnel has been, and often still is, immediate decision-making.

The ability to make immediate decisions is dependant in large measure on the quality, accuracy and timeliness of information available on which to base these decisions.

Vehicle Tracking System, or VTS, from ROADsoft Solutions Inc. is a graphics-based tracking and display system which permits real-time

**Accurate
information...
when and where
you need it**

monitoring of fleet activities anywhere, and at any time.

And ROADsoft Solutions' Vehicle Tracking System is not limited to the display restrictions of a CRT monitor: it can be combined with the proven M3i MOSAIC System to provide large-screen viewing and information display capabilities.

In any fleet operation, time is the one crucial element.

Whether you have to respond to life-and-death emergencies, meet customer demands or reinforce your competitive edge, ROADsoft Solutions' Vehicle Tracking System can help ensure that your people and equipment are in the right place at the right time, every time.

VTS—the technology advantage

Data is acquired by a ROADsoft Vehicle Tracking System using proven, leading-edge technology and equipment.

Global Positioning System (GPS) satellite signals, generated by United States Department of Defense satellites, are integrated with the M3i MOSAIC large-area screen display system and a digital radio communications network to create a vehicle location and monitoring system of superior value to fleet managers.

While the typical 25-80 metre accuracy provided by navigation receivers is adequate for most users' requirements, ROADsoft Solutions can supply Differential GPS (DGPS) and Dead Reckoning options to provide vehicle tracking precision of five metres or less.

GPS receivers are typically installed onboard each vehicle in a fleet. Once installed, the receivers calculate the vehicle's longitudinal and latitudinal coordinates once every second. This data is filtered by the mobile radio communication terminal, and sent to the fleet base station or control centre on either a timed or distance-covered basis.

The entire fleet, or a group of vehicles, can be displayed at the discretion of the operator. And, using a mouse, the Vehicle Tracking System may be interrogated for detailed information about any one vehicle. Data such as speed, direction or operational status may be obtained instantly—

and appropriate, informed decisions can be made.

VTS—the applications

The ROADsoft Vehicle Tracking System, in addition to providing enhanced personnel and customer security and contributing to reduced fleet operation costs, also permits decreased response times, thereby improving service quality.

The records-keeping potential of ROADsoft VTS is invaluable as a fleet management tool. Statistical analysis and vehicle information such as utilization and maintenance records can all be incorporated into a Vehicle Tracking System.

ROADsoft Vehicle Tracking Systems feature open architecture to interface with existing Computer Assisted Dispatch (CAD) systems or they may be integrated with a number of other ROADsoft Solutions modules. VTS operates with any digital radio communications sub-system, including private voice systems, cellular networks, RF public networks or satellite networks.

Communication server software runs under Windows 3.1, Windows NT, UNIX or AIX. The GPS receiver interface uses Windows DLL techniques. Maintenance of peripheral interfaces is greatly simplified by the inherent flexibility of the software employed by ROADsoft VTS.

The inherent flexibility and accuracy of ROADsoft Solutions' Vehicle Tracking System, coupled with its ability to supply real-time data, makes VTS an invaluable tool for a variety of cus-

tomers and their particular operational requirements. Some of these applications include:

- Over-the-road TL and LTL highway and city carriers
- Courier and package-delivery operations
- Emergency and first-response vehicle fleets
- Law enforcement and regulatory vehicles
- Mass transit systems
- Service and delivery vehicle fleets
- Ferry and inland waterways fleets

The Company

Vehicle Tracking System is a concept and a product developed by ROADsoft Solutions Inc., a wholly-owned subsidiary of M3i Systems Inc.

ROADsoft Solutions Inc. produces a complete range of software and computer-based systems to help corporate, government, law enforcement and emergency response organizations in North America and Europe manage their resources more efficiently and cost-effectively.

M3i Systems Inc. develops, implements and supports Command and Control systems, along with Dispatch Management systems for a variety of electric, water and gas utilities as well as first-response management organizations around the world.

To explore how a ROADsoft Vehicle Tracking System can best be utilized to help make your organization's fleet management operations more efficient and more profitable, please contact:

ROADSOFT
SOLUTIONS

ROADsoft Solutions Inc.
1111 St-Charles West
Suite 135
Longueuil, Québec
Canada J4K 5G4
Tel: (514) 928-3332
Fax: (514) 442-5076



Avcan Technologies, Inc.

Pitt Meadows, B.C.

- **GPS productivity tools**
 - **Product family for GIS, vehicle tracking, and surveillance**
- 

AVCAN TECHNOLOGIES, INC. (formerly AC Avionics)

**11465 Baynee Road South, Unit 1
Pitt Meadows, BC
V3Y 2B4**

Telephone: 604 465-5854

Facsimile: 604 465-8894

Contacts: Bob McLennan, CEO

Business Description:

AVCAN is a systems integrator using GPS technologies to create GPS Productivity Tools (tm). Over the past six years, AVCAN has identified eight areas of interest, broken them into two tiers, and initiated development of GPS-based navigation and positioning solutions using its own proprietary software and hardware. The first tier of products are oriented around natural resources: GPS Productivity Tools (tm) for Forestry, Mining, Ground-based Agriculture, and Aviation-based Agriculture. The second tier of products are oriented around Geographical Information Systems, Vehicle Tracking and Security Systems, Surveillance and Monitoring Systems, and Wide-Area Differential GPS Correction.

Major Clients:

- Transport Canada
- Weldwood of Canada
- ALC Airlift Corp.
- Valley Helicopters
- B.C. Ministry of Forests
- Fletcher Challenge
- Fisheries & Oceans Canada
- Conair Aviation
- Canadian Helicopters

Number of Employees: 10 (8 full-time, 2 part-time)

Quality Standards: TQM

Total Sales: \$700,000 (1993)

Plant Size: 2,800 square feet

OBS Subscriber: No

Security Clearance: Secret (Canadian DND)

March 28, 1994

AvCan Vehicle Tracking Systems

We now have a satellite based Global Positioning System (GPS) available around the world on a full-time basis. Combining the GPS position and time stamp with low-cost digital communications networks, AvCan Technologies, Inc. can now provide the ability to accurately track, on a real-time live basis any vehicle (cars, trucks, aircraft, boats, trains, etc.). The GPS signal is available night or day to provide an accurate, practical, and low-cost method of determining a vehicle's position, one that is essentially immune to interference from terrain, buildings, or other obstacles.

Combining the modern digital radio network with the GPS signal, the AvCan Vehicle Computer can report vehicle position to one or more tracking facilities. Each tracking facility has the ability to display the position of every vehicle in the fleet on a map generated by the Tracking Computer. The Tracking Computer also has the ability to link the reporting vehicle to other digital information stored in a database. When we combine the database and the real-time GPS position, we have a GPS Productivity Tool™ that can be used in a wide range of tracking applications.

The AvCan Technologies Vehicle Tracking System (VTS) can be easily installed and used with any mode of transportation; air, marine, or land; or all at the same time. The AvCan VTS is fully automatic, no driver/operator interface is needed. The AvCan system doesn't require a special control channel, the fleet can use the reporting channel without waiting for special radio time or control time. The AvCan VTS can also be configured to provide automatic vehicle dispatch and messaging capability, eliminating the need for radio chatter. The AvCan VTS is digital and can be interfaced with practically any computer based automatic dispatch or electronic system which supplies computer or database information to the vehicle driver/operator.

The Global Positioning System

GPS, the Global Positioning System, was developed by the American Department of Defense for implementation in the late 1980s for military position-fixing and navigation. By the end of 1993, all satellites will have been deployed and the system will be fully operational.

The GPS positioning system is based on 24 satellites which are in an elliptical orbit some 20000 km. above the earth. The system is designed to ensure that at least 4 satellites can be tracked from any position on earth.

Like Loran, VLF-Omega, and Tacan, GPS is the latest military technology adopted for world-wide civil use in air and maritime navigation, in surveying and mapping, in law enforcement, in vehicle tracking and fleet management, and in many natural resource applications such as agriculture, mining, and forestry.

Since the GPS satellites are constantly transmitting digital data, rather than relaying data, they are user passive and cannot be saturated. They are available to anyone with suitable receiving equipment. The standard, or design accuracy, of the GPS system with a receiver that is tracking 4 satellites is plus or minus 15 metres. Since it is a military system, the American Department of Defence has introduced Selective Availability, an encryption system, which degrades accuracy to plus or minus 100 metres.

Differential Global Positioning Systems

With the AvCan Technologies high accuracy GPS Receiver installed in a vehicle, and the AvCan Technologies GroundLock™ Differential Transmitter on the ground, we can increase the military degraded signal from plus minus 100 metres to sub-metre accuracy. We do this with a ground-based transmitter situated at a known location. Inside the GroundLock™ Differential Transmitter, we have a GPS Receiver, a computer, and a transmitter (we vary the power levels to vary range).

The AvCan GroundLock™ Differential Transmitter compares a known location (its location) with the location determined by the GPS Receiver and transmits a correction signal to all nearby AvCan GPS receivers in the area, these receivers use the information to improve their position solutions. The closer the receiving GPS receiver is to the AvCan GroundLock™ station, the more accurate the correction signal; conversely as the distance between the two increases, the corrected accuracy decreases (but the corrected accuracy is still substantially better than the original 100 metres).

Since corrected accuracy degrades as distance between the GroundLock™ Station and the mobile GPS receiver increases, we normally transmit the correction signal through a VHF or UHF transmitter. The range then is determined by transmitted power, antenna type, and antenna height. Under most circumstances, a 25 mile radius is considered optimum and 200 miles is about as far as can be used without degrading accuracy below 15 metres.

AvCan Vehicle Tracking System

The AvCan Technologies Vehicle Tracking System is made up of a core hardware module called the AvCan Tracking Sensor (ACTS). The ACTS allows the fleet operator the ability to choose from three different levels of GPS accuracy; the AC 400 - non-corrected general receiver (+/- 100m. accuracy), the AC 402 - non-corrected high-level receiver (+/- 15m. accuracy), and the AC 404 - differentially corrected high-level receiver (+/- 1m. accuracy). Each receiver is manufactured to the same level of quality, but each uses a different technological solution to achieve its accuracy and navigation objectives.

With the AvCan 400 Series Tracking Sensor we package our DataLink™ Converter which converts the format of the GPS data to link the AvCan Vehicle Tracking System with the fleet operator's dispatch system. The whole purpose of the Tracking Sensor is to provide a method of interfacing the GPS signal with the fleet dispatch and messaging system.

As an option, AvCan Technologies is able to supply our AC 500 Series Moving Map Display System. The AC 500 System has been designed around two separate stand-alone modules. The AC 500V module, designed for the tracked vehicle, may be installed to provide the ultimate in vehicle based navigation capabilities as well as providing a wide range of navigation and messaging functions. The AC 500B module, designed for base use, provides a moving map display which may be scrolled over a wide-area.

The underlying assumption in the AvCan Technologies Vehicle Tracking System is that the fleet is using some form of radio communications for dispatch and messaging, that each vehicle is so equipped, and that the AvCan equipment will be installed to interface with that system. If these assumptions are not met, the Vehicle Tracking System will have to be designed specifically for that fleet.

AvCan VTS Base Station

The AvCan Vehicle Tracking System uses a Base Station designed around the IBM-PC system. The system requires a 386 or higher processor with SVGA capabilities, at least 4mb of memory, a minimum of 40mb hard-drive space, and a 3.5" disk drive and an unencumbered RS232 Comm Port.

The AvCan VTS Software runs under the MS-DOS operating system designed for the IBM-PC platform. It provides the fleet operator the capability to track and position display of up to 200 AvCan VTS equipped vehicles on a real-time basis. The method of interrogating and receiving position and identification data from each tracked vehicle can be established to coincide with current fleet management methods.



The moving map display provided under the AvCan VTS Software can be customized for each fleet operator using custom symbols, locally created waypoints and road grid, and specific use areas and partitions. Waypoints and partitions can be identified with alphanumeric data established by the fleet operator.

As noted earlier, the AvCan Vehicle Tracking System is designed around the use of a digitally capable radio communications network appropriate to the operating area of the fleet operator. AvCan Technologies can supply a wide range of digitally based radio communications systems, systems which would be licenceable in the operators area.



Digital Dispatch Systems Inc.

Richmond, B.C.

- **Provides total turn-key solutions for the taxi, courier and paratransit markets.**
 - **Sold systems to Boeing (Seattle) and Yellow Cab (Houston)**
 - **Head office in B.C. with a U.S. operation in Lenexa, Kansas.**
- 
- 

DIGITAL DISPATCH SYSTEMS INC.

**7100 River Road
Richmond, BC
V6X 1X5**

Telephone: (604) 270-1171

Facsimile: (604) 270-9160

**Contacts: Vari Ghai, President
Jonas Lindgren, Sales Manager, Western Region**

Business Description:

Manufacturer of turnkey dispatch systems including proprietary mobile data terminals and in-house UNIX-based dispatch software.

Major Clients:

- Yellow Transportation, Baltimore
- Yellow Cab of San Diego
- GHTC, Houston

Number of Employees: 26

Quality Standards:

Total Sales: \$3 million

Plant Size: 5,600 sq. ft.

OBS Subscriber:

Security Clearance:

March 26, 1994

DDS CORPORATE OVERVIEW

Digital Dispatch Systems Inc. (DDS), develops application software, manufactures hardware and provides system integration services. We ensure our customers receive the leading edge in technology and problem solving.

DDS is in the business of providing total turn-key solutions in the mobile data industry to the taxi, courier and paratransit markets. DDS provides the application software, host computers, mobile data hardware for the vehicles and the radio backbone infrastructure, project management, training, documentation and on-going support for these systems. DDS's proprietary technology provides the ability to transmit data over conventional voice radio channels in a mobile environment.

Employees of DDS pioneered the Taxi Dispatch System concept in the early 1980's and DDS has continued the tradition by providing break-through technology and features to the industry. At least 50% of the Taxi Dispatch Systems in the world have some involvement from DDS employees, which means that DDS has extensive experience, know-how and an in-depth understanding of the needs of the taxi industry. DDS has successfully completed several installations worldwide, including the largest Taxi Dispatch System in North America for Yellow Cab of Houston, Texas, with a fleet of 1300 vehicles operating 24 hours per day.

The corporate office is located in Richmond, British Columbia, Canada and the US operation is based in Lenexa, Kansas, USA. DDS possesses over 100 years of combined experience in software and hardware system development and implementation and has become a key developer of innovative and advanced technology in the automated mobile data industry. This is evidenced by Boeing Corporation's selection of DDS to provide a totally automated dispatch system to service over 100,000 employees in Seattle, Washington.

DDS has captured an honorable place in the market due to a professional and comprehensive approach in satisfying clients' needs and requirements. A large number of taxi companies worldwide enjoy the unique features and the advantages of our Taxi Dispatch System.



Epic Data International Inc.

Richmond, B.C.

- **Manufacture of integrated data collection systems**
 - **Applications to trucking, airlines and postal services**
- 
- 

EPIC DATA INTERNATIONAL INC.

