

PUBLIC SAFETY TECHNOLOGY

... IS IT JUST ANOTHER BUZZWORD ?

Frederick W. Mintz
L. A.P. D. Reserve Officer

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Member of the Technical Staff
California Institute of Technology - Jet Propulsion Laboratory

IN1RODUCTION

Along with the marked increase of both violent and "white collar" crime, in addition to the growing intrusion of internationally based terrorism as well as drug trafficking within the borders of the United States, there is an increasing use of high technology by these criminal elements. Their ability to out-spend local and state law enforcement jurisdictions to buy high technology devices and better weapons, is a cause of growing concern among law enforcement officials at all levels of government. Further, the growing concentration of population, in large, urban centers, provides the basis for both overwhelming calls for service and predictably catastrophic results, when faced with the prospect of a large natural or man-made disaster. Notice, the when...not if. Finally, to compound these problems, the total resources available for meeting the increasingly urgent public demands for service by emergency response agencies, at the Federal, state, and local levels, are: **currently dwindling budgets... and aging equipment !**

The Jet Propulsion Laboratory (JPL) is an operating division of the California Institute of Technology (Caltech) funded through a prime contract with The National Aeronautics and Space Administration (NASA). As a NASA Center, JPL's major mission is to "explore the planets and outer-space". Over the Past forty years, JPL has been singularly successful in meeting this mission through the application of science and engineering technology for spacecraft platforms and instruments. JPL has also earned an outstanding reputation in applying its space science and technology to "urgent National needs", one of JPL's additional mission statements. These projects are carried out through the Technology and Applications Programs (TAP) Division. Most of the TAP projects have been for the Department of Defense with the addition of a few, major programs for the Federal Aviation Agency (FAA) and the Department of Energy (DOE).

Recently, JPL has turned its attention toward the needs of public safety organizations and agencies such as the Federal Bureau of Investigation (FBI), the Office of National Drug Control Policy (ONDCP), the National Institute of Corrections (NIC), and the Los Angeles Sheriffs Department, utilizing state-of-the-art space technology for counter narcotics and custody projects. The success of these projects has led JPL to commit to explore other agencies' needs through the new Public Safety Technology program in the Civil Programs Office.

JPL is seeking to organize and apply the wide range of science and technology, gathered through its many successful space and defense programs, to an equally wide range of needs of public safety and emergency response agencies throughout the United States.

JPL is seeking out, through agency visits and conferences, the priority needs of Federal, state, and local agencies for emergency response, investigative, forensic, and custody technology. Through this on-going information gathering program, JPL seeks to become a center for public safety technology information. JPL is in a unique position to apply, through rapid technology development, its expertise in those scientific and technical areas, which seem to have immediate application to public safety problem statements and needs. Further, through national and international collegial contacts, JPL is in a position to apply inter-agency as well as NASA interdisciplinary science and technology to these needs. Because of its relationship to Caltech and NASA, JPL will not undertake technology development for weapons or remote surveillance instruments. It is strongly felt, however, that there is a large base of technology, of the type which is outlined in this article, that can be rapidly developed to meet the growing demands for public safety technology.

As an example, JPL is currently pursuing three areas of technology development which are a result of explicit needs, presented to this author, by the Los Angeles Sheriffs Department, the Los Angeles County Probation Department, and the California Department of Corrections. These projects were initially funded at the Federal level by the Office of National Drug Control Policy (ONDCP) and the National Institute of Corrections (NIC).

THE REMOTE BIOCHEMICAL ASSAY TELEMETERING SYSTEM (R-BATS)

The County of Los Angeles, Probation Department, under the leadership of Mr. Barry Nidorf, has, for the past decade, used a system for monitoring persons on probation, which comprises a rather large, heavy, metal box, which is strapped to the probationer's ankle. The box contains an electronic, battery powered transceiver, which responds to a signal transmitted from another box, the size of a small VCR, located in the probationer's home. The main transmitter box is queried by a computer, which randomly calls the home-based box over standard telephone lines.

One of the conditions of probation, of course, is that the probationer remain drug free. In order to assess this condition, probationers are tested on a regular basis. The blood or urine test is carried out at County laboratory facilities. The labor and materials costs associated with these tests are high as well as time consuming.

In response to this problem description, given to JPL by Mr. Nidorf, JPL has undertaken a project to miniaturize the location-finding part of the process and remotely automate the drug testing function.

