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CENTRE CANADIEN DE RECHERCHES POLICIERES

TM-02-97
ELECTRONIC DRUG DETECTION EQUIPMENT

By: **Corporal Daniel Paradis**

TECHNICAL MEMORANDUM

Submitted by
Corporal Daniel Paradis
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Royal Canadian Mounted Police

April, 1996

NOTE: **Further information about this report can be obtained by calling the CPRC information number (613) 996-6343**

EXECUTIVE SUMMARY

Submitted by RCMP Drug Enforcement Branch, Ottawa ON

The Drug Enforcement Branch of the RCMP has evaluated the use of several instruments capable of detecting particulate drug resides. Starting with their attendance at a symposium in the USA in the fall of 1995 and subsequent on-site visits to the DEA and FBI facilities, they hosted an in-house demonstration, in April of 1996. Three Canadian companies were in attendance with instrument demonstrations from two. A high degree of success was achieved in locating concealed drugs as well as identifying and quantitating them.

In addition to this report a 30 minute videocassette, outlining technical presentations from the manufacturers and simulated search and recovery scenarios, is available from:

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SOMMAIRE

Par la Sous-direction de la police des drogues de la GRC, Ottawa (Ontario)

La Sous-direction de la police des drogues de la GRC a évalué plusieurs instruments pouvant détecter d'infimes particules de drogue. Elle a participe à un symposium aux Etats-Unis à l'automne de 1995 et a visité les installations de la Drug Enforcement Administration (DEA) et du Federal Bureau of Investigation (FBI). En avril 1996, elle a organise une demonstration-maison de ces instruments. Trois sociétés canadiennes y ont participe et deux d'entre elles ont présenté leur materiel. Ce dernier a permis de trouver des drogues dissimulees et d'en determiner la nature et la quantite.

En plus du present rapport, il est possible d'obtenir une video de 30 minutes sur les presentations techniques des fabricants et sur les scenarios de recherche et de recuperation simulées, en communiquant avec:

caporal Daniel Paradis
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THE USE OF ION MOBILITY SPECTROMETRY IN THE DETECTION OF TRACES OF CONTROLLED SUBSTANCES.

by Daniel Paradis

For many years now the RCMP and other law enforcement agencies in Canada have been using the services of police dogs to detect explosives and controlled substances in various settings. The dogs have certainly proven reliable and even today, with the presence of sophisticated electronic equipment capable of detecting invisible traces of certain important components, scientists still agree that the dog is still the best available 'machine" on the market. However, not unlike human beings, dogs have tempers, feelings and bad days. Furthermore dogs will indicate vapours of certain substances but can not specify what types of vapours or in what strength for obvious reasons. Some electronic equipment can do just that.

In the last few years, the use of ion mobility spectrometry in the detection of traces of controlled substances has been improved. In fact, this is nothing new as the same technique has been utilized for a few years in the explosive vapour detection and has been proven quite reliable. In 1996, portable electronic drug detectors are truly becoming an adjunct to police dogs. Companies such as Bar-ringer, CPAD and Scintrex in Canada, and others in the United States and the rest of the world are now producing smaller, lighter and more efficient equipment than ever. Such equipment is already being used by several law enforcement agencies in the world. In Canada, Canada Customs and Correctional Services own some equipment and are currently using it in an effort to increase their capabilities of detection. In the United States, the Drug Enforcement Administration (DEA), the Federal Bureau of Investigation (FBI), U.S. Customs, U.S. Coast Guards, only to name a few, are all users.

The use of this type of equipment in the United States supports enforcement and asset forfeiture groups in finding trace quantities of controlled substances. Traces of controlled substances are collected on a small filter held in the end of a vacuum sweeper hose which has been previously tested to insure no contamination. The instrument uses an analytical technique in which the traces of controlled substances on the filter are heated to vapours and ionized. The time required for the ions to drift through an electric field is measured and the substances are identified by the "drift" time through the electric field.

The idea of using a vacuum sweep to collect traces of controlled substances is not new, what is new is the capability to analyse the samples collected on the spot. The instrument is in fact a very sophisticated field test. A great advantage of using this type of instrument is that collected samples can be analysed on sight to determine the need for further searches or collection of samples while in place with the search warrant.