**7280 River Road
Richmond, B.C.
V6X 1X5**

**Telephone: (604) 273-9146
Facsimile: (604) 273-1830**

**Contacts: Helmut Eppich, President
Duncan Smith, Vice-President, Engineering**

Business Description:

Founded in 1975, Epic Data International (Epic), manufactures and markets integrated data collection systems used to gather and manipulate real-time data for operational control and planning. Working in partnership with over 850 customers worldwide, Epic develops comprehensive business solutions through the application of data collection technology. Using an industry standard open systems architecture, information captured by Epic's data collection systems feed critical applications such as time and attendance, labour reporting, job costing, security, maintenance and inventory control. Epic provides its customers with the technology to reduce operating costs, lower inventories, improve quality, and increase productivity.

Major Clients:

- | | |
|--------------------------|--|
| • General Electric | • Hughes Aircraft |
| • LV Aerospace | • DEC |
| • General Dynamics | • Rolls Royce (UK) |
| • British Post Office | • Dowty Landing Gear |
| • Rosyth Royal Dockyards | • Lockheed |
| • Martin Marietta | • Northrop |
| • Canadian Government | • Rockwell International (Fletcher, NC) |

Number of Employees: 175

Quality Standards: Recently adopted ISO 9000 program

**Total Sales: 1991 - \$26M
1992 - \$25M
1993 - \$25M**

Plant Size: 14,500 square feet

OBS Subscriber: No

Security Clearance: Secret

March 28, 1994

British PO Stamps Out Problems

This express mail tracking system has won international acclaim.

by Sandra Liquorish

Tracking and tracing items is critical to the reliability of an express mail service. The British Post Office recently developed a system that is winning admiration worldwide.

Developing an extensive data collection system for Datapost—the express mail system as it is known in the United Kingdom—was not simple: the system needed to encompass 300 sites with 3000 staff.

We wanted a system that would demonstrate to customers our ability to track, trace, and provide delivery details on specific items. We also wanted to provide management information to the operations department, planning group, finance, and sales and marketing. Finally, we wanted to improve the efficiency of the operation and enhance budgetary control.

This is already taking place with the development of an interface between the tracking and tracing system and financial computer system. The system, called DITAT for Datapost Inland Tracking and Tracing, also handles incoming and outgoing international express mail items.

The first design problem faced was the fact that the service has 300 remote sites. We wanted to be able to access the information across sites, not just locally at the individual sites. Further-



more, different sites presented different traffic variations.

The system needed to be flexible enough to grow as business increased. Plus the system needed to be friendly enough to accommodate staff rotation, where some employees rotate jobs every six weeks.

The hardware needed to be durable enough to withstand a warehouse/factory environment. Also, some functions needed to occur in real time. A further consideration was that most of the staff who were going to use the system had had no previous computer experience.

The overall hardware design needed to be compatible with our IBM corporate mainframe computer. All local data is collected centrally in the mainframe, which is then interrogated for

customer inquiries and management reports. UNIX processors are used at the local sites. These processors can be bought with different sizes of memory; different numbers of ports; and the ability to handle two types of communications, both dial-up and SNA protocol.

In addressing the problem of staff rotation and the need for robust equipment, we chose to use Epic Data workstations. At local sites, a UNIX processor is connected to one or more CRTs with one or more printers and one or more Epic Data workstations. In choosing a workstation, the technical division reviewed a number of products and selected the ones most suitable. These were then installed in the field with the eventual end users, who tried different terminals and documented their thoughts on survey forms. Epic Data workstations were chosen because the end users favored them.

The workstations were also durable enough for the environment. Moreover, we liked the flexibility of designing the keyboard and the capability of mounting the terminals in various ways. We could actually customize the unit and design our own keyboard. We added a volume control knob since some work areas are fairly noisy. Also, we had flexibility in contingency—we could use the workstation with a bar



Photo 1: Datapost labels conform to international postal administration standard, Code 39.

code wand or laser gun, or as a bar code slot reader.

Efficient Data Capture

We had to find a simple and efficient data capture method in order to be able to operate the system in real time. We chose bar codes. This also fit in with the international postal administration standard of using Code 39 bar codes for labeling items and parcels. At Datapost, our bar code label conforms to that standard. In addition to an item label, we also needed a bag label, since items go into bags. For reading labels, we chose Epic Data bar code wands for low-volume sites and Epic Data laser guns for high-volume sites. With bar code, the user is no longer required to write out dispatch notes.

A final consideration in system design involved transactions. We decided to limit the functionality of the workstation to reduce the level of choice and indecision that the user might experience. Second, we computer-generate the transfer dockets to reduce the time needed to collect information on bag labels. Third, to assist with the problem of not having locally designated computer operators, we automatically send the data from the local site to the mainframe every time the local operators call for a dispatch note. Transactions not triggered by a dispatch note

are collected locally every two hours by the system and sent to the mainframe.

We also automatically send information from the mainframe to the local sites early every morning on what items will be received.

Another problem we were handed in implementation was a short time scale. Business wanted it installed yesterday. We compromised to 15 months. We faced a large geographic distribution with 300 sites from the tip of the Scottish Isles to Cornwall and Kent.

We also knew we didn't have the right manpower skills for implementation. Some work areas were substandard for computers or limited in space. We had to produce 100 percent equipment reliability upon installation to gain confidence of users and ensure schedule implementation without interruption. Thus, we would need union coordination and a solid training program to ensure everything arrived on time and on schedule.

Local Management

We solved these problems by appointing an implementation manager early in the cycle of development. Then we appointed Datapost district representatives to cover each large geographic distribution area. Familiar with local problems, these people were responsible for all site activities except

actual equipment installation and acceptance. We also developed a full training program.

To keep everyone posted, we published schedules—in advance—for installation, targeted training, and "go live" dates. We coordinated installations going to the larger sites first. We started off by doing four sites per week, and we have now increased that to six sites per week. We will have all sites on board by the end of 1989.

Another key to successful planning is to avoid building or facility problems. They seem to be the biggest hurdle. When you hear, "We started the building work—it was on target—but when we took the roof down, there were wood worms and I'm afraid we've got to do the roof rafters," there is little you can do. Thus, we learned to build flexibility into our scheduling.

The next step was to carry out site surveys. Rather than just send out the equipment and tell local personnel to hook it up, we determined how many terminals each site needed. We also used an ergonomics package that analyzed what would be the best place for workstations. These surveys also provided a detailed equipment plan so that the local electricians would know where to do their work, and British Telecom would know where to install the telephones that would be attached to the modems (used to communicate back to the corporate mainframe).

The site surveys gave us an opportunity to rectify shortcomings in the work place environment. Plus, we began to get local agreement from management and the unions for the proposed plans.

Then we tested the equipment in the field, involving the local union people from the start in selecting the equipment. Thus the equipment that went into the sites was partially chosen by the local end users, and they felt, rightfully so, that they had had a hand in the selection.

After the equipment trials we developed the full system, initially testing it at three pilot sites. Before installing equipment at the local level, we commissioned it centrally to ensure reliability at installation. This has worked

LOCAL HARDWARE DESIGN

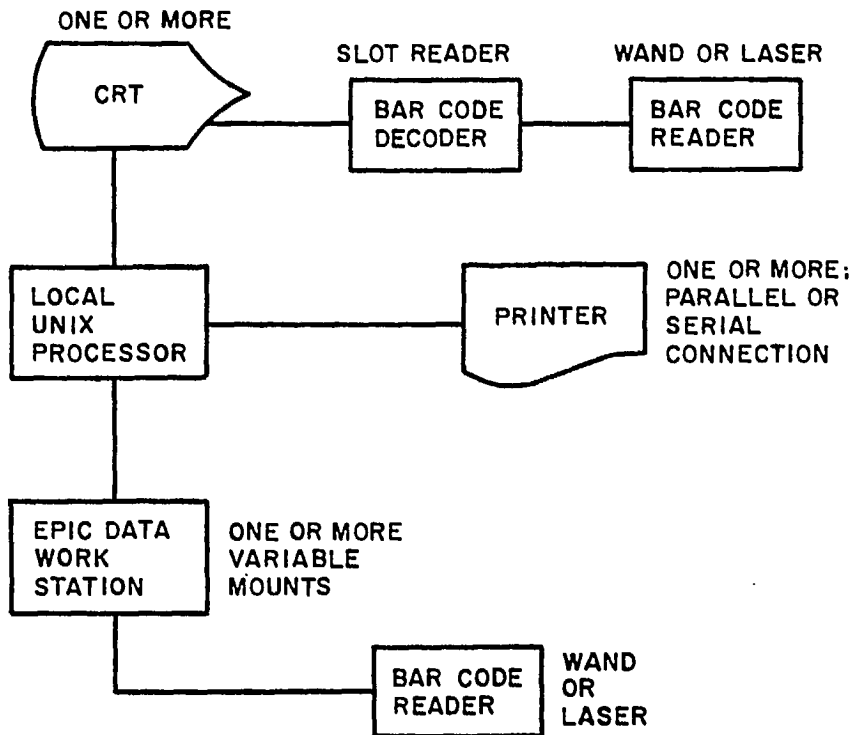


Figure 1. The British Post Office designed a data collection system that spans 300 sites and involves 3000 personnel.

very well. We've had minimal problems with the equipment not working on site. Built-up confidence in the equipment installed also requires fewer spares to be carried on the van going out to the installation. As a result, we are now able to get three systems into one car. This allows us two teams of two going around the countryside installing three sites each, six sites a week total.

Working with the Union

Working with the union did not prove to be a major problem. We started talking to them early and constantly updated them. For instance, in the early stages we got a package agreement from them on using laser guns. They were concerned about the laser gun and its host of warnings. But they gave an early agreement on their use. When we got close to establishing a pilot system, we published items about the system in the union journal. And, finally, about a month before the pilot site went in, we exhibited at the union's annual conference.

At our exhibit, union personnel had

a chance to get acquainted with the equipment. They could see the results of their work on screen or on print outs. Most of the people simply wanted to discuss the project with us and try the laser scanners.

We also took along ballpoint pens with our logo on them and hard rock candy with our project name in them so union members would get some goodies to take home. Eighty percent of the attendees looked at the system. This turned out to be advantageous when we went to their sites. When management mentioned DITAT to the local union person, the response was, "Yes, I know that!"

Given the number of local sites, we had a lot of people to train. For each local letter district we trained one district tutor, 50 to 60 people in all. These tutors in turn trained the local people.

We also developed a workstation that could concurrently handle operators using it in both training and production modes. Thus, we have a mixture of users on the system, some using it for training and some using it for

production work. Also, the training material we provided was simple and didn't require any additional aids, such as video. Lastly, we divided the training into two parts: theoretical and hands-on.

Support Problems/Solutions

Try to deal with 24-hour support! The Post Office wants the system to be capable of running 24 hours a day, five and a half days a week. With the large geographic coverage and having different equipment from different vendors, how do you update software at the local site? Our solution appears easy to the user.

We have a central help desk—one number to ring—no matter what the problem. Each office has a highly visible poster saying, "No matter what your problem, call the help desk." That help desk provides front-line, first-line support.

The help desk is unable to solve all the problems so we have a backup team of support staff who are accessible by beeper overnight. All staff members are trained in DITAT and have been to a DITAT site to see the system in operation.

To assist the help desk, we have one central fault recording system. We use a software package called Informat that runs on our IBM mainframe. This uses a unique number for every problem, allows us to update the problem as it progresses, and is available 24 hours a day so we are always able to tell people of our progress. Furthermore, support staff can access the data with an informer terminal that simply plugs into a telephone socket at home. This allows them to lock onto the mainframe in Chesterfield and to dial into individual UNIX sites. Thus, they need not be at the office to solve problems.

Every Datapost installation has its own dedicated phone on the desk. When the person on the help desk asks the user, "Is the green light on?" the user can verify that immediately. We also produced a user's manual, which turned out to be too thick and too daunting for everyday use. So we provided a quick reference guide—10 pages—that describes basic functions

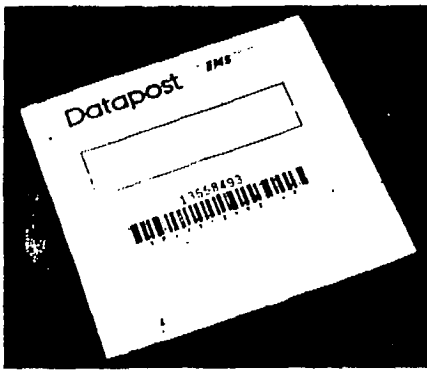


Photo 2: Rapidfile forms help pinpoint receipts.

and ignores the quirky erroneous conditions that rarely occur. We also incorporated help screens on the local UNIX processor.

To distribute the documentation we've developed a personal computer system using a basic package called Rapidfile. We personalize each letter that goes out explaining a release or documentation. We include a reply slip for users to return, indicating receipt. Using these slips allows us to pinpoint places where people aren't receiving information.

Finally, we developed a piece of software that allows any system errors generated locally to be brought up once a day onto the central front-end so we can interrogate and see what problems are developing at the sites. Sometimes developing problems aren't obvious to end-users until the problem is fatal. This monitoring helps eliminate such disruptions.

We also centrally download software and data from the six front-end UNIX processors to each of the 300 sites where it is tagged with the date and time it is going to be released.

We have developed a piece of software that updates all the data and all the systems software on the other front end processors once the front end is updated.

It Works!

By analyzing our needs, checking for potential problems, including personnel in the planning from the very beginning, and creating programs and tools that provide our users with con-

fidence in working with the system, we have created a system now being studied by other post offices throughout the world. □

Sandra Liquorish is manager for the British Post Office's DITAT (tracking and tracing) project.

APPLICATION PROFILE

Company Name:

World Mail Parcels Group
British Post Office
United Kingdom

Business: Express mail service

Hardware/Software: UNIX processors;
Epic Data workstations, Epic Data bar code wands and laser guns; Informat software; IBM mainframe; Rapidfile

Primary Application: Tracking and tracing express mail items

Primary Benefit: Enhanced service and mail system reliability for customers; useful data for management

Resource:

Epic Data Corp.
7280 River Rd.
Richmond, BC V6X 1X5 Canada
(604) 273-9146

epic data

Reprinted from ID Systems, November 1989
Copyright © 1989 by Helmers Publishing, Inc.
174 Concord St., Peterborough NH 03458
All Rights Reserved



Pacific Avionics & Instruments Ltd.

Richmond, B.C.

- **Custom communication equipment including GPS vehicle tracking systems**
- 
- 

PACIFIC AVIONICS & INSTRUMENTS LTD.
4200 Cowley Crescent
Richmond, BC
V7B 1B8

Telephone: (604) 278-2105
Facsimile: (604) 278-9729

Contacts: Mr. Gordon Bott, Director of Maintenance
Mr. Robert Heap, Quality Control

Business Description:

PAI has 25 years of sales/service and installation of avionics and instruments. Overhaul capability for all major instrument and gyro manufacturers. Complete engineering capability and design of new installations and retrofit.

