

POTENTIAL AND LIMITATIONS

Isaac systems have potential application to the entire transportation industry, among other specialized fields.

They are currently employed in automobile racing to optimize steering and control. Race series managers use Isaac systems to monitor the treatment of their rental engines by racing teams. Thus, critical parameters (oil pressure, fuel

pressure, water temperature) are recorded and alarms are activated if certain parameters exceed suggested levels.

Police departments install Isaac systems for monitoring purposes. For police administrators, Isaac systems are a means to ensure and demonstrate their respect of the rules and procedures governing law enforcement, along with a degree of

transparency valued by the public eye. Moreover, it allows better maintenance at a lower cost.

Isaac systems will soon be improved by integrating:

- real-time monitoring on liquid crystal display
- GPS positioning
- wireless data transfer

INFORMATION

This data sheet is based on the results of a project conducted under the technological platforms concept for alternative-fuel vehicles. Funding and technical support were provided by Environment Canada and the Canada Economic Development Agency.

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St. Lawrence TECHNOLOGIES

St. Lawrence Technologies data sheets are intended for all companies, industries, organizations and individuals interested in new environmental technologies. They are produced by the Technology Innovation and Industrial Sectors Section, Environment Canada, as part of the St. Lawrence Vision 2000. They serve to disseminate the results of technology development and demonstration projects conducted in the following four sectors: industrial waste water; contaminated soil; hazardous wastes; contaminated sediment and innovative tools.

Data sheets may be obtained from: Technology Innovation and Industrial Sectors Section, Environment Canada

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Publications available on The Green Lane:
http://www.qc.ec.gc.ca/protect/english/eco_publ_technologies.htm

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Printed at:
Imprimerie VDL inc.

Published by authority of the Minister of the Environment
© Minister of Supply and Services
Canada, 1998
Cat. No.: EN1-17/48-2000E
ISSN: 1188-7990
ISBN: 0-662-29506-4
October 2000

Cette fiche est également disponible en français sous le titre :

Systèmes d'acquisition de données ISAAC

Canada



St. Lawrence TECHNOLOGIES



INNOVATIVE TOOL

ABSTRACT

Isaac Instruments Inc. has developed a group of data-acquisition systems intended for use in the transportation industry. Among these monitoring systems are the IMS, for motor sports, the EVM, for electric vehicles, the AMS, for aircrafts, and the EMG, for emergency vehicles. The systems record a myriad of operating parameters including schedule of use, distance, speed, engine power, G forces, temperatures, pressures, etc. The data is downloaded and displayed on computer using a user-friendly analysis software.

A typical application of the Electric Vehicle Monitor (EVM) is the Montréal 2000-Electric Vehicle Project. There are more than 20 electric vehicles of various models (mostly Ford Rangers and Solectria Force) on the streets of the Greater Montréal region. In each of these vehicles, an EVM has been installed to record distance, speed, electrical currents, battery voltage, and ambient temperature.

ISAAC DATA-ACQUISITION SYSTEMS



HIGHLIGHTS

- **Isaac Data-Acquisition System Components**
 - Stand alone black box with two integrated accelerometers and non-volatile memory.
 - Harness and sensors.
 - Analysis software (Windows environment).
- **System Functions**
 - Records and displays different parameters as needed (vehicule speed, currents, battery voltage, pressures, temperatures, G forces, etc.).
 - High-speed data transfer to personal computer.
 - Records in different modes (i.e. according to time or distance, triggered by conditions specified by user).
 - User-friendly software displays parameters in the form of tables, graphs, bar charts and alarm reports.
 - Automatically draw a map of route travelled (closed-circuit testing).



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OBJECTIVES

When Isaac Instruments Inc. first developed its systems, engineers aimed to design a compact tool that could reliably, simply and economically record and display vehicular data for analysis. The systems had to provide fast access to data and prevent data loss in the event of power failure. They also should be flexible enough to adapt to the needs of users.

Typical users are vehicle fleet managers (trucks, aircraft, electric vehicles, etc.), racing team engineers, companies specialized in the development of industrial transportation products (brakes, collision trials, etc.), and managers of emergency vehicles (police cars, ambulances, tow trucks).

BACKGROUND

To remain competitive, fleet managers are looking for ways to optimize vehicle use and maintenance costs. This is a challenge when vehicles are operated by different drivers, each with their own driving habits, and in a country like Canada, where road and weather conditions can vary enormously.

Fleet managers must thus deal with hard-to-detect system failures resulting from premature wear, punishing driving, or simply normal part wear and tear.

Isaac Instruments Inc. systems were specifically designed to optimize vehicle maintenance and use. Information relative to each application is rapidly obtained and displayed to allow for the easy detection of anomalies.

For the Montréal 2000-Electric Vehicle Project, the data gathered make it possible to carry out statistical studies as well as an energy assessment, and will be used to determine whether such vehicles can meet commuter needs.