For the last year or so, DEA and FBI have been using their equipment to collect and test samples from homes, warehouses, trailers, trucks, cars, air planes, clothing, bags, boxes, currency, papers,

peoples hands and hair and various other things. They have used them in undercover operations when they took samples of the undercover operators and/or informants before and after their meetings with the targets. They have used them to take samples on money or documents, to tie them to narcotics. They use them in vehicle and building searches, in order to locate secret compartments. They can take samples from everything a target will touch, objects such as door and car handles, TV remote controls, small objects, pants pockets, shoes, tools (specially tools used to open crates/boxes), weapons, etc. As all users of this type of equipment claim, imagination knows no limits and everyday they learn new ways to use their equipment. One other thing is also quite obvious to them, this equipment is certainly not ready to replace police dogs, it is accurate but must be target specific to work well. Searching an entire residence could take a very long time as hundreds of samples would need to be collected to insure a complete search. A police dog could walk through the same residence and complete a very good search in only a few minutes. Both the dog and the equipment actually complement each other quite well.

A very interesting case was developed by the FBI in Florida with the help of a Ionscan 350 (Bar-ringer). Several dog cages were imported from Colombia and stored in a warehouse. The pattern of importation made them suspicious. One of the cages was inspected by Customs officers and cut in half It appeared to be made of fibreglass and nothing else. A sweep was done with the ionscan 350 and strong traces of cocaine were immediately detected. Further analysis revealed that liquid cocaine had been mixed with liquid fibreglass, poured into moulds and transformed into dog cages. A controlled delivery was done and hidden cameras revealed that the recipients used large saws and meat grinders to transform the cages in a powder form_ The powder was then put through a chemical process and the cocaine was separated from the fibreglass. At the end, the FBI weighted the cocaine seized and realized that it consisted of about 30 % of the total weight of the cage.

However, the FBI's most important use of the equipment is in detecting traces of narcotics, mainly cocaine, on currency. The ink on currency never really dries, it is in fact a "microscopic" sticky surface onto which, as it is circulated, human oils and miscellaneous environmental dirt and grime (including narcotics) become attached. In the case of cocaine, Dr Thomas Jourdan, FBI Washington, maintain that a person who has handled the drug and then handles currency transfers residues in the low hundred of nanogram (billionths of a gram) range to the bills, and that this amount over the course of subsequent handling and manipulation is reduced to a steady state background" level. . Dr. Jourdan has created a data base of several hundred bills analysed overtime. He has come to consider 13 nanogram (ng), which encompasses more than 95% of the background samples analysed, as the upper limit of the genera1 background level for cocaine on currency (in the USA). It should be noted that the bulk of the currency is contaminated at . **1** to 5 ng. In an attempt to be as neutral and lenient as possible, Dr. Jourdan will accept that contamination from 13 ng. to 100 ng. is not indicative of anything other than being much closer to the contaminating element. In over 40 case studies of actual money laundering investigations, currency indicated a contamination level of over 50 to 80 NG. Dr. Jordan can therefore safely claim that contamination of over 100 NG. on currency is indicative of coming directly from a cocaine handler. Dr. Jordan has successfully testified to that effect in the last few months. This

type of evidence still requires corroboration, however it is a great corroborative evidence in itself

After having received and analysed all the above information, Drug Enforcement Branch contacted three Canadian companies and asked them if they would accept to participate in a "real life like" demonstration of their equipment. They all accepted. This demonstration took place at the Canadian Police College in Ottawa on 96-04-29/30. The three companies present were Bar-ringer, CPAD and Scintrex. Scintrex did not have any equipment to show us as it is not quite ready, however they advised us that their equipment, which will be quite small, light and accurate should be out in June of this year and they will make two of them available to us for testing and evaluation purpose. When we receive them, we will look for two agencies or divisions that can insure several drug searches in the evaluation period.