Capability/Products:

- Fully equipped Instrument Shop for complete overhaul and servicing of flight instruments, engine instruments and panel or remote mounted gyros.
- Avionics repair and overhaul capabilities for all products including Weather Radar and Autopilots.
- Manufacturing of pre-fabricated wiring harnesses for both fixed wing and rotary wing aircraft.
- Custom communication equipment including:
 - Voice-activated intercommunication equipment
 - RF signal encryption
 - Data telemetry
 - Radio telephone interlink systems
 - G.P.S. vehicle tracking systems

Major Clients:

Aero Mechanism (Fliteline), B.F. Goodrich, Bendix/King, Garmin, Global Wulfsberg, Gull, Howell, Honeywell/Spex-Exchange, Rockwell Collins, Sigmatek, Morrow, Jet, N.A.T., Narco, Sigmatek, Transport Canada, Royal Cdn. Mounted Police, Canadian Coast Guard

Number of Employees: 24 (6 tech., 4 sales, 4 admin.)

Quality Standards: • ISO 9000 (in process)
• J.A.L. Standard (in process)

Total Sales: \$3 Million

Plant Size: 7,200 sq.ft.

OBS Subscriber: Yes

Security Clearance:
March 29, 1994



pacific avionics & instruments ltd.

4200 COWLEY CRESCENT, RICHMOND, B.C., CANADA V7B 1B8
TELEPHONE (604) 278-2105 FAX (604) 278-9729



COMPANY PROFILE

Keywords: 25 years of sales/service and installation of avionics and instruments. Overhaul capability for all major instrument and gyro manufacturers. Complete engineering capability and design of new installations and retrofit.

History: Founded in 1967 as a one-person/one room shop, expanding to our present organization. Still under original ownership.

Capability/Products:

- Fully equipped Instrument Shop to carry out complete overhaul and servicing of flight instruments, engine instruments and panel or remote mounted gyros.
- Avionics repair and overhaul capabilities for all products including Weather Radar and Autopilots.
- Sales and Service Centre for all major aviation manufacturers.
- Manufacturing of pre-fabricated wiring harnesses for both fixed wing and rotary wing aircraft.
- Our Commercial Division, located in the same facility, specializes in custom communication equipment including -
 - ◊ Voice activated intercommunication equipment
 - ◊ RF signal encryption
 - ◊ Data telemetry
 - ◊ Radio telephone interlink systems
 - ◊ G.P.S. vehicle tracking systems

These systems are primarily used by Fire Departments, Search & Rescue and Security Transfer Agencies, and Agriculture management.

Pacific Avionics & Instruments Ltd. is a Dealer and/or Representative for many of the major manufacturers of the aircraft industry. We have Warranty Service Agreements with:

Aero Mechanism (Fliteline), B.F. Goodrich, Bendix/King, Garmin, Global Wulfsberg, Gull, Howell, Honeywell/Spex-Exchange), Il Morrow, Jet, N.A.T., Narco, Rockwell Collins, Sigmatek, Smiths, Trimble.

Current Market Activity:

- Our present marketing efforts are concentrated on a Canada-wide market for charter and commuter aircraft operators. Efforts are underway to include the I.S.O Quality System, as well as to secure company approval to J.A.L. standards.
- We have standing offers with Transport Canada, R.C.M.P. and Coast Guard for aircraft equipment sales, service and installations.
- Our location on the west coast, favourable exchange rates, high quality workmanship and excellent service will provide even wider markets from the Pacific Rim countries.

Export Countries: U.S.A.

Plant Size: 7,200 square feet, hangar space available, large aircraft parking area.
Average Work Force: Currently 24, consisting of 16 technical, 4 sales and 4 administrative personnel.
Gross Sales: 3 Million
Export Sales: \$500,000
Qualification: Transport Canada AMO 1-74

Contact: Gordon Bott, Director of Maintenance

February 1994

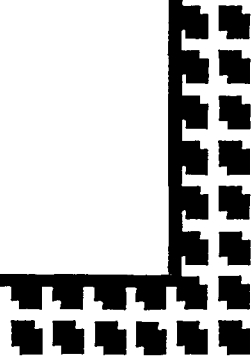

AVIONICS • INSTRUMENTS

SALES • SERVICE • INSTALLATIONS



Pacific Insight Electronics Inc.

Nelson, B.C.

- **Automatic headlight control systems**
 - **Vehicle security systems including voice recognition**
 - **Transmission warning devices**
 - **Both an OEM an aftermarket supplier**
- 
- 

PACIFIC INSIGHT ELECTRONICS INC.

**624 Lakeside Drive
Nelson, B.C.
V1L 5S7**

Telephone: (604) 354-1155
Facsimile: (604) 354-1166

Contacts: Mr. Bradley D. Smithson, President
Mr. Daniel Cooke, Sales and Marketing

Business Description:

Electronic components design and system configuration. Manufacture Automatic Headlight Control systems, Daytime Running Lights, Industrial Strobe Lights, Vehicle Security Systems (incl. voice recognition technology), Vehicle Security Accessories, Electronic Control Management units, Fan Control modules, Transmission Warning devices, High Voltage Lighting, Emergency Vehicle Equipment and Military Vehicle Components.

Major Clients:

OEM --

- Western Star (for LSVW)
- General Motors Canada
- Daewoo Motors of Korea
- Eaton Corporation
- Allison Transmission
- Navistar Int. Transp.
- Canadian DND

Aftermarket --

- General Motors Canada
- GM Goodwrench
- Peterson Manuf. Co.
- K.D. Lamp Co.
- Accele Electronics
- Avis Rent-a-Car, Inc.
- Insight Group USA

Number of Employees: 29

Quality Standards: ISO 9001 (in process)

Total Sales:

Plant Size: 8,000 sq.ft.

OBS subscriber: No

Security Clearance:

March 26, 1994

Pacific Insight Electronics Corp.

Company Facts

Company was founded in 1983. Publicly owned and listed on the Vancouver Stock Exchange (symbol PIH-V).

Research & Design, Engineering, Production, Sales & Marketing and Administration operations are housed in an 8,000 sq. ft. facility in Nelson, B.C. Insight employs 29 people in Production, Administration and Engineering.

Manufacturing in Nelson offers the advantages of low overhead costs and access to a non-unionized, young labour force. In addition, your customers will benefit from Exporting to the U.S. from Canada. The weaker Canadian dollar allows us to pass along additional value in our products through favourable exchange rates. Transportation access to the U.S. is facilitated by an airport, daily courier service and two major truck carriers that service Nelson.

The Company has in-house CAD drafting & design capability as well as testing and lab facilities. We design and manufacture all of our products employing Design Engineers to oversee circuit and software development and Technologists to supervise process and quality control.

Critical areas of production, with respect to quality and efficiency, are automated. Automated equipment is currently employed in component processing, cutting, wire preparation, soldering and full-function product testing processes.

Quality systems strictly follow ISO 9001, an Internationally recognized standard. Insight will be seeking ISO Certification by the end of 1994.

Products Manufactured

Daytime Running Lights, Automatic Headlight Control modules, Industrial Strobe Lights, Vehicle Security Systems, Vehicle Security Accessories, Electronic Control Management units, Fan Control modules, Transmission Warning devices, High Voltage Lighting, Emergency Vehicle Equipment and Military Vehicle Components.

Key Customers

The following list represent what Insight considers key customers. As well as contributing significantly to sales revenues, these companies offer our Company access to markets for Insight's new technology as well as existing products.

Original Equipment

General Motors Canada- Daytime Running Lights

GM Volvo Heavy Truck Corp.- Daytime Running Lights, Temp. control modules.

Western Star Trucks- Daytime Running Lights, Temp. Control modules, Driver Information systems, dash design for class 8 heavy duty truck project

Daewoo Motors of Korea- Daytime Running Lights

Eaton Corporation.,- Voltage Converters, Transmission ECU, Temp control modules

Allison Transmission- Temp Control modules

Navistar International Transportation- Temp Control modules, headlight controls

Department of National Defense.- Cold Start Modules, Lighting Control module

Aftermarket Components

General Motors Canada- Daytime Running Lights, Twilight Sentinel, Vehicle Security

GM Goodwrench- GM Goodwrench Twilight Sentinel

Dominion Automotive Industries Ltd.- Daytime Running Lights,

Peterson Manufacturing Co.- LED Marker-lamps, Headlight Control

K.D. Lamp Co.-Headlight Control

Acele Electronics- Vehicle Security Accessories

Avis Rent-a-Car, Inc.- Automatic Headlight Control

AVVA Light Corp.- High Voltage Lighting Circuitry

Insight Group USA.- Micro-Lock & Millenium Vehicle Security



Silent Witness Enterprises Ltd.

Surrey, B.C.

- **Onboard “black box” reporting on stops, idle time, speed table analysis, acceleration analysis, and RPMs.**
- 
- 

SILENT WITNESS ENTERPRISES LTD.

**17761 Unit B - 66th Avenue
Surrey, BC
V3S 7X1**

Telephone: (604) 574-1526

Facsimile: (604) 574-1527

**Contacts: Mr. J.M. (Jack) Gin, P.Eng.
Mr. Rob Bakshi, VP, Engineering**

Business Description:

Silent Witness' primary products include the Black Box™, an electronic vehicle monitoring system. The SW-100 Black Box™ is an on-board computer that can provide various reports including Stop Reports, Idle Time Reports, Speed Table Analysis, RPM Table Analysis, Acceleration Analysis, Minute-by-Minute Reports, and even Second-by-Second Reports.

The Black Box™ is currently installed in thousands of private commercial fleet vehicles across North America. The hardware/software system of the Black Box™ can be adapted and applied for use in vehicle emissions detection and control.

Silent Witness also designs and manufactures CCTV systems and has broad market distribution throughout the USA and Canada.

Major Clients: Confidential

Number of Employees: 30

Quality Standards:

Total Sales: \$5 million (U.S.)

Plant Size: 8,000 sq.ft.

OBS Subscriber: No

Security Clearance: None

March 29, 1994

Silent Witness Enterprises Ltd.
17761 Unit B - 66th Avenue
Surrey, B.C. V3S 7X1
Tel. 604-574-1526
Fax 604-574-1527

Silent Witness Enterprises Ltd.
Proposal - Emmissions Detection & Control
1/5/94

GENERAL

Silent Witness Enterprises Ltd. is an innovator in the information technologies industry. The company has operations in both the USA and Canada; in Los Angeles for sales, distribution, service and maintenance, and in the Vancouver suburb of Surrey for engineering, product development & marketing. Primary products include the SW-100 Black Box™, a tamper-proof on-board vehicle monitoring system.

Houston Metro is currently the largest public transit system utilizing the Black Box™ for its commercial fleet management. Several other public transit companies are currently evaluating the Black Box™. The Black Box™ is currently installed to thousands of private commercial fleet vehicles across North America.

CONCEPT

The hardware/software system of the SW-100 Black Box™ can be adapted and applied for use in vehicle emmissions detection and control. Simply stated, the system works with an exhaust emission detector sending continuous signals to a tamper-proof on-board computer that alarms a beacon or emitter when excessive pollution is registered; D.O.T. or police personnel will be able to detect the violating vehicle. The on-board computer would be programmed to record the emission levels to be downloaded by regulatory officials at appropriate times.

The regulated installation of the Black Box™ as adapted with emission detectors can efficiently and effectively contribute to the IVHS program goals of increasing efficiency, enhancing mobility and reducing energy consumption.

1. CONTROLLING VEHICLE EMISSIONS:

With the simple addition of chemical/pollution detectors to exhaust systems, the Black Box™ would be able to provide pollution analysis based on a variety of parameters including speed, acceleration & time, etc.

The Black Box™ is already installed to thousands of commercial fleet vehicles in North America. It is assumed that fleet vehicles including all commercial trucks contribute to a large portion of air & noise pollution.

In addition to the benefit of pollution detection, the fleet owner and the government regulator can control over-speed, over-acceleration and excessive engine braking; these may also be pollution causing factors that are of interest to the Department of Transport.

Fast infrared downloading of Black Box™ information can be achieved at highway checkpoints.

2. SIGNALS TO AUTHORITIES FOR ENFORCEMENT:

Regulated installation of pollution detection equipment to commercial fleet vehicles are already being considered in Europe. This equipment includes a signalling beacon attached to the vehicle to alert police of excessive exhaust pollution.

CURRENT TECHNOLOGY

The SW-100 Black Box™ is an on-board computer that can provide various reports including Stop Reports, Idle Time Reports, Speed Table Analysis, RPM Table Analysis, Acceleration Analysis, Minute-by-Minute Reports, and even Second-by-Second Reports. It was originally developed by Silent Witness Enterprises in the mid-1980's and is now installed to thousands of vehicles across North America.

BENEFITS of the Black Box™ system:

- Adaption of existing technology.
- Precise, controlled and direct information to the D.O.T. that can be used in a court of law.
- Ancillary benefits to the fleet owner for fleet management.
- Low cost installation with a proven short payback period to the fleet owner.
- Inclusion of other tasks for the benefit of other IVHS goals such as fuel consumption monitoring, overspeed control, noise control, etc.
- With the integration of latest infrared technology, the SW-100 Black Box™ could also control toll metering equipment while vehicle is still in motion. ie. No need to stop at toll booths. The SW-100 Black Box™ as regulated by D.O.T. authorities could act as an on-board meter of IVHS usage in the same way a home meter records electrical consumption.

SUMMARY

The SW-100 Black Box™ solution can be an important regulatory means to simply and effectively achieve Department of Transport IVHS goals. The SW-100 Black Box™ as an on-board device can provide the complete solution to emissions control through regulated use of the Black Box™ by every vehicle. However, it is recognized that this full regulation solution may not be practical. Nevertheless, the benefits of commercial & civil service vehicle emissions control combined with all of the other benefits that can be provided by the Black Box™ for controlling speed, acceleration, excessive braking and noise, make this a system worthy of further consideration by the D.O.T.

PROJECT PLAN

1. Define emissions detection requirements.
2. Integrate emissions detection system to SW-100 (hardware + software).
3. Install systems to appropriate quantity of test vehicles. eg. Metro Houston transit buses or police vehicles.
4. Measure, analyze and report.

Silent Witness Enterprises Ltd.
17761 Unit B - 66th Avenue
Surrey, B.C. V3S 7X1
Tel. 604-574-1526
Fax 604-574-1527

Contacts: J.M.(Jack) Gin, P.Eng.
Rob Bakshi, VP Engineering.



Spectrum Signal Processing Inc.

Burnaby, B.C.

- **North America's largest producer for DSP hardware and software**
- 
- 

SPECTRUM SIGNAL PROCESSING INC.

**8525 Baxter Place
100 Production Court
Burnaby, B.C.
V5A 4V7**

**Telephone: (604) 421-5422
Facsimile: (604) 421-1764**

Contacts: Rick Doucette, Canadian Sales Manager

Business Description:

A leading company in the development of Digital Signal Processing (DSP) hardware and software. Their products are used in development and OEM systems for such applications as air traffic control, radar systems, navigation equipment, control, multimedia, and other processing intensive applications. Spectrum is the largest DSP board level supplier in North America, with the majority of their products being used by the U.S. military and its prime contractors.