The concept design calls for a wrist worn, solid-state drug detection system, about the size of a large wristwatch, integrated with detection circuits, an alarm device, and a RF

transponder/transmitter. Designed to be used for probationers or parolees to remotely ascertain location and illegal substance abuse, it is felt that this invention will save hundreds of thousands of dollars currently being spent in drug testing programs. The removal of the cumbersome aspects of the ankle-box, is seen as a positive move also.

Figure 1 shows a conceptual drawing of the R-BATS device. It is intended to be about the size of a large calculator watch. Indeed, a simple quartz watch can be incorporated in the final prototype.

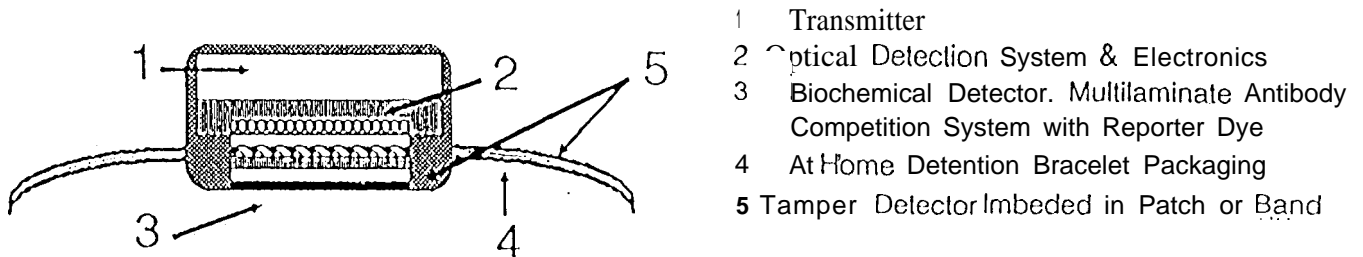


figure 1

Figure 2 is a cross-sectional drawing of the chemical sensor portion of the device. While a laboratory prototype, of this section has been successfully demonstrated, work is continuing toward the miniaturization of this portion of the device.

In operation, the R-BATS system absorbs the sweat from the pores of the human skin and transports this sweat up and through the chemical sensor. Sweat is known to contain metabolites of illegal substances in sufficient quantity to be detected by the chemical system designed by JPL biochemists. (11)

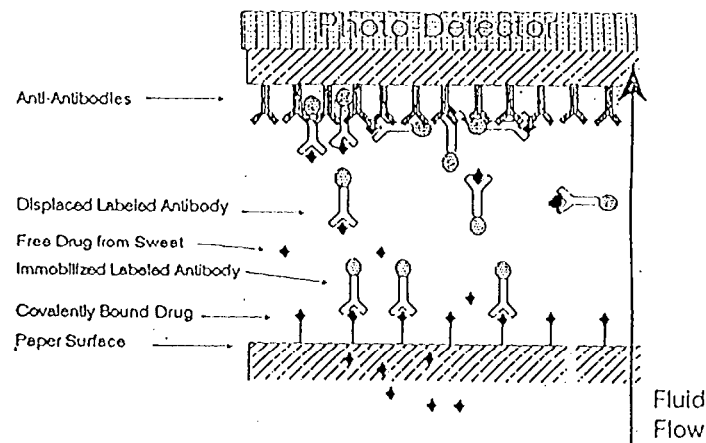


figure 2

When the chemical detection system is activated by the presence of any of the chemicals of interest, this "triggers" an alarm circuit in the miniature radio-frequency (RF) transceiver, built into the upper portion of the device. When the Probation Department computers call the home-box, the R-BATS system transmits a signal code indicating illegal substance abuse.

THE DATA FUSION SYSTEM

The Angeles National Forest is the purview of the Los Angeles Sheriffs Department as well as the U.S. Forest Service. Efforts to locate and eradicate Cannabis farms is difficult, time consuming, and dangerous work. JPL was called upon by Chief Paul Myron, former President of P. O. L. A. C, when he was in charge of the Narcotics Division, of L. A. S. D. to try to find a way to apply JPL remote sensing and image processing expertise to this labor intensive problem.

The Data Fusion System is a computer based prediction system, which integrates multi-levels of geographic information systems (GIS) such as topographic, hydrographic, geologic, and botanical digital maps, as well as satellite and aerial photos, with agency intelligence information. The purpose of the system is to predict, with a high level of accuracy, the location of marijuana farms in a large natural environment (the Angeles National Forest). Although the Data Fusion System is not classified, details of the system characteristics is law enforcement sensitive information.

The first parts of the working system have recently been delivered to the Sheriffs Department and personnel training carried out such that the Narcotics Division is reported to be enthusiastically using the system to confirm known locations of Cannabis farms successfully. A second delivery of system software is due in July, which will allow the Narcotics Division to locate these known farms on satellite pictures.