Bar-ringer and CPAD were put to test on Monday 96-04-29. The "C" Division police dog was also present to permit us to evaluate how the equipment could work with a police dog. A small quantity of cocaine, wrapped up in a double plastic bag, was hidden in one area of the house and a small quantity of heroin, wrapped in the same way, was hidden in another part of the house. The person hiding the narcotics made sure that he had previously touched the narcotics and then touched the furniture/wall when hiding the narcotics. The police dog came in the house to do his search and within very few minutes had indicated both areas where the drugs were hidden. The dog master then showed the areas to the CPAD technicians, the technicians took swipe samples of the furniture and walls where the dog had indicated. They then took the two samples to the equipment which was outside inside a vehicle (minivan). They analysed both samples and within seconds gave us the results. They were right on both counts. The exact same exercise was done for Barringer with the exact same results.

Cocaine was then hidden in the armrest of a vehicle, making sure that invisible traces of cocaine were left on the armrest and steering wheel to simulate contamination of those objects while hiding the drugs. Again the dog quickly indicated the cocaine and both CPAD and Bar-ringer quickly recovered the samples from the contaminated areas, as indicated by the dog master and correctly analysed them

Thirdly, both companies were asked to investigate four sheets of paper placed on a table. Three of the sheets were uncontaminated and the fourth had been handled immediately after handling hashish with the same hand. CPAD detected cocaine on one clean sheet of paper, cocaine and methamphetamine on another and methamphetamine on the third. They detected cocaine on the sheet which was contaminated by hashish. Bar-ringer obtained similar results. Seeing this, we asked Bar-ringer to test the room in general and the rug. These tests also indicated cocaine traces. This revealed that the entire room was contaminated with cocaine and some me&amphetamine. Not impossible, considering we had previously handled cocaine in that room and the house in general was used for the Drug Investigation course and the Clandestine Lab course.
Furthermore, in the case of Barringer, it was noted that a glove swipe was done of the documents, however the technician totally missed the contaminated area with the glove. Therefore he did not

obtain a THC sample, thus could not analyse it.

For the last test, a small quantity of methamphetamine was placed in someone's pants pocket. CPAD took a vacuum sample of the pocket and did not detect anything. Bar-ringer also took a vacuum sample and detected low traces of cocaine and higher traces of methamphetamine. It should be noted that cocaine, heroin and methamphetamine had been transported in the same container that day, therefore cross-contamination was quite possible.

On the second day, the three companies were asked to give a verbal presentation of their equipment in front of law enforcement officers from Ontario and Quebec including, RCMP ("A", "O" and "C" Divisions), Montreal City Police, Quebec Provincial Police, Ottawa-Carleton Regional Police, Gatineau Police Force, Hull Police Force and Ports Canada Police Force. It should be noted that both CPAD and Barringer had to prove what they were saying later on by giving a classroom demonstration of their equipment. Scintrex, whose equipment is not yet ready, told the class that their detector would be smaller, lighter and very efficient without having to show any evidence. They, however offered to loan us two for tryout and testing in June of this year. It certainly would be wiser to reserve any comments about it until it has been properly tested. The equipment should be given to RCMP Drug Enforcement Branch, Ottawa who will be responsible to contact two agencies who will be ready to proceed with several searches and use the equipment. In the classroom demonstration, CPAD and Bar-ringer did well in detecting the cocaine, CPAD could not detect THC nor methamphetamine. Bar-ringer did well with the two last tests.

All in all, Bar-ringer appeared to have more success in these tests, which could explain why most police agencies using that technology so far are using Bar-ringer equipment. It is not to say that the other ones should be disregarded. They entered the technology race after Bar-ringer and could easily catch up in time. CPAD advised us that they were working on a new prototype which should be much more practical and efficient.

All of the above demonstration was video recorded, 13 hours of tape all together. In the few days following the demonstration, the tapes were edited to a presentable version and the final product should be part of the package you have received with this paper. Also, we have included information packages supplied by Bar-ringer and CPAD. Scintrex should have theirs available soon and they will be forwarded to you, if not already in this package.