Major Clients:

- Motorola
- Hewlett-Packard
- Schlumberger
- Ford Motor
- TRW
- MacDonald Dettwiler
- Allan Crawford Associates
- Hughes Aircraft
- Paramax
- MPR Teltech
- U.S. DOD

Number of Employees: 70

**Quality Standards: ISO 9002
Currently manufacture to IPC standard
610 A class 2**

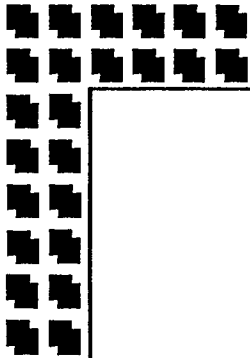

Total Sales: \$8.5M in 1992; \$13M projected for 1993

Plant Size: 15,000 sq. ft.

OBS Subscriber: No

Security Clearance:

March 29, 1994

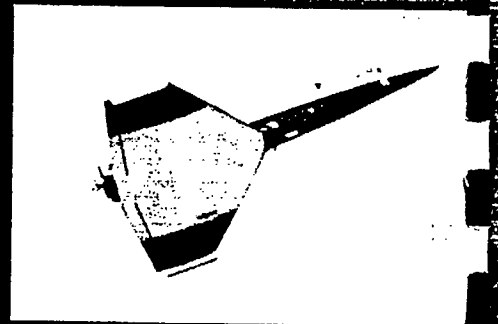
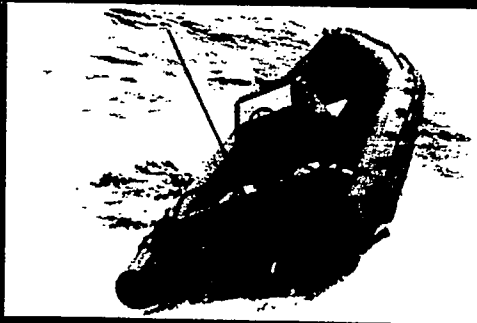
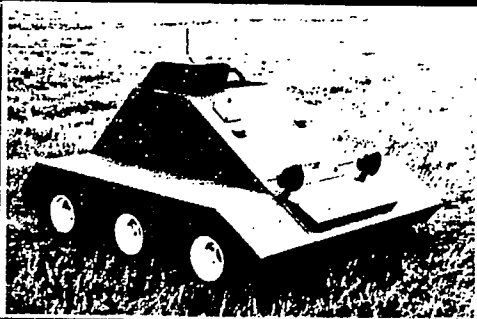
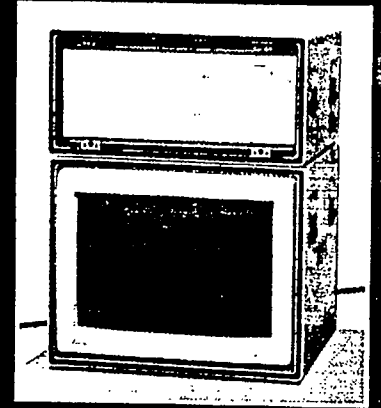
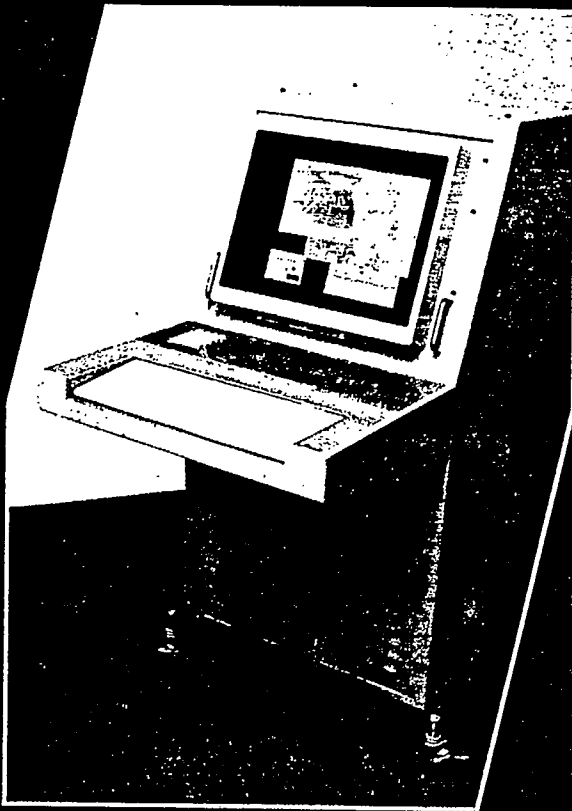
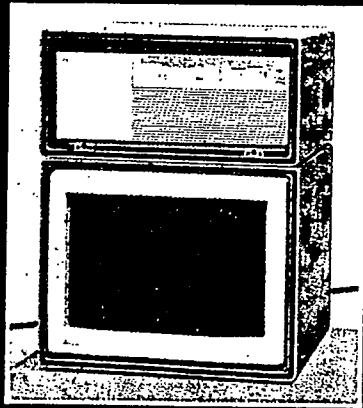


CDL Systems

Calgary, Alberta

- **Vehicle control station for real time mission control**
- 

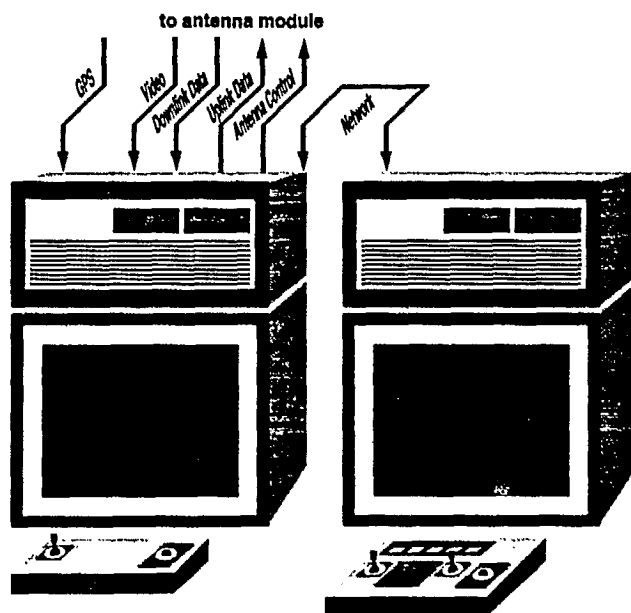
VEHICLE CONTROL STATION



VEHICLE CONTROL STATION

The Vehicle Control Station (VCS) remotely provides position and status monitoring of land, sea and air vehicles and allows real-time control of the vehicles and their payloads in response to changing mission conditions. The VCS is designed for a wide variety of surveillance drones and military training target vehicles. Each control station provides "on-screen" controls, and can interface with selected hardware controls, such as joysticks and trackballs, or with existing hardware control panels. The VCS connects to existing radio-telemetry equipment for the vehicle communications link. Several stations can be networked to share vehicle and payload information.

Central to the VCS is a scrolling map, providing instant recognition of vehicle position, direction and sensor orientation. All operational vehicles are visible at one time. The mission path, actual path and selected overlays can be superimposed on the map background. The map can be derived from scanned maps, digital data or satellite imagery.



Vehicle Control Station Schematic shown with optional second workstation

A mission planner module allows total pre-mission and during-mission planning within time and fuel constraints, including timed loiters at selected points or automated searches. Different combinations of vehicles are accommodated, allowing air, land and sea vehicles to be coordinated.

Each vehicle can have separate vehicle control and status windows. Vehicle operating limits are pre-programmed to provide an alarm when a limit is exceeded, allowing the status window to remain hidden until a warning condition exists. Payload control and display windows are separate from vehicle windows allowing the vehicle and payload functions to be split between two operators at different workstations. This allows some operators to mark targets and handle communications, while others control vehicles or their payloads. Vehicle and payload information may be recorded for playback at a later time, and may be synchronized with video tape data as required.

CDL

CDL SYSTEMS

100 DISCOVERY PLACE ONE
3553 - 31ST STREET NW
CALGARY, ALBERTA, CANADA T2L 2K7

TEL: 403-289-1733

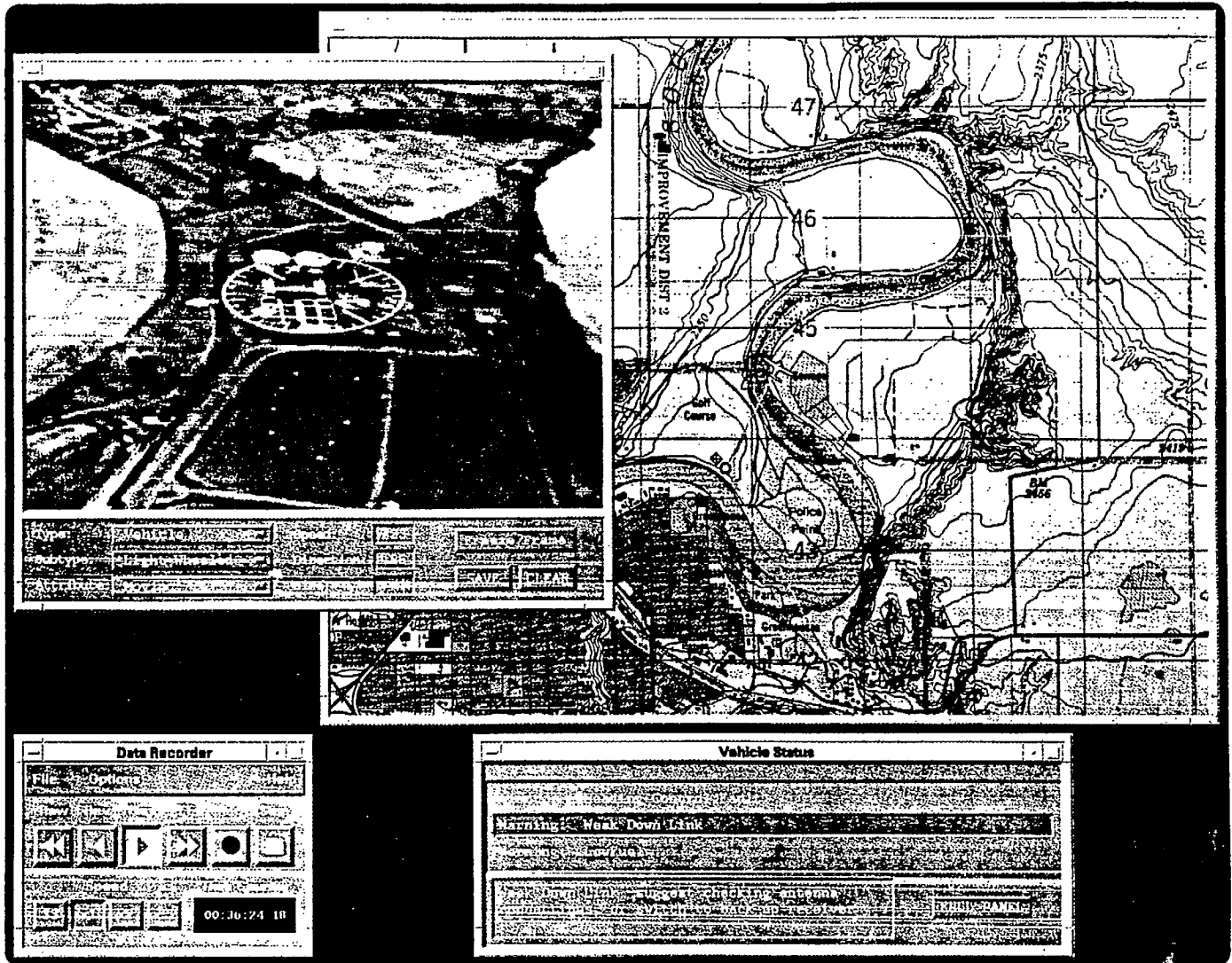
FAX: 403-282-1238

MR. DAVE WEILER

E-MAIL: dave@vcs.combdyn.com

The VCS is developed with the cooperation and sponsorship of the Defence Research Establishment Suffield, Alberta, Canada.

SURVEILLANCE SYSTEMS CONTROL



Map and Image Overlays

- imaging sensor "footprint" on map
- compass rose on live video

Data Recording

- telemetry data recorded digitally
- time synchronization with video tape

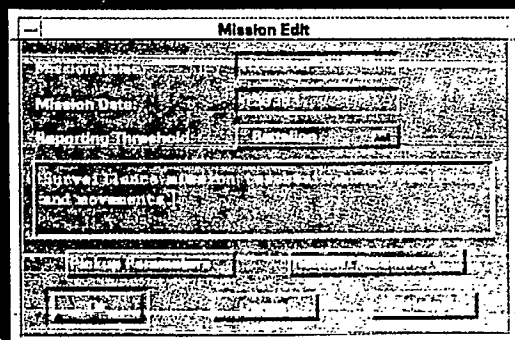
Target Reporting

- mark stationary or moving targets
- collect into groups for reporting

Vehicle Status Monitoring

- automatic fault monitoring
- full instrument panel can be displayed

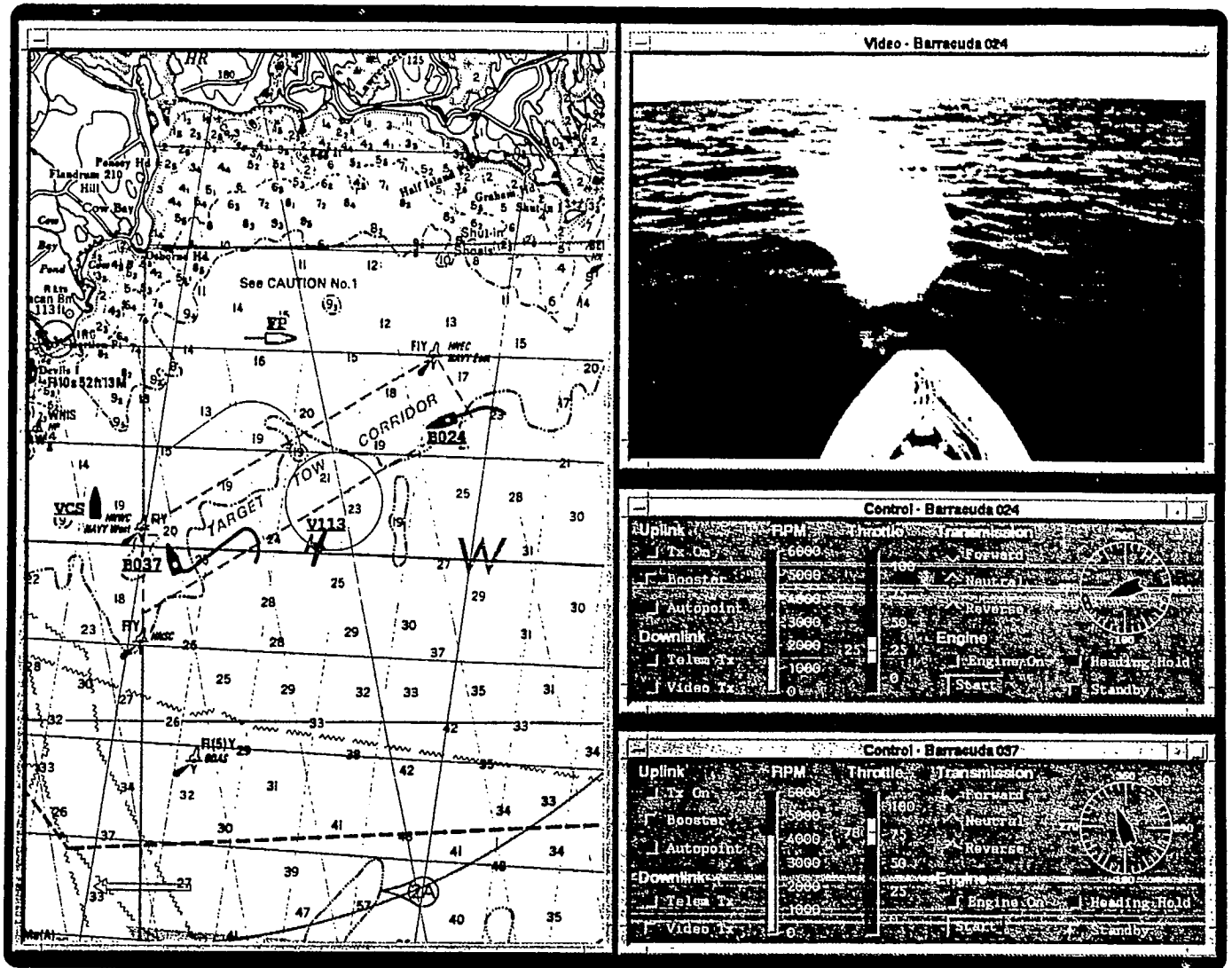
PLANNING



Surveillance Mission Planning

- satisfy task requests from multiple sources
- plan mission within time and fuel constraints
- destination for reporting results