TECHNOLOGY

Isaac Instruments Inc.'s data-acquisition systems employ leading-edge technologies to ensure data integrity. The use of a non-volatile memory serves to protect the data for long periods without power (up to 10 years). Engineers at Isaac Instruments Inc. took their cue from aeronautical design techniques, using shielded cables equipped with an abrasion- and heat-resistant Teflon cover guard, and high-quality connectors with gold contacts, as per military standards.

The robust black box was designed to withstand heavy vibrations and violent shocks. Its internal components will function in extreme environmental conditions, at temperatures

ranging from -40 to +85°C, as well as in wet conditions.

A number of programming languages are used to produce Isaac software, including assembler, C, and Delphi. High-speed serial ports ensure that data are rapidly transferred from black box to personal computer.



RESULTS

The Isaac data-acquisition systems offer fleet managers a tool for comparing the behaviour of vehicles and drivers. Fleet managers can use this type of quantitative evaluation to optimize preventive vehicle maintenance and make objective decisions having a direct and considerable impact on the profitability of the services they offer.

Isaac Systems Operation

The main element of the systems is the black box, to which all sensors (engine and vehicle speed, pressure, current, voltage, brake temperature, etc.), transforming physical information into electric signals, connect. The data are accumulated at a rate that can vary from one sample every 30 seconds to 500 samples per second. Two accelerometers (one lateral, one longitudinal) are also integrated into the black box, as are sensors recording ambient temperature and supply voltage.

In data-recording sessions — which can vary from a few seconds to a few weeks — data are saved in the non-volatile memory (2 MB capacity).

A personal computer is wired to the black box to extract the data for analysis.

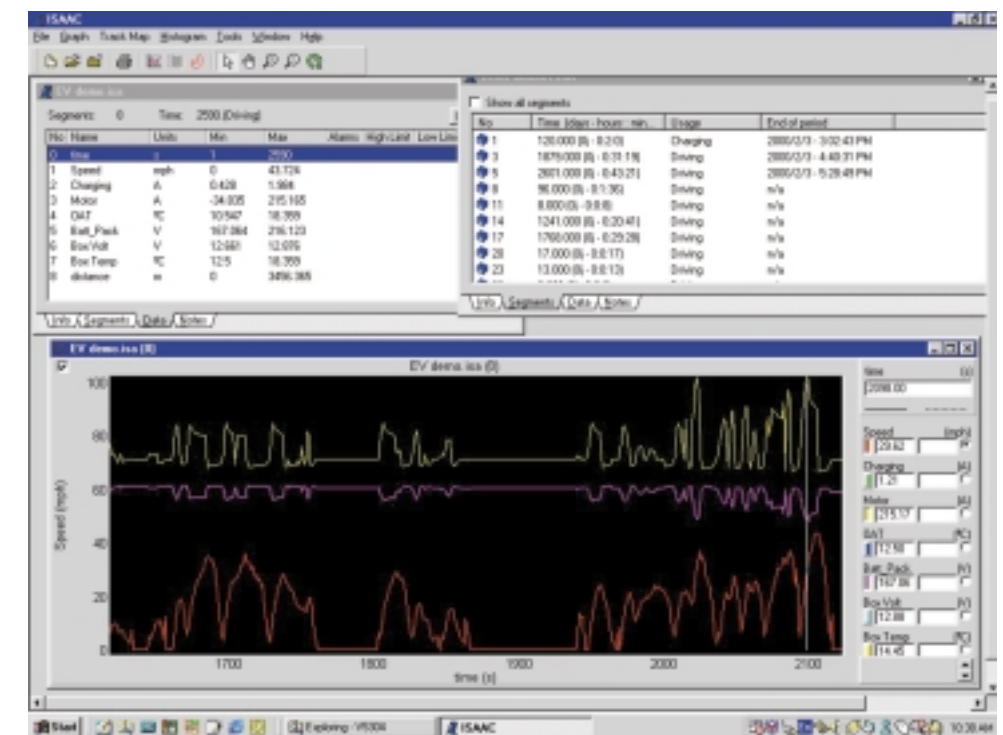
The Isaac data-analysis software operates in a Windows environment. It is fast, user-friendly and even bilingual, so users can switch between English and French at will. The desired parameters can be displayed for comparison purposes and to detect anomalies, or simply to verify parameters of use (e.g. maximum speed, engine power, brakes, etc.).

The data can be displayed in different forms, including a schematic of speed over time, for example. In this way, all the parameters recorded can be accessed in the form of an X-Y curve. Data can also take the form of a bar chart indicating the percentage of time a parameter spends in a given interval of its span. The alarm report overviews the entire recording session to offer a means by which to rapidly identify situations wherein a preset condition has been exceeded, for how long and how frequently.

An Example

For the Montréal 2000-Electric Vehicle Project, the results are conclusive. After tens of thousands of kilometers travelled, each second of driving and recharging was recorded by the EVM system.

Approximately once per month, the data is transferred to a portable computer.



The managers of this project can thus regularly check the energy efficiency of these vehicles, and compile the data for the entire fleet for statistical analysis.