It is up to all to examine this package and decide if the investment is worth it. I certainly believe there is room for this type of equipment, along with the police dogs, in drug enforcement. I have given only a few examples of how it can be used, however as Dr.'s Jourdan of the FBI and Sobotka of the DEA have said, imagination is limitless and we learn new ways to use the equipment every day. Canadian courts have not been tested yet with this equipment. There is only one civil case presently in Quebec where a group of people are claiming that the equipment (Bat-ringer Ionscan 350) used by the federal detention centre "Leclerc" is not working properly and gives false reading. We are awaiting for a hearing date and an eventual decision, however we

have to remember that the people making that claim are visitors who were refused contact visits with prisoners as the Ionscan test revealed very high readings The Leclerc institute has set up the warning signal on the equipment to go off only when the reading reached 400 ngs., which is approximately 20 times higher than what we had during our tests. My guess is that whatever visitors set off the warnings were in fact carrying narcotics or had recently. It is very unfortunate that these visitors had the option to leave the premises or accept non-contact visits in lieu of being searched. Whatever decision this court renders at the end of the day, should Canadian law enforcement agencies start using the equipment in large numbers, we will eventually have to face some challenges in the criminal courts and case laws will be made. We have to ensure that we are ready for this and that we agree on a protocol to use the equipment so that courts will also be open to their use. This could be very similar to the breathalyser court history.

To this effect, our branch is in agreement to provide uniform training to all users. We will insure that the appropriate expertise is obtained for the course. We will also offer our services to keep a national record of all cases involving searches with this type of equipment. This could be very informative to all users and could become very important in a court case. This would imply that all users would be required to submit some kind of monthly return to our branch.

Finally, some prices were quoted during the lectures, approx $ 100,000 for CPAD, $20,000 for Scintrex and approx $60,000 for Barringer. I was told by the companies that all of these prices are flexible in case of bulk purchases, therefore some kind of coordination might be in order and again, we would offer our services. Some people in Technical Operations Directorate have developed very good contacts with these companies and bulk purchase could become quite advantageous.

Submitted for your information.

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Royal Canadian Mounted Police
Forensic Laboratory Services Directorate

Gendarmerie royale du Canada
Direction du service des laboratoires judiciaires

MEMORANDUM NOTE DE SERVICE

TO / A: C.S. Toxicology
Central Forensic Laboratory

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FROM / DE: D. McClure
Toxicology Section
Central Forensic Laboratory

Security - Class. - de Sécurité
Confidential

Our File / Notre Référence

Your File / Votre Référence

Date
April 22nd 1996

SUBJECT / OBJET **Report : Evaluation of Electronic Drug Detecting Equipment. Visit to FBI (Washington) and DEA (Dallas) Labs. Mar.** 25-29 1996.

Refer: Request of the Oi/c Drug Enforcement Branch (DEB) to the Oi/c Science and Technology Branch (S&T), 'L' Directorate for technical support. The support was required to compliment a DEB member tasked with evaluating electronic drug detecting equipment. To obtain an initial understanding of the **subject, problems** and possible solutions, visits to the FBI and a DEA laboratory were arranged.

Cpl. Daniel PARADIS and I visited the FBI lab in Washington on March 25th and went on to the DEA lab in Dallas the next day. In the FBI lab we met with Dr. Thomas JOURDAN who has extensive knowledge on the use of the Barringer Ionscan Model 250, a semi-portable detector utilizing an ion mobility spectrometer (IMS). The sample is collected on a Teflon filter (approx. 2.5cm diam.) by vacuuming the area of interest. The filter is then removed from the vacuum apparatus (a small "household" vacuum cleaner) and placed in the Barringer unit. A plunger heated to 250°C and swept by an airstream, is then raised into contact with the filter causing desorption of the analyte into the IMS. The instrument is calibrated by use of a standard (nicotinamide) which is added, automatically, into the analysis stream. The calibration timing is adjusted manually and seems to be very stable, but is altered by any changes in altitude (a concern if the unit is shipped and used in different locations). Compounds of interest are given specific 'windows' of time, measured in milliseconds, from ionisation to detection and if **a** substance is detected in that window it is labelled as that compound and an alarm given. Complications in terms of false negatives can occur when two substances compete for the ionisation process, perhaps the worst being when nicotine and methamphetamine are present in the sample. In such a case the methamphetamine is not detected and cocaine, if present, can get shifted out of its window. The whole procedure, from pushing the button to start the desorption step to the report, is approximately four seconds. Due to the general nature of the detector any positive results

must be confirmed by a second vacuuming process and analysis by a more specific detector, typically a mass spectrometer (MS).