MULTI-TARGET SYSTEMS CONTROL



Vehicle Control Panel

- control two vehicles from each workstation

Multi-Vehicle Tracking

- monitor locations of other targets
- monitor location of control station

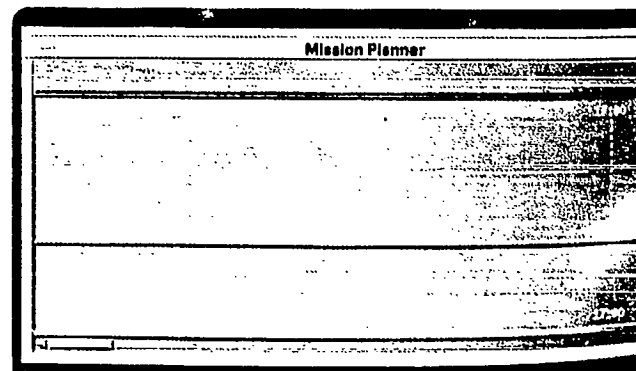
Live Video

- miss-distance scoring
- visual feedback to operator

Multi-Target Mission Planning

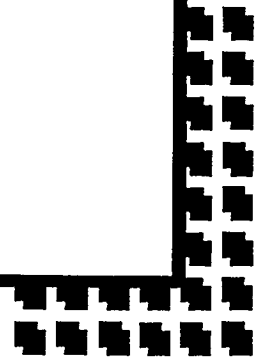

- enter and modify target paths
- coordinate multiple targets
- enter waypoints graphically on map

MISSIO





Interalia Inc.
Calgary, Alberta

- **Vehicle Voice Announcement Unit**
 - **Voice Capture System**
- 
- 

interalia inc.

DIGITAL VOICE ANNOUNCERS

CORPORATE PROFILE

Interalia inc. has emerged as a leader in the design and manufacturer of Digital Voice Announcement systems for the transportation, telecommunications, and other related industries.

Established in 1975, Interalia has earned a reputation for its ability to respond to specialized customer requirements and full technical and service support. Headquartered in Calgary, Alberta, Canada Interalia operates subsidiary companies in the U.S.A. and the United Kingdom. Through our International Sales and Marketing Department located in Calgary Interalia has supplied equipment to numerous countries throughout the world including: Singapore, Hong Kong, Malaysia, Australia, New Zealand, Italy, Saudi Arabia, Mexico, the Netherlands, and Chile.

Utilizing modern codec technology, messages are converted from analog to digital form and are then stored in memory. Utilizing these digital techniques Interalia has developed products with advanced capabilities, high quality signal reproduction, very high reliability and maintainability, and ease of use and installation.

Interalia employs a full time engineering staff which develops the hardware and software for our product line. Our continuing emphasis on product development and enhancement has meant a continuous source of new and enhanced products. The production facilities of Interalia are located at our headquarters in Calgary, Alberta, Canada.

Interalia's highest profile line of equipment consists of multi-message and multi-line telephone answering and information systems. This equipment has found a broad range of applications such as ACD, government public information, weather bureaus, financial institutions, tourism and travel, and transportation systems.

In addition to our standard product line of telecommunications equipment Interalia has designed specialized on board train announcement systems, and public address announcement systems. The Interalia on board train announcement systems are installed in Vancouver, British Columbia, Canada; Singapore; Detroit, Michigan, U.S.A.; and Stenstead, U.K.. These systems employ digital voice announcement technology custom engineered for the specific application environment. Changes and enhancements to the messages are accomplished through the use of a computer based information capture and update system supplied with the digital voice announcement equipment. Interalia is presently developing an advanced version of the on board train announcement system which utilizes modern FLASH memory technology as its' storage medium.

In support of our European sales we have obtained BABT 340 Facility approval. We are also proud of achieving ISO 9002, thereby providing global recognition of Interalia's quality of product and service. Our Certificate of Registration issued by QMI on August 1/1992 is Certificate Number 001195, to CAN/CSA-Q9002-1991. As a result of these approvals we are compliant to AQUP 4 & 5 requirements and MIL-1-45208.

interalia inc.

4110 - 79 ST. N.W., CALGARY, ALBERTA, CANADA T3B 5C2
TELEPHONE: (403) 288-2706 FAX: (403) 288-5935

interalia

DIGITAL VOICE ANNOUNCERS

Interalia's Digital Voice Announcers are state-of-the-art recorded message announcement systems that play repetitive messages to single or multiple outputs. The announcer interfaces with standard telephone lines, PABX's, Central office equipment, Key Systems and other applications. *Interalia's* Digital Announcers easily service heavy call traffic situations that cannot be handled by tape-based systems.

Each *Interalia* announcer employs solid state digital recording, storage and reproduction technology. Absence of magnetic tapes and moving parts results in maintenance-free announcer operation.

Benefits of *Interalia* Digital Voice Announcers are: promotes enhanced customer service, provides promotional information to customer, contributes to improving call handling efficiency, presents a professional and courteous image to customers, no maintenance costs.

Common uses of *Interalia* Digital Voice Announcers include: ACD/UCD announcements, centrex ACD, attendant overflow/call screener, telephone company intercept messages, after hours announcements, hotel wake-up call, music/promotions-on-hold, and public information announcements such as weather forecasts and movie theater times.

Other non telecom applications are: safety announcements, radio station IDs, public address announcements, instructions for emergency building evacuations and sound effects and narrations in museum exhibits.

Standard Features of *Interalia* Digital Voice Announcers:

- Solid State Design
- Digital Recording
- User Configurable
- Non Barge In
- Various Recording Methods
- 8 Khz Digitizing Rate
- Self Containing Diagnostics
- Call Counts For Each Line
- Various Operating Modes
- C.P.C. Signal Disconnect



***interalia* inc.**

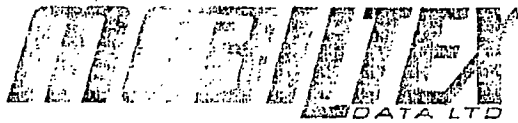
4110 - 79 ST. N.W., CALGARY, ALBERTA, CANADA T3E 5C2
TELEPHONE: (403)288-2706 FAX: (403) 288-5935



Mobiltex Data Ltd.

Calgary, Alberta

- **Vehicle monitoring systems.**
 - **Communications management systems**
 - **Truck dispatch systems**
 - **OEM products**
- 
- 



Ms. Anna Loparco
Western Economic Diversification
Suite 1500, 9700 Jasper Avenue
Edmonton, Alberta
T5J 4H7

March 30, 1994

REC'D - C.A.R.

MAR 31 12 01 PM '94

M.E.D.
ALBERTA

Dear Ms. Loparco:

Introduction: Mobiltex Data Ltd.

Mobiltex Data Ltd. was formed in 1985 and is headquartered in Calgary, Alberta, Canada. We are involved in the engineering, design and manufacture of high-quality Mobile Data Systems and Mobile Radio Signalling products. We specialise in customising communications systems to match our client's needs. We also provide support for our systems, offering the degree of service required.

Mobiltex currently has a 8500 sq. ft. facility with 7100 sq. ft. dedicated to design and manufacturing and 1400 sq. ft. dedicated to administration. In-house capabilities include:

- PCB Design and Schematic Capture CAD Systems
- Emulator Systems for various microprocessors
- Facilities and equipment for:
 - Circuit Simulators
 - Production Equipment
 - Burn-in and Testing
 - Metal Working
 - Industrial Silk-Screening
 - Hot/Cold Climate Chambers
 - Surface Mount Technology
- R.F. Test Equipment for radio testing, maintenance and design
- Complete Software Development Library for Turbo Pascal, C and Assembler

Our current product line includes:

- Mobile Data Terminals
- Station Controller Units
- Host System Controllers
- Remote Terminal Units, and
- Customised Software

Our products are typically sold as systems and can be optimized to a particular client's requirements. We have grouped our Mobile Data Products into four general categories:

- Vehicle Monitoring Systems (VMS Systems)
- Communications Management Systems (CMS Systems)
- Truck Dispatch Systems (PMCS Mining Systems)
- OEM Products

In addition to Mobile Data products, Mobiltex manufactures off-the-shelf and OEM Signalling devices for the mobile radio industry.

Although product/system design and manufacturing is our primary business, Mobiltex can also provide additional services such as:

- Specification Development
- System Engineering
- System Installation & Implementation
- Ongoing Maintenance
- Operations & Maintenance Training
- OEM type services for specialised products

Mobiltex's sales activities include:

- Direct Sales
- Sales through System Resellers or Distributors
- On Custom/Job Shop basis
- Joint Ventures
- Partnering Agreements

Our current major market base includes:

- Pipeline Operators
- Hydro Electric Utilities
- Telcos
- Oil & Gas Facilities
- Open Pit Mining
- Transportation
- Mobile Radio Industry

Mobiltext Systems are sold primarily in North America with the exception of Mining Systems which are sold worldwide.

Mobiltext Systems and products have a proven track record of operating reliable in adverse conditions which include wide temperature variations, dirt, chemicals, voltage extremes and transients, and operator abuse. Our products are subjected to dynamic high temperature burn-in and testing prior to shipment. All Mobiltext products are designed and manufactured in Calgary.

Most of our products are designed to enhance existing voice communications systems. As a result, many of our products are used in low to medium data throughput systems in which voice and data coexist on the same radio channel.

Of equal importance to reliability, especially in operator interactive systems, is ease of use. A great deal of effort has been expended in the design of Mobiltext products to minimise the amount of training required for users to comfortably operate the system. System functions are carried out with minimal keystrokes and are aided with visual prompts, color-coded keys, audible feedback, validity checks, and common sense procedures. All functions of the system are optimised for quick and efficient use of the radio channel and designed to coexist with normal voice communications.

We develop our product for the application rather than changing the application to suit the product. Even with custom engineering, our Mobile Data Systems are typically significantly lower in cost than competing high speed Mobile Data Systems.

Thank you for your interest in Mobiltex. Please call me at (403) 291-2770 if you have any questions or, if you have a specific requirement you would like to discuss.

Sincerely,
Mobiltex Data Ltd.

A handwritten signature in black ink, appearing to read 'Rob Stevin', is written over a horizontal line. The signature is stylized and somewhat cursive.

Rob Stevin
Marketing Director

encl: VMS Brochures
CMS Brochures



NovAtel Communications Ltd.

Calgary, Alberta

- **Full range of OEM GPS cards**
 - **Cellular radio communications system**
- 
- 

NovAtel Communications Ltd.

6732 - 8 Street N.E.
Calgary, Alberta
T2E 8M4
(403) 295-4500 FAX (403) 295-0230



Contact: Ms. Lindae Stokes, Corporate Communications

Company Founded: 1983

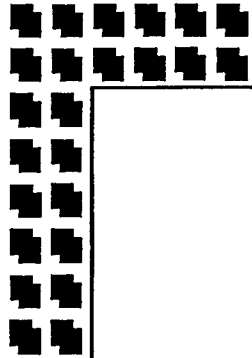
Products and Services: NovAtel Communications features three main product lines: wireless access communications systems, global positioning systems and personal communications products.

NovAtel's Wireless Access Communications System, the WACS-3, is a rugged, transportable, wireless loop communications system designed to provide cost-effective telephony services. It is ideal for areas where wired service is neither feasible nor economical and is designed to grow as the operator's requirements increase. The WACS-3 integrates the cellular-compatible Radio Interface Unit with a versatile electronic switching platform. This provides a high performance telephony link, whether it is being used as a completely independent radio telephone system or interconnected to a public telephone network.

NovAtel's global positioning systems (GPS) are satellite-based navigation systems which allow users to determine their position by tracking satellite signals. Using the patented Narrow Correlator, a unique correlation technique, NovAtel's GPSCards™ offer industry-leading accuracy and high performance levels. GPS applications include differential coastal navigation, landing systems, aerial spraying, geological surveys and even the tracking of migratory paths.

The newest division, Personal Communications Products (PCP), is designing technology to support the next generation of communications products including wireless voice, switched-circuit data, cellular digital packet data and other advanced architectures. These products are designed to be integrated into laptop computers, home security systems, GPS receivers, wireless modems and remote data devices. As well, digital cordless products such as wireless private branch exchanges and community phones are also being developed for home and office environments.

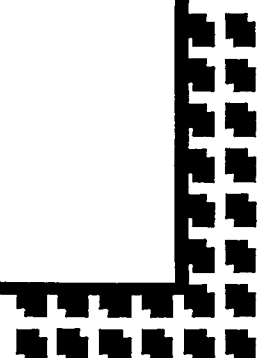
Headquartered in Calgary, NovAtel has an extensive, international network of dealers and agents worldwide including sales and distribution centres in Hong Kong, the United Kingdom and Europe. The company's R&D expertise is supplemented by an in-house manufacturing facility in Calgary.