A number of State agencies as well as agencies outside California have expressed interest in duplicating this system for other terrain.

THE PERSON LOCATOR SYSTEM

Management of custody facilities ^{has} ~~have~~ always been concerned with the need to locate custody personnel, especially during unusual occurrences such as mass disturbances. The California Department of Corrections came to JPL to explore custody facilities' applications of technology such as outer-space radio-communications - an area in which JPL is a world leader. (JPL is still in touch daily with the Voyager I and 11 Spacecrafts, which are currently about 7.5 billion miles from Earth. The Spacecraft transmit on about 10 watts of power !). After a thorough discussion of the problems associated with locating people in a custody facility, JPL accepted the challenge of developing an inexpensive person locating system which could be used for both custody personnel and their "guests of the State".

The Person Locator System is a computer controlled, personal transponder system which graphically depicts the custody facility; and a micro-miniature, multi-transmitter node system which is queried by the computer system, in modes controlled by an operator. Each prisoner wears a wrist band (not detectably different from the currently used bands) which is powered by the remote RF signals of the system, (e.g. it is self-powered by incoming RF energy). The wrist band is programmed externally with a digital code unique to each individual. The prisoner inside the facility can be incrementally or automatically located through a query of the system by the computer operator or a pre-programmed, timed **query**. The perimeter of the facility is

programmed such that any violation of the perimeter is automatically alarmed at the control point as well as at any other points desirable. The wrist band also contains an integrated tamper system such that if the band is stretched or cut, it automatically transponds an alarm signal to the central control unit.

Figure 3 is a diagram of the conceived system. The proof-of-concept for the passive oscillator design is crucial to the success of this technological development, which was successfully demonstrated in March of this year, at a meeting of the National Advisory Board of the National Institute of Corrections, U.S. Department of Justice, which funded this on-going program at JPL.

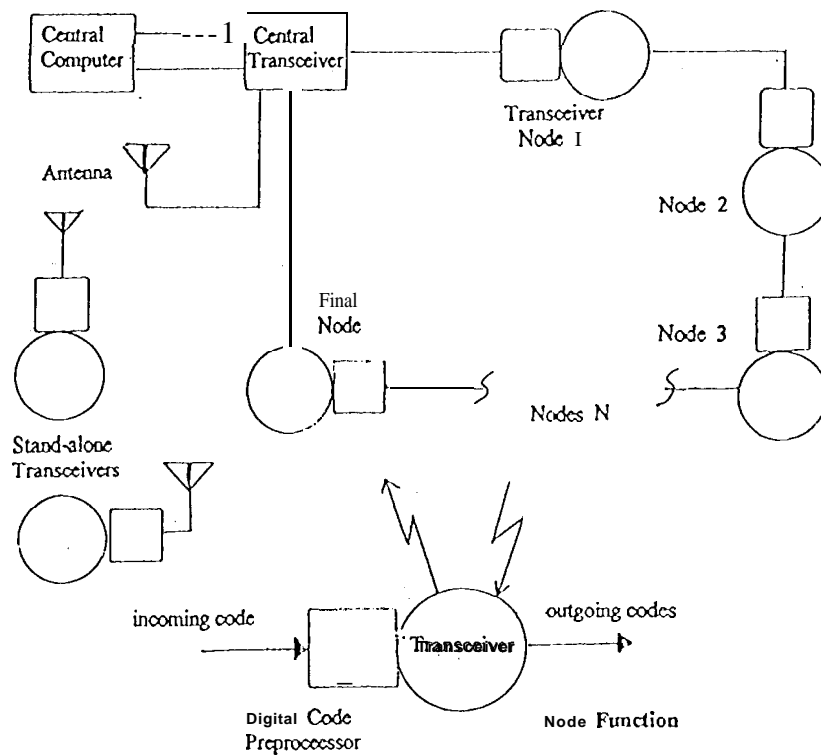


figure 3

A block diagram of the passive transponder is shown in Figure 4. Three functions are performed on the 450 MHz received signal. First, DC voltage (- 2 V) is generated to power the CMOS digital circuit; second, the signal is demodulated with an AM detector circuit generating Rx; and third, a signal twice the received carrier frequency is generated (900 MHz) and functions as the transponder transmit carrier. The received message, Rx is processed by the CMOS digital circuit that in turn generates a transmit message, Tx which is AM modulated on the 900 MHz carrier and transmitted with a half-wave dipole antenna.