The FBI lab uses this instrument mostly for detection of drugs (usually cocaine) on currency to verify conspiracy or to indicate a tie in with a drug seizure. Their "proceeds of crime" legislation allows for the forfeiture of assets associated with a crime to go into the coffers of the police/drug agency involved. Their method for screening currency involves doing a blank to ensure no examination area/apparatus contamination, vacuuming one side of ten randomly chosen notes of each denomination, followed by analysis on the Barringer Ionscan unit. If a positive result is obtained, the backside of the notes are vacuumed and analysed using a mass spectrometer. Currency is considered to be associated with drug dealings if the quantity of cocaine present is at or above lOOng/vacuum batch with the average level for ‘clean" notes being 4.5ng/batch.

An interesting example of the instrument's usefulness arose from the inclusion of cocaine into a polymer. A box of innocuous looking pipe fittings (similar in appearance to PVC) was seized in spite of a drug sniffing dog not being interested in them. A Teflon filter was rubbed against a fitting and the Barringer unit indicated a strong cocaine signal. The cocaine was mixed in with the polymer and then cast, the sealing of the cocaine so complete that they were able to play catch with the dog and the 'fitting without the dog "alarming." To give an idea of the quantities possible, they also showed a very normal appearing large dog kennel made from this process, it contained 7Kg of cocaine. Once the article containing this entrapped cocaine reaches the destination country it is ground up using a meat grinder and the cocaine extracted using solvents.

At the DEA lab we met with Mr Adam SOBOTKA, the supervisory chemist, and members of his staff. Ms Angela DeTULLEO and Ms April LEE were assigned to us and gave us a tour of the facilities as well as a thorough understanding of their use of the Barringer instrument. They have a Barringer Ionscan Model 350 which is more portable than, but otherwise similar to the model 250. Although it is quite heavy (it is built in very strong looking modules) it has been transported by every known means, set up in the back of vehicles and run off a portable generator. When travel to another site is required, they usually go in a team of two or three, travelling in a mini-van if locations are within a 1000Km radius. Their primary use is for the screening of vehicles possibly being used to transport drugs or having transported them. One of their more successful seizures was a multimillion dollar private jet where they were able to detect narcotics on the yoke (a plane's "steering wheel"). The screening of currency differs from the FBI's in that they sample all the money rather than a portion, and they don't seem to be as comfortable labelling it "proceeds of crime" without extra evidence to support it. They both agreed on vehicle searching methodology and shared the same opinion that a canine unit should be used to highlight an area

of interest if searching large areas such as a building. When a vehicle is searched, the steering wheel, pedals, controls, and drivers seat and vacuumed with one filter. The passenger areas and storage areas are also sampled separately.

Although both the FBI and DEA use Barringer detectors, neither one did an evaluation of equipment offered by other companies, the Barringer unit "just seemed to come along at the right time and was well suited for the job." The latest Barringer Model, the 400, is currently under evaluation at the FBI lab. The 400 is much smaller and lighter than the 350, raising concerns by the labs that it might be more delicate, but the added features and lower price make it attractive.

The visit was of great benefit to me in that a tremendous amount of knowledge about sniffing/screening techniques was obtained and I also learned a great deal about drug enforcement procedures from Cpl. Paradis. These complimentary areas of knowledge will greatly aid the upcoming evaluation of electronic drug detection equipment. The evaluation will involve equipment from several manufacturers and will have 'real world' as well as scientific tests. A video of the proceedings will be made and distributed to Canadian Police Agencies interested in this type of equipment. Continued involvement on my part will be required to set up, run, and provide advice on, technical tests. Future forensic lab assistance may be required in the confirmation step (MS) once the equipment has been purchased and is being used in field operations.

D. McClure
Senior Technologist, Toxicology Section