QC Data

Calgary, Alberta

- **Automated Vehicle Navigation and Location (AVNL) application of GIS based technology.**
- **Three-level system being developed.**





CORPORATE OVERVIEW

QC Data was established in Calgary, Alberta in 1977 with a simple mission: to provide the highest quality digital data capture at a competitive price through the application of superior technological approaches. Since that time, more than fifteen years ago, QC Data has emerged as a contending force in the application of the latest in data conversion and data management technology and methodology (referred to by QC Data as "*Spatial Data Business Solutions*").

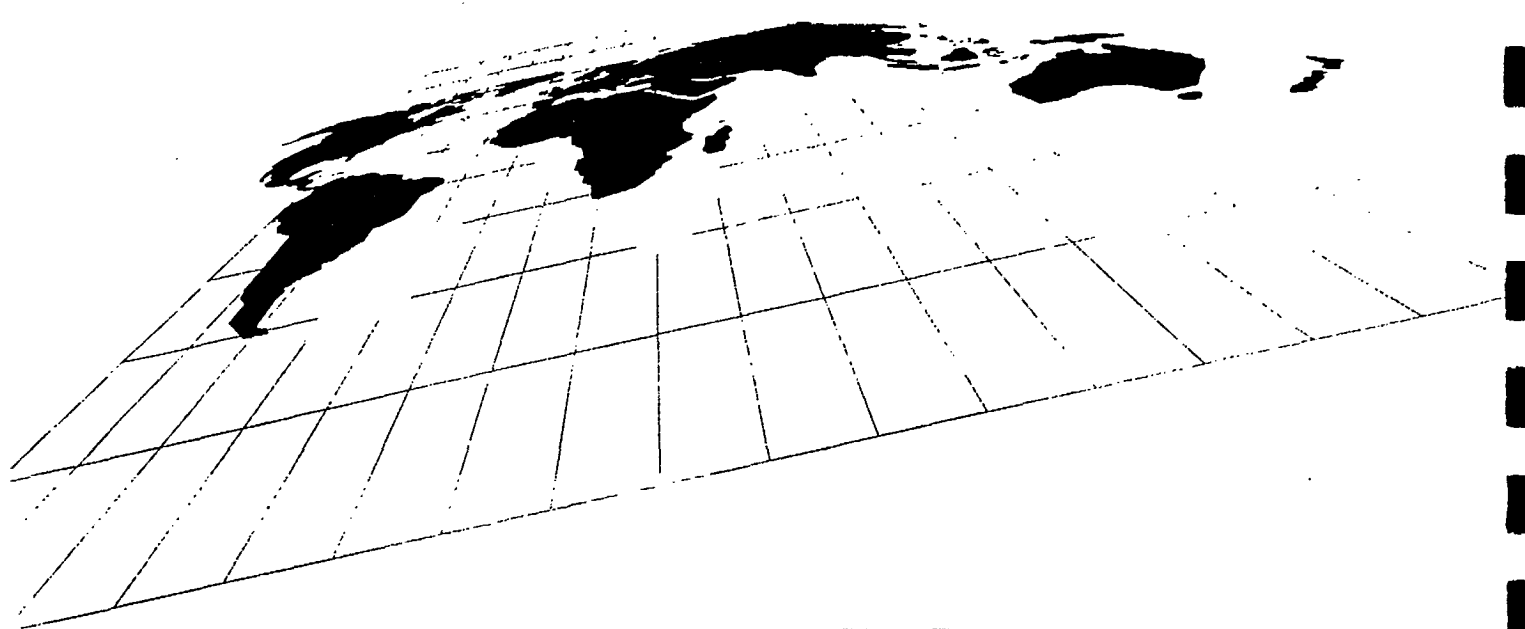
QC Data Ltd. is an international company with its corporate head office maintained in Calgary, Alberta, Canada. With over 350 employees, the firm has branch offices located around the world with production facilities in Canada, the United States, Europe, Russia and Mexico. QC Data Ltd. is a member of the Emergo Group of Companies. Emergo is a worldwide equity participation company providing financial, managerial and commercial strength to its family of companies. The Emergo Group has substantial holdings in energy and petroleum services markets, in geographical information services, in real estate, in warehousing and distribution industries and in the ownership of an executive retreat centre.

With a corporate commitment to maintaining a technological lead and a pre-eminence in conversion and data management services, QC Data invests in research and development of new technology to apply appropriate, cost-effective solutions to meet clients' current and future needs. QC Data puts quality ahead of everything else in designing its approach to each unique project. *At QC Data, quality is not just add-on, it is integrated by design into every process.* This approach and philosophy has significantly contributed to QC Data's successful track record of providing effective data management and conversion solutions for numerous data entry, GIS and AM/FM projects within municipalities, local and federal governments and utilities.

Another important factor contributing to QC Data's success is that QC Data has dedicated many years to developing a strong team of professionals. By recruiting a solid worldwide infrastructure of experienced managers, expert applications specialists and highly trained technicians, and continually investing in state-of-the-art conversion technology, QC Data is now positioned on a global basis to accomplish its stated objectives. As outlined in QC Data's Corporate Business Plan, QC Data's newly established "*vision*" is to become "*Globally respected as a leader in providing Spatial Data Business Solutions*".

The profile of QC Data's client list is diverse including multi-year contracts with Northwestern Utilities (Canada), Northern States Power (United States), U.S. West Communications, Georgia Power and U.S. Forest Service. Most recently, QC Data was selected as the conversion vendor for North York Hydro. QC Data has worked with large organizations such as: Ontario Hydro, Transport Canada and Energy, Mines & Resources Canada, and local agencies such as: St. Catharine's Hydro, Pierce County, and the State of Washington. This broad spectrum of experience enables QC Data to effectively understand each client's unique requirements, and apply the most appropriate mix of data management and/or conversion "skill-sets" to build a cost-effective program at all levels.

QC DATA



EGT Profile

Capturing European Geographic Roadnet Data

QC Data is a Calgary based company involved in data conversion and data management for Automated Mapping/Facilities Management (AM/FM) and Geographic Information Systems (GIS). Over the last few years, QC Data has become involved in the application of these technologies towards Automated Vehicle Navigation and Location (AVNL). AVNL is an existing "state-of-the-art" application of GIS based technology and is of significant benefit to a number of end-users. For example: Emergency Service organizations, Fleet Management, Transportation and car-rental agencies. (See reverse for further definition).

QC Data's involvement in AVNL to date is as a partner within a multi-participant consortium based in Europe. This consortium, "European Geographic Technologies (EGT)", is developing a comprehensive database model of geographic related data which will be made available as a basis for a number of end-use requirements. QC Data's primary responsibility, as a consortium partner, lies in establishing a comprehensive geographic database utility. This involves: capturing/converting the geographic data, managing and maintaining that data to ensure it's continual consistency and integrity, and, then, marketing/reselling the data for various GIS, CAD and AM/FM end uses.

As part of the strategy for marketing the geographic data, created and maintained above, EGT will also participate in the identification of various end uses for this data. One such end use, that has been identified to date, is for AVNL. Subsets of the EGT database are being made available in appropriate format and media for use within in-car navigation and location systems developed by various manufacturers. These systems are only now becoming commercially available as a result of leading edge research and development by various firms. As mentioned above, application of this advanced technology has significant benefit with various markets including: Emergency Services, Transportation and the general public.

See Reverse for Definitions.....

QC DATA

Definitions

First Level Systems - Automated Vehicle Location (AVL)

Initial developments of AVNL provided in-car based systems which could display a graphical representation of a digital map, with the location of the vehicle superimposed on the map. This level of implementation is considered "passive" in that it provides no more than a graphical feedback of vehicle location. These initial systems require digital map data with little more than good quality accuracy.

Second Level Systems Automated Vehicle Navigation & Location (AVNL)

Second generation systems, just now entering the market, provide the ability for the on-board system to provide interactive navigation assistance to the user. At this level, the system operates in an "active", not "passive", mode. Not only is a graphical representation of the vehicle location available to the user, but the system can actively interrogate the database and provide interactive feedback to the user by giving specific directions to reach a selected destination.

This level of implementation requires road map information which is not only of a high degree of accuracy, but also intelligently structured so as to support network analysis for the purposes of navigation. This means that far more data than just graphics representation of a road network is needed. Additional information that is required includes: accurate distances, addressing, road restrictions (i.e. turns and one-ways), etc. Further, there is other information that can increase the value, and hence the marketability, of the technology to end-users. This would include such information as businesses (i.e. hotel and restaurants) and road signage. This way, an "in-car" AVNL user could query the system for the location of all 5-star Italian restaurants, select one of the restaurants, and have the system provide the map and voiced directions.

Third Level Systems Interactive Vehicle Navigation & Location (IVNL)

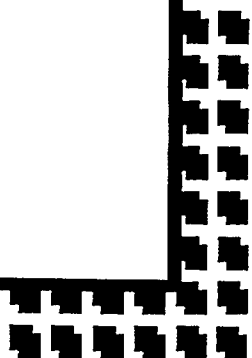

Third generation systems, only now in the research stages, involve the highest degree of interactivity amongst driver, vehicle and the transportation infrastructure. All of the functionality and data requirements of second level systems is required. Additionally, the system "interacts" with an intelligent and active transportation infrastructure, which can communicate information to the on-board system regarding ongoing transportation information.

Examples of this level of implementation would be the ongoing broadcasting of traffic loads, speeds, etc., which would be interpreted via the in-car systems as an extension to the AVNL database. This level of implementation requires not only an extensive in-car database, but also a significant investment in the transportation infrastructure.



**Display Systems International,
Inc.**

Saskatoon, Sask.

- **Computerized character and image generation systems.**
 - **Specific applications to the transportation industry.**
- 
- 

Who is DSI?

Display Systems International, Inc. (DSI), is a Canadian-based, privately held computerized character and image generation systems engineering corporation operating in the information display industry. First incorporated in September, 1983, in Saskatchewan, Canada, under the name DEL Compu-Cable Systems, the company conducted business in response to the knowledge that a substantial opportunity was developing in the Information Display Systems market. On August 25, 1990, in order to better reflect its growing and diversifying business operations, the company reincorporated to form Display Systems International, Inc.

The Company's corporate headquarters are located in Saskatoon, Saskatchewan, Canada. In December, 1990, DSI marked a major milestone by locating an office in Dayton, Pennsylvania, establishing a direct presence in the United States in order to develop its U.S. market potential.

In its first nine years of operation, DSI has designed 11 specific products and numerous product solutions for individual needs, matching technology with solutions to information display problems. It's latest product, just recently unveiled, is the ELITE 2000 IBM compatible information display system. Growing market acceptance of the Company's products, both in North America and internationally, enhanced expansion of DSI's product line through continuing development and the introduction of new products. Today, to accommodate specific product and international marketing requirements, the Company distributes, installs and services its products through a distribution channel including an authorized Dealer-Distributors Network and Value Added Resellers in 10 provinces in Canada and 49 states in U.S.A. DSI has also enjoyed success with sales in Europe, the Caribbean and the Pacific Rim.

What does DSI do?

DSI manufactures and markets integrated character and image generation systems enabling user to create and manipulate text, graphic and image/audio captured information. DSI manufactures a complete line of low cost, high performance, full turnkey display systems, featuring an easy to use menu driven interface and an advanced, multiple function scheduling system. DSI's systems are used by the cable and private cable TV, corporate, point of purchase, and transportation industries for community events and photo advertising channels, cross-channel promotions, corporate communications systems, presentation design systems, point of purchase advertising systems, and transportation terminal information display systems.

What are DSI markets?

DSI's markets are part of the overall multimedia and video computing market, one of the fast growing computer markets of the nineties. DSI's markets can be broken into four primary segments--Cable and Private Cable TV, Corporate Communications, Point of Purchase Advertising and Transportation Display Systems--each of which demonstrates different market characteristics, product requirements, and growth rates.

Information display can take several forms, depending upon the industry using the technology. The Cable Television industry use electronic information products to display community events and local advertising services. The Private Cable Television industry use systems in hotels, apartment buildings, hospitals, and campgrounds for such applications as convention schedules, tenant information, electronic bulletin boards and classified advertising. The Corporate Communications industry use display systems for employee information networks and service information directories. The Point of Purchase industry use DSI's systems to display advertisements and sales promotions for multiple sites. The Transportation industry use systems to display flight arrival and departure and baggage information to passengers throughout the flight terminal.

What is DSI's goal?

DSI's mission is to continue to position itself as a leader in the information display industry, in the forefront of technology through research and development, while closely monitoring and evaluating client needs, to become the most innovative information display products and systems corporation in the world.

DSI will fulfil this mission, and achieve further corporate success and growth, through:

- providing total quality, cost-effective, software systems;
- a highly motivated, professional support team and distribution network;
- easy to use, high quality products that reduce training, support and maintenance costs;
- results oriented, innovative solutions to meet the information display needs of clients;
- customer satisfaction, supported by a money back guarantee.

DSI has committed a substantial investment in research and development of new applied microprocessor-based technologies to meet emerging applications. The Company continues to develop economical products to solve information display problems and address individual and corporate needs.

Who uses DSI's systems?

DSI has hundreds of systems installed in cable and private television companies, diverse groups of corporations and institutions, transportation terminals, and retail store outlets. Among the company's clients are:

Cable and Private Cable TV Display Systems - such as Winnipeg Cable TV, Winnipeg, Manitoba; Continental Cable, Richmond, Virginia; Trump's Castle, Atlantic City, New Jersey; and the Museum of Science and Industry, Chicago, Illinois.

Corporate Communications Display Systems - such as Louisiana Power and Light Company, New Orleans, Louisiana; and the Atlantic Court House, Atlanta, Georgia.

Point of Purchase Advertising Display Systems - such as the Drug Emporium Drug Store franchise, Virginia Beach, Virginia.

Transportation Terminal Information Display Systems - such as Hartsfield International Airport, the largest passenger terminal complex in the world, located in Atlanta, Georgia.

Other customers include: Intercontinental Meat Packers Ltd; Big White Ski Resort; the University of Moncton; St. John Regional Hospital; Eglin Air Force Base; Kananaskis Lodge; Saskatoon Travel Lodge; Lethbridge Regional Hospital; the University of Saskatchewan; SIAST Kelsey Campus; Rogers Cable Inc. and over 2,000 additional cable and private cable TV operations from Nome, Alaska to Miami Beach, Florida and from New York, New York to Anaheim, California.



Kanotech Information Systems Ltd.

Regina, Sask.

- **Desktop GIS software for light rail rapid transit systems, road condition management, etc.**
- 
- 



KANOTECH
INNOVATION IN GIS

CORPORATE PROFILE

Founded in 1985 by a group of professional engineers and computer scientists, Kanotech Information Systems Ltd. was chartered to make desktop-based geographic information systems (GIS) accessible to clients in municipal governments, utilities and a broad range of engineering disciplines. Kanotech's visionary decision to use broadly adopted computer-aided design (CAD) programs as the graphics engine of its GIS has made the company's software a popular and inexpensive solution which is used across a broad range of applications. These applications include municipal information systems, rapid transit systems, wastewater treatment facilities, public utilities, hospital management, real estate tracking and oil spill management.