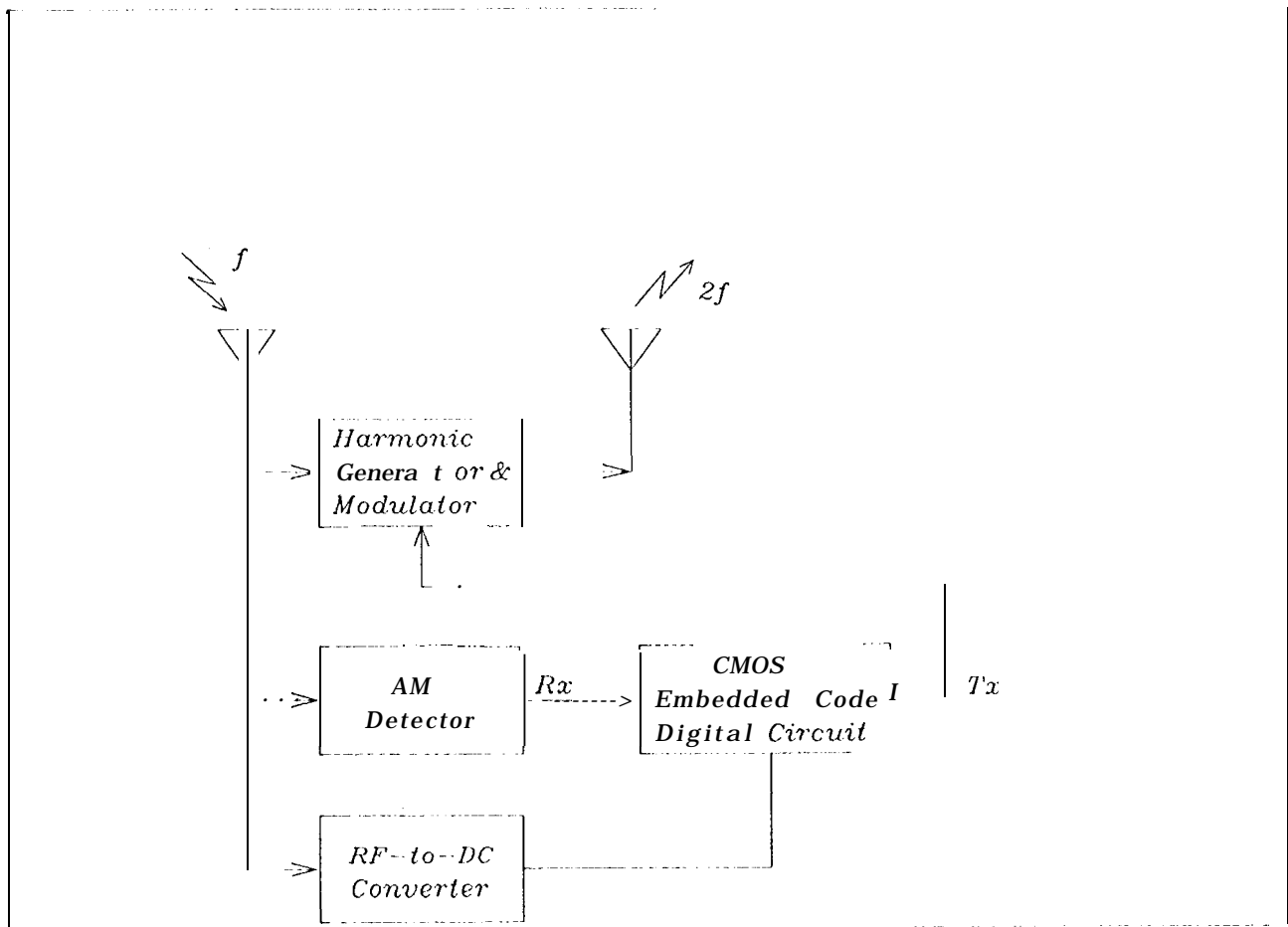


figure 4

The foregoing is but a mere introduction to the numerous uses and applications of technology which the Nation's Space Program could have on law enforcement technology. This author carries a quiver full of ideas which have immediate application to a myriad of tactical, training, and management problems known to exist in law enforcement.

What remains... is the finding of these and other ideas which exist in the minds of colleagues at the other NASA Centers and other National Laboratories.

It always comes down to this.. doesn't it ! Without the necessary funding from the Federal and State levels, local law enforcement will continue to suffer from **dwindling budgets... and aging equipment !**

Fraternally speaking... let us resolve to be diligent... let your voice be heard, at whatever level you have influence... so that "Public Safety Technology", doesn't become... just another buzzword !

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