At the core of Kanotech's strategy is the concept of building a simple, open system of spatial data management. This approach extends GIS well beyond traditional applications by simplifying its use and leveraging client investment in existing software tools and sources of data such as AutoCAD graphics, and database information from such industry standards as ORACLE, R:BASE, dBASE, SQLBASE and SQLServer. By combining PC and host databases, graphics and imaging technology, client server architecture and multimedia together within a sophisticated spatial database, Kanotech delivers a truly powerful visual information management system.

Visualize, Create, Build, and Do

Kanotech Information Systems Ltd. adopted a new corporate identity in 1992 to reflect a dynamic new direction. The name, taken from the Greek word *Kano* -- meaning to visualize, create, build and do -- signalled the completion of a major technological initiative by the company. The initiative, code-named Project Kano, completed two years of research and development into creating a radical new approach to spatial data integration, which is reflected in the Kanotech line of GIS solutions. Kanotech's involvement with Autodesk's new ADE technology and the co-development of PowerPak with intelliCADD reflect the flexibility of Kanotech's technology, and place it firmly in that select group of companies whose experience, expertise, and innovative thinking define the leading edge in visual information solutions.

Serving Client Needs

Kanotech develops, markets, sells and supports its GIS products and services worldwide. A Western Canadian company with offices in both Edmonton, Alberta, and Regina, Saskatchewan, Kanotech delivers its products through a sophisticated distribution and support channel that provides a consultative approach to ensure that Kanotech solutions meet specific client needs. Kanotech channels include:

The Development Strategy

Phase One

The initial research conducted by the NHDA will target the shipment of products between Europe, Asia and North America. Phase one research will primarily consist of:

- profiling local shipments by commodity, mode, rates and time;
- determining international shipping patterns by company;
- defining international air cargo by volume, origin and destination, commodities, gateways and rates;
- determining air cargo competition from alternate airports;
- examining current Canadian and Manitoban agri-product production capacity;
- developing a detailed economic analysis of current systems which capitalize on Winnipeg's centralized geographic location; and,
- investigating the potential coordination of rail and truck schedules in conjunction with air lift in and out of Winnipeg.

Phase Two

The second phase will be devoted to the transformation of the detailed market research and logistics analysis into tangible products which can be competitively delivered through the Winnipeg intermodal distribution system. This stage will involve the development of:

- the intermodal park concept;
- point to point distribution systems for North American centres;
- a detailed model capitalizing on the value added activities associated with special customs arrangements;
- the identification and contracting of key client companies;
- a marketable operation plan clearly defining Winnipeg's advantages; and,
- a marketing strategy based on time and cost analysis for shipment from international centres as identified in the first phase.

Value-added resellers: comprehensively prepared to sell and support Kanotech products, the company's VAR channel delivers system integration, training and technical support for the company's Spatialist™ product line.

Consultants: fully conversant with spatial database technology, certified consultants have the resources to build complex custom applications, based on Kanotech products, for clients with even the most sophisticated requirements. Services include needs analysis, custom programming, database design and implementation and advanced system integration and training.

International Partners: combining the skills of VAR and consultant, the company's international partners work closely with Kanotech to provide needs analysis, sales support, product training and technical support, as well as custom system development services to clients worldwide.

OEM Relationship: Kanotech's technological strategy also includes a toolset that enables third-party developers to create customized GIS applications based on Spatialist. Already developers have delivered new spatial data management applications to markets that are based on Kanotech's advanced technology.

Alberta

Suite 105, 13245 146th Street
Edmonton, Alberta
Canada T5L 4S8
Ph: 403-455-9197
Fx: 403-452-4183

Saskatchewan

575 Park Street
Regina, Saskatchewan
Canada S4N 5B2
Ph: 306-721-2362
Fx: 306-721-2474

Spatialist is a trademark of Kanotech Information Systems Ltd.
AutoCAD and Autodesk are registered trademarks of Autodesk Inc.
All other product names are trademarks or registered trademarks of their respective authors.

Highways and Transportation

The Situation

Saskatchewan Highways and Transportation was faced with a problem common to all highway departments – how to graphically integrate their highway network with the related textual information from their Pavement Management Information System (PMIS).

Based on research that Kanotech Information Systems Ltd. had previously conducted on referencing systems and on its geographic information system implementation experience, the Department retained Kanotech Information Systems Ltd. to demonstrate the viability of developing a transportation-based geographic information system using the tools provided by the **Spatialist** GIS software.

The Solution

In examining the GIS needs of the Department, it was clear that an integrated solution involving a number of industry standard software packages was required. The system developed would not only require the capability of interfacing with the host-based Pavement Management Information System, but would also have to satisfy the unique needs of a Highway Department. The **Spatialist** software was ideally suited to this application because it interfaces to

the industry standard AutoCAD graphics software as well as to numerous industry standard database applications.

The pilot project area encompassed over 25,000 square miles (25,900,000 hectares) and some 3,000 miles (4830 kilometres) of the Province's highway network. Information contained in the Department's mainframe PMIS database such as traffic data, accident statistics and inventory data, was downloaded to a personal computer and then linked to the highway network contained in the Saskatchewan Central Survey and Mapping Agency's 1:1,000,000 digital provincial base map. Rural municipality, constituency and highway district boundaries were also overlaid on the base map to provide pre-defined named polygons which users could easily reference in both textual and graphical formats.

The individual highway segments and the polygon overlays were then loaded into the **Spatialist** spatial database and cross-linked to the attribute data which had been downloaded from the mainframe.

Using the tools provided with **Spatialist**, a menu system complete with processes and standard inquiries, was constructed specifically for highway applications. The system

"The Spatialist software provides transportation managers with an indispensable tool for overall management and planning of the transportation system in the 1990's."

– Roy Chursinoff
Saskatchewan Highways
and Transportation



was designed to generate graphical responses to map-oriented questions asked of the PMIS database. Typical queries generate maps showing information on pavement conditions, riding comfort index, accident hot-spots and traffic volumes in a variety of formats.

The referencing system in use at the Department comprises a series of control sections tied to relative chainages contained in the relational database. Using its dynamic segmentation feature, the **Spatialist** software is able to automatically proportion the chainage along the geometric definition contained in the spatial database. This permits the same attribute data to be cross-linked to different spatial databases, which can be created at a variety of accuracy levels. More importantly, it permits the same spatial database to be cross-linked to different attribute databases, allowing other Department databases to be accessed via the GIS.

The Results

The initial pilot project was completed in eight weeks. Thereafter, Department staff began the process of further customizing the software to new applications. After a year of in-house evaluation, the transportation-based GIS was implemented throughout the Department. Roy Chursinoff, who was responsible for the coordination of GIS in the Department, stated that, "The **AutoCAD-Spatialist** solution was ideally suited to the Department's short term and long term needs. Building around AutoCAD and the various third party design and application packages provides the Department with a wide variety of vertical application software which is required in the management of a transportation infrastructure."

Spatialist is a trademark of Kanotech Information Systems Ltd. All other product names are trademarks or registered trademarks of their respective authors.

Light Rail Rapid Transit

The Situation

British Columbia, Canada Transit's Skytrain project was the showpiece of Expo '86 in Vancouver. This state-of-the-art light rail rapid transit system is an elevated driverless system operated under computer control. The system is being aggressively expanded by B.C. Transit with links from New Westminster, B.C. across the Fraser River into Surrey, B.C.

One of B.C. Transit's critical objectives in designing and maintaining the Skytrain is the implementation of a complete life-cycle management system. To ensure maximum efficiency, it is critical that the system processes of planning, design, construction and maintenance be integrated through a common information system. Areas of key concern are noise abatement and proper alignment of the linear induction motor (LIM) rail which powers the trains.

An integrated system requires both computerized base maps and the linkage of these to maintenance data and work orders generated by the operating company.

The Solution

B.C. Transit retained Permatrack Technologies Inc., assisted by Kanotech Information Systems Ltd., to develop an AutoCAD-Spatialist

application which demonstrated the viability of applying GIS technology to the information management needs of the Skytrain operations and maintenance group.

AutoCAD had been used extensively by various consultants who worked on the earlier phases of the Skytrain project. Consequently, AutoCAD drawings for a portion of the system were available. In the initial phase of the project, these drawings were reviewed and a standard layering and drafting convention was developed for use by internal staff and external consultants. This initial step ensured that base engineering information was provided in a consistent and uniform manner.

Next, the specific referencing system used by the various groups was examined. The design team used chainages along the centerline of the rails as the common reference system. Traditional engineering plan and profile drawings were used to lay out the proposed design. The operation and maintenance group referenced their work by a track section number. A track section is a single loop within the Automatic Train Control monitoring system. Information display on a schematic track chart is used by the operation and maintenance group for visual reference.

"Spatialist provides a mechanism for the design of life cycle planning in large engineering design projects of this nature."

— Jen Liew
President, Permatrack
Technologies Inc.



KANOTECH
INNOVATION IN GIS

To satisfy these widely varied needs, two separate spatial databases were constructed. The first was a true engineering alignment complete with specific appurtenances. These were tied to the relational database by chainage. The second spatial database was created using the Track Chart display and was tied back to the relational database using the track section number.

Once the basic mapping was created, the relational database was loaded with data on design details, reference documents, noise and LIM rail deviation. It was also linked into the existing maintenance management database.

The Results

The completed Skytrain application, named **SKYMAP**, provides comprehensive integrated information for the operations and maintenance group. Locational information on rails, appurtenances and fasteners can be retrieved for any portion of the system and displayed within AutoCAD. Related attributes on the type, make, installation date, and warranty period can be easily

retrieved or used to locate specific items.

Schematic maps can be created to show noise levels before and after rail grinding, and these can be used to monitor the effectiveness of alternative grinding programs. A document management system, also a part of the system, can identify an object in AutoCAD and then automatically view either a scanned document, a photographic image or the detail drawing related to the item.

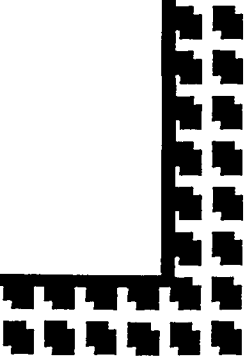

As a result of the demonstration project, B.C. Transit has installed the system and is incorporating it into its overall information system design. Jen Liew, President of Permatrack Technologies Inc., stated that "The combination of the AutoCAD software and the GIS tools provided by the **Spatialist** software provides a unique combination which can be applied to the effective management of virtually all large scale engineering and design projects." " **Spatialist** provides a mechanism for the design of life cycle planning in large engineering design projects of this nature."

Spatialist is a trademark of Kanotech Information Systems Ltd. All other product names are trademarks or registered trademarks of their respective authors.



Massload Technologies

Saskatoon, Sask.

- **Loadcells for truck and rail applications**
 - **On-board digital weighing system for trucks**
- 
- 

ON BOARD WEIGHING

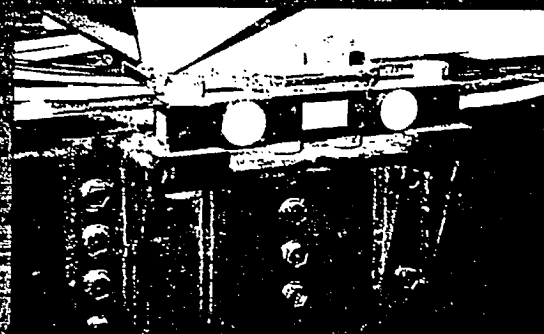
No more guesswork — No more surprises!

Installing a MASSLOAD onboard weighing system on your truck will allow you to keep constant watch on your loaded weight. You will then be able to confidently load your truck without compromising safety or risking overweight fines. No more guesswork — no more surprises!

THE LOADCELLS — The ML 1100 is milled out of one piece of 4140 alloy steel. Further heat treatment adds to the loadcell's strength. A rigid mount makes the loadcell an integral part of the truck frame. Weight measurement occurs when strain gauges embedded in the loadcell picks up on minute deflections caused by loading. Since there are no moving parts, there is nothing to wear out.

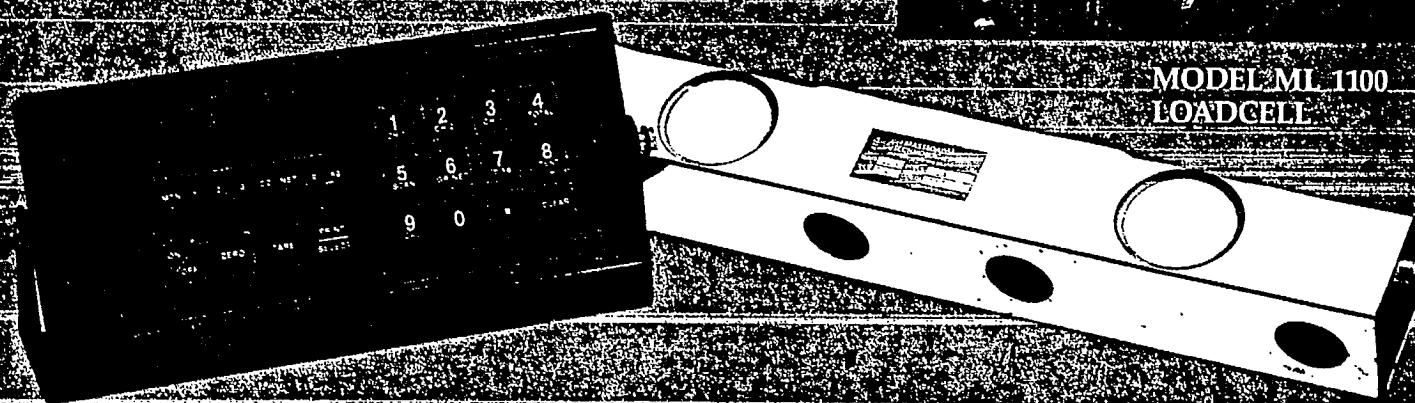
Most onboard weighing loadcells use bending beam technology. MASSLOAD has gone one better. The ML 1100 is of the more sophisticated shear web design. A double ended shear beam loadcell discounts side loading errors and as a result is considerably more accurate and reliable. The design and performance of this design has been proven in many demanding legal-for-trade applications. Full environmental protection makes the ML 1100 impervious to dust and moisture. Since it is also temperature compensated, this loadcell will perform to specification at temperatures ranging from -40°C to 57°C (-40°F to 135°F).

THE DIGITAL INDICATOR (THE DF 2000) — Standard features that include pound to kilogram conversion, Gross-Net-Tare functions and push button zero set the DF 2000 apart from other onboard weight indicators. The DF 2000 also features an optional set point buzzer that will alert the operator with an audible alarm when a preset loading limit has been reached.



**MODEL ML 1100
LOADCELL**

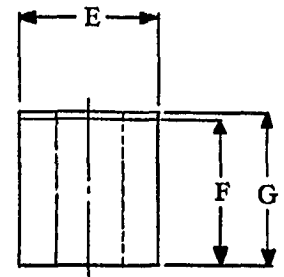
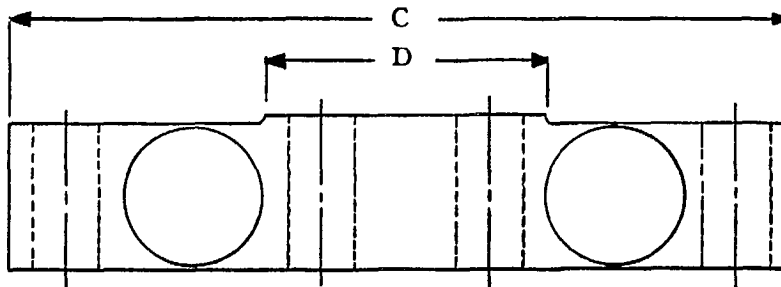
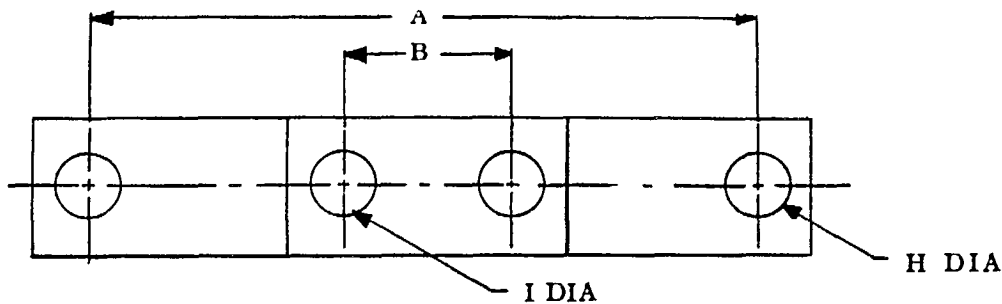
**MODEL DF 2000
DIGITAL WEIGHT INDICATOR**



MASSLOAD TECHNOLOGIES

CANADA • SINGAPORE • USA





| L/C (lb) | A | | B | | C | | D | | E | | F | | G | | H | | I | |
|-------------|-------|-----|------|----|-------|-----|------|-----|------|----|------|----|------|----|------|----|------|----|
| | in | mm | in | mm | in | mm | in | mm | in | mm | in | mm | in | mm | in | mm | in | mm |
| 12k5 | 12.00 | 305 | 3.00 | 76 | 14.00 | 356 | 5.00 | 127 | 2.00 | 51 | 2.00 | 51 | 2.10 | 53 | 1.09 | 28 | 1.06 | 27 |
| 25k | 12.00 | 305 | 2.50 | 64 | 14.00 | 356 | 4.50 | 114 | 2.44 | 62 | 2.64 | 67 | 2.74 | 70 | 1.19 | 30 | 1.19 | 30 |

Performance Specifications

A complete system consists of 4 or 6 ML 1100 loadcells.

Capacity: 12,500 lbs., 25,000 lbs.
 Safe Overload: 350%
 Accuracy: .25 Percent
 Output: 1 mv/volt
 Maximum Excitation: 15 v DC
 Hysteresis: .04% FS
 Non Linearity: .06% FS
 Compensated Temperature Range: -40°F to +135°F
 Thermal Sensitivity Shift: .001% of reading / °F
 Thermal Zero Shift: 0.0015% FS / °F
 Barometric Effect: NIL
 Side Load Discrimination: 500:1
 Bridge Resistance: 700 ohms (Nominal)

WARRANTY

MASSLOAD TECHNOLOGIES is proud to offer you the unprecedented and exclusive two year warranty. Each product is guaranteed to be free of defects in parts and workmanship for a period of 24 months. One full year above industry standards.

Represented by:

MASSLOAD TECHNOLOGIES

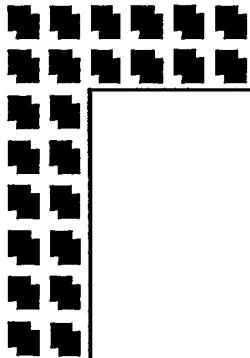

211 - 47th Street East
 Saskatoon, Saskatchewan
 Canada S7K 5H1
 Tel: (306) 242-2020
 Fax: (306) 931-1991
 Toll Free in Canada 1-800-667-3825

MASSLOAD TECHNOLOGIES

PTE. LTD.
 Block 164 Kallang Way
 #02-35/36
 Singapore 1334
 Tel: (65) 749-3230
 Fax: (65) 749-3862

MASSLOAD TECHNOLOGIES

3021 Valley Forge
 Bismarck, North Dakota
 U.S.A. 58501
 Tel: (701) 255-3512

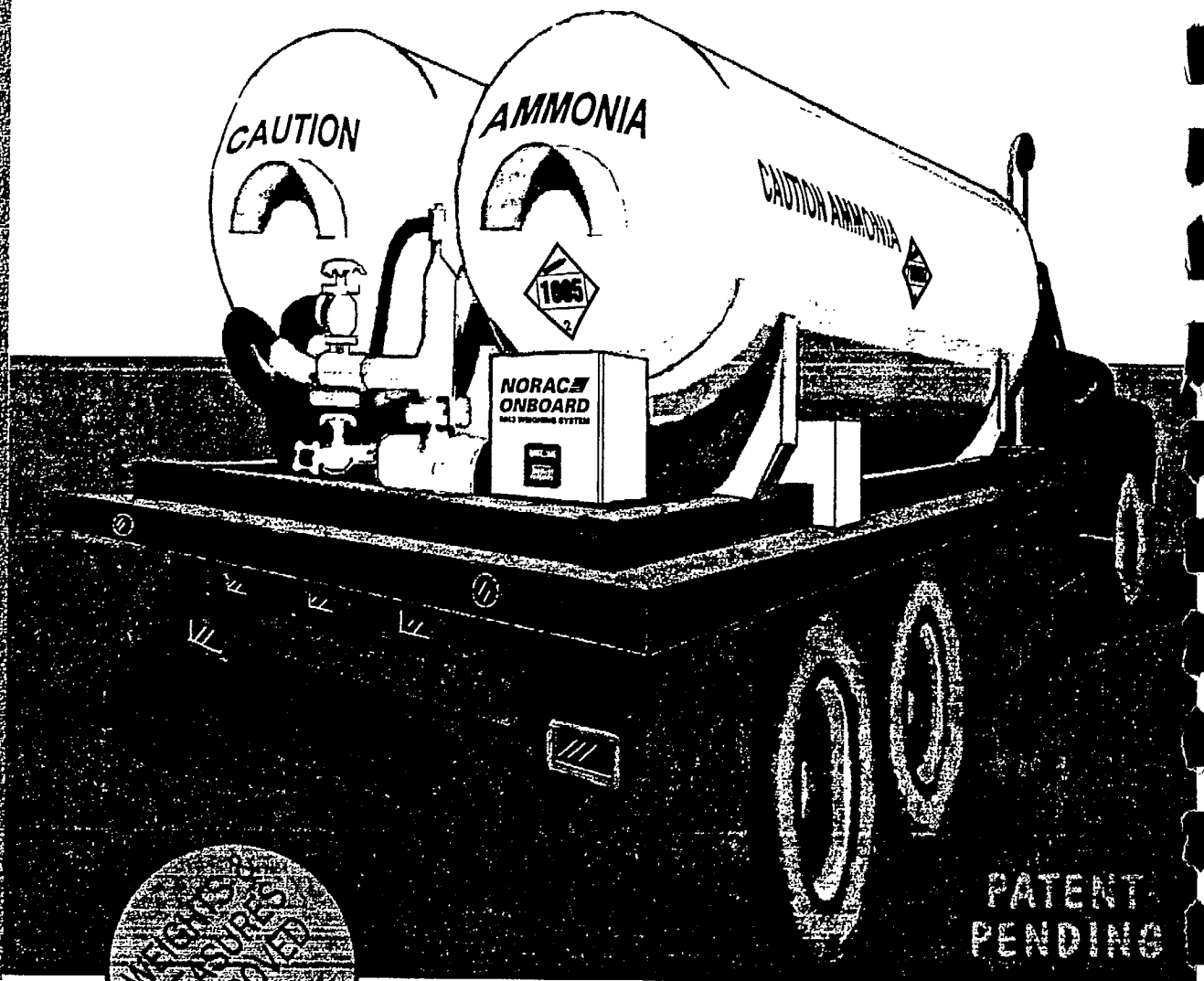


Norac Systems International

Saskatoon, Sask.

- **Onboard weighing systems for trucks.**
- 

NH3 ONBOARD™ Weighing System



- Hydraulic Lockdown
- Low Profile
- 6° Offlevel Operation
- Instant Setup/Takedown
- Easy to Operate Control Panel

The NH3 Mobile Load Out System
That Leads the Way!

TM

•LOW PROFILE

With the tanks raised only 1" above the truck bed, the center of gravity is practically unchanged. This ensures driver safety during transport.

•HYDRAULIC LOCKDOWN

The positive hydraulic lock-down system effectively secures the tank to the truck during transport. It is automatically engaged when the tanks are lowered, eliminating the need for additional pins or manual lockdowns.

•LEGAL FOR TRADE (SWA#: AM4847)

S-Type tension load cells provide consistently accurate readings well within legal tolerances of 0.1%. They are completely unloaded during transport, preventing shock loading and ensuring that tolerance for years of use.

•NEAT INSTALLATION

The entire package is designed so that it is almost unnoticeable and does not detract from the appearance of the unit.

•INSTANT SETUP/TAKEDOWN

The scale is activated and deactivated in seconds. Transport to weighing mode simply requires the hydraulic lift of the tanks onto the load cells and a push of a button to initiate delivery and weighing.

•6° OFFLEVEL OPERATION

The system can be used in hilly terrain, with the truck off level by as much as 6° in any direction.

•KEEP YOUR VAPOR LINES

There is no need to remove vapor lines, making customer rebates unnecessary.

•VERSATILE

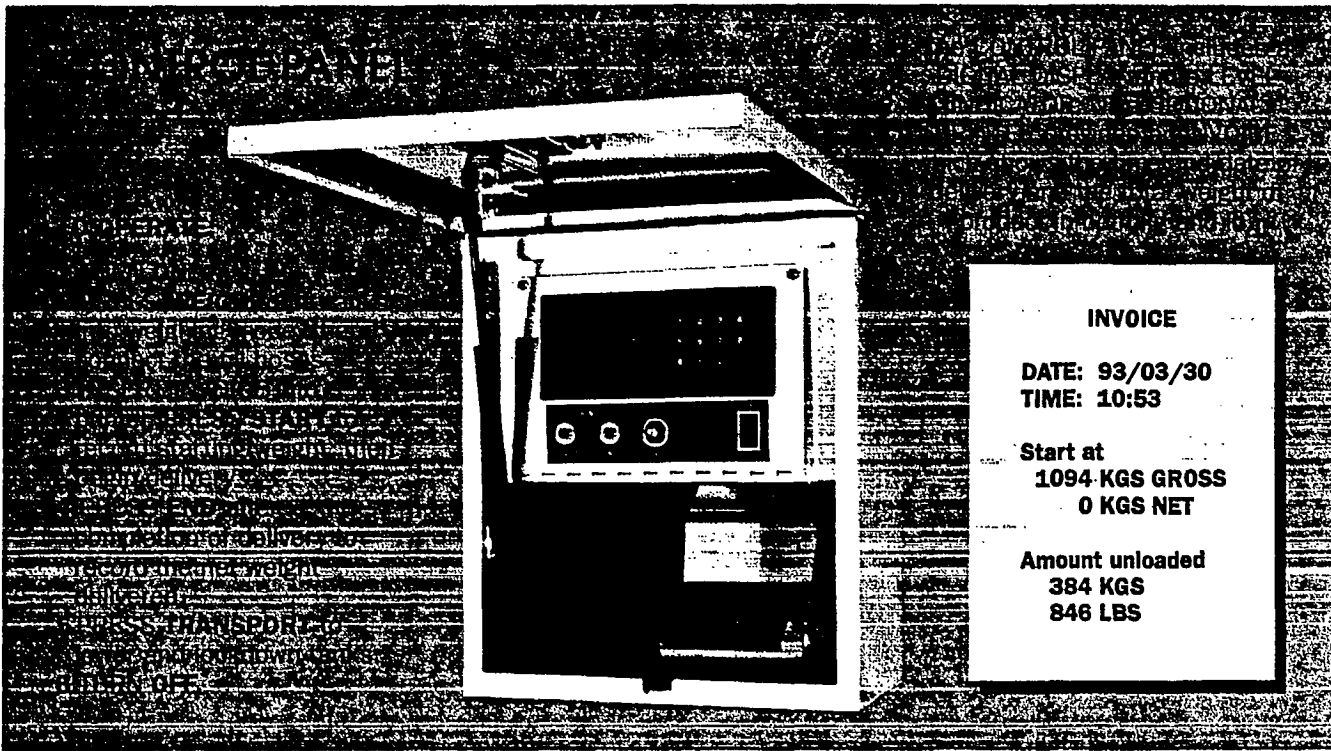
Can be attached to a frame or skid mount system.

•NO CONVERSIONS

The weight of the product is measured in kg directly, so conversions from liters are not necessary.

•FULLY TEMPERATURE COMPENSATED

Load cells are compensated at all temperatures.



INVOICE

DATE: 93/03/30
TIME: 10:53

Start at
1094 KGS GROSS
0 KGS NET

Amount unloaded
384 KGS
846 LBS

DESIGNED BY Engineering leaders in weighing systems.
MANUFACTURED BY NORAC with close to 20 years in the weighing industry.
SERVICED BY qualified scale technicians throughout Canada.

Printed In Canada

AUTHORIZED DEALER:

CALL TOLL FREE 1-800-667-3921

NORAC SYSTEMS INTERNATIONAL INC.

809 - 46th Street East
Saskatoon, Saskatchewan
(306) 664-6711
FAX (306) 664-6664

MAILING ADDRESS:
P.O. Box 340
Saskatoon, Saskatchewan
Canada S7K 3L3

B. C. RESEARCH INC.
3650 Westbrook Mall
Vancouver, BC
V6S 2L2

Telephone: (604)224-4331

Facsimile: (604)224-0540

Contacts: James Hill, Director of Marketing and Sales

Business Description:

BC Research is a multi-disciplinary, technical development and services company, focussed on environmentally- and economically-sustainable technology. Four focus areas are biotechnology (specifically, forestry), environmental sciences and engineering, clean transportation systems, and ergonomic/human factors.

The ergonomics efforts are concentrated in vibration and impact assessment in transportation systems and in more general human/machine interface problems.

Major Clients:

- U.S. Army
- Canadian Coast Guard
- MacMillan Bloedel (forestry and Pulp & Paper co.)

Number of Employees: 90

Quality Standards: U.S. Military specs.

Total Sales: \$7 million (ending June 1994)

Plant Size: 180,000 sq.ft.

OBS subscriber: Yes

Security Clearance: Canadian and U.S. Military

September 21, 1994

INDUSTRY CANADA/INDUSTRIE CANADA



114801

JOUR TA 1235 .C3 1995

QUEEN TA 1235 .C3 1995 a. (19
Canada. Industry Canada. (19
Canada's transportation elec