PULLING BACK THE CURTAIN:
The Inner Workings of the Intoxilyzer 8000

by
Adam
Ellis

Owensboro is a small, largely blue-collar community nestled into a bend of the Ohio River on the Northern border of Kentucky. It is buffered by farmland for miles in every direction and home to MDP, the parent company of CMI, which provides the Florida Department of Law Enforcement with Intoxilyzer 8000 breath test machines. After years of litigation, puerile subterfuge and thousands of dollars in fines levied against CMI, Florida attorneys were finally permitted access to Intoxilyzer 8000 Source Code. In June of this year Stuart Hyman and Joerg Jaeger, along with Source Code expert Dr. Harley Myler made a trip to Owensboro to pull back the curtain on the inner workings of the Intoxilyzer 8000. I made a second trip with Dr. Myler in August to further explore and understand the code.

Source Code is a generic term referring to the set of instructions written by software engineers which are then compiled to create a program. All software, including the word processor used to draft this document, has some form of Source Code. An example might be "IF Volume = < 1.1 liters, THEN Display "Volume Not Met" AND Call Second_Attempt Subroutine."[1] After the Source Code is entered by the engineers, it's compiled into Machine Code. A compiler takes the human input and converts it into something the machine can understand. The compiled Machine Code is then uploaded to the internal memory of the Intoxilyzer 8000 as a file, probably with a name something like "8100.27." The instructions contained in the Source Code for the Intoxilyzer 8000 govern the way the machine behaves; without Source Code (or more specifically, Machine Code) the Intoxilyzer 8000 would be nothing more than an expensive paper weight.

For a city that is nearly in the middle of America, Owensboro is quite remote. Evidently there are no commercial flight options at the Owensboro-Daviess County Airport. Mr. Hyman and Mr. Jaeger flew into Louisville, Kentucky for their trip, where I understand their landing was delayed while coyotes were cleared from the runway. Dr. Myler and I flew into Evansville, Indiana and then drove a rented Volkswagen Routan 45 minutes to sleepy Owensboro, where we encountered an unsurprising lack of entertainment options while waiting for CMI to open for business the following morning.

We arrived at a small, unmarked building formally known as CMI headquarters at 8:00 in the morning on August 25, 2011. As we approached the building we were received by CMI's Chief Engineer, Brian Faulkner, who was affable, but far from warm as he directed our attention to a large Department of Defense security warning posted on the doorway of the building. Although the Intoxilyzer 8000 has absolutely nothing to do with the Department of Defense, evidently the small vacuum tubes manufactured by MDP for use in military helicopters and satellites fall within the DOD purview. I

can only surmise that someone thought a purported DOD warning against attempting to leave the facility with Source Code or photographs would have more impact than the same warning coming from CMI. After being warned we were led down the hallway of a seemingly empty building, past several closed doors bearing "off limits" signs, to a small room where we were instructed to leave cellular phones, cameras and any digital devices capable of recording or transferring data. The entire exchange with Mr. Faulkner was awkward, to say the least; it was difficult to discern if he was simply annoyed by our presence or genuinely concerned about what we might find and how it might affect his career. We were then led to another room where we were introduced to a security guard, who we later learned was a local high school graduate awaiting deployment with the Marines. He found the two-day job online through a temporary employment agency and accepted CMI's offer to pay $11 an hour to ensure Dr. Myler and I didn't attempt to steal anything. The guard's room was directly adjacent to the Source Code room, and the two rooms were separated by a large sliding glass door which afforded the guard a view of everything we were doing.

Inside the Source Code room we found an HP desktop computer plugged directly into an Intoxilyzer 8000 via serial port connection. Plugged into the Intoxilyzer was a wet bath solution churning away in a small glass jar. We were also presented with a revision history for the Source Code, which was incomplete; it began with the update from version 8100.13 to 8100.16, which evidently took place on April 16, 2004. A complete revision history is necessary to develop a complete understanding of how the code works, but despite having agreed to provide us with the same, CMI has failed to do so to-date. Passwords for the CORBA interface (software which allows FDLE to download data from the individual Intoxilyzer machines to a database in Tallahassee) were also provided, along with passwords

for menus 1-3 on the Intoxilyzer itself. Upon examining the machine I realized there was also a level 8 menu for which CMI did not initially provide a password. Despite CMI's continued refusals to fully comply with the terms of our agreement, the examination proceeded. We were focused on versions 8100.26 and 8100.27 of the code. The .26 version occupies 12.1 MB of disk space, while the .27 version weighs in substantially larger at 18.5 MB, or 29,670 lines of actual code.

Dr. Myler was able to piece together that the machine contains a separate DSP (Digital Signal Processor) in addition to the primary processor (which operates at a mere 40 MHz) during the first day of our visit. DSPs are specialized processors designed to process data quickly and repetitively, and are normally used in applications where processor latency is unacceptable, such as the Dolby Digital 7.1 decoder found in home theater systems. Without a powerful DSP in your home theater system, you may well hear the squeal of car tires on the starting line when the race is already over on the screen. Similarly, the ability to process data in real time from the 3- and 9-micron sensors within the Intoxilyzer 8000 is critical; timing is everything. The Intoxilyzer 8000 runs DSP version 1362.14 on an 8051 chip. The DSP has a separate and distinct Source Code associated with it, which is a significant piece of the puzzle because it appears that the raw data from the 3 and 9 micron sensors is analyzed, rounded and truncated by the DSP before being passed on to the primary processor for the remaining calculations. We asked CMI to produce the Source Code for the DSP and the level 8 password when we resumed our analysis on the morning of August 26, and were informed just before lunch that the level 8 password would not be provided, and that the DSP Source Code would probably not be provided any time that day due to the amount of time required to produce it. When asked how long it would take to simply copy the Source Code to a thumb drive and walk it over, CMI responded with nonsensical runaround

one would expect from a company trying to delay proceedings. Needless to say, CMI acquiesced and provided the level 8 password early in the afternoon on Friday, but not before we wasted considerable time attempting to work around the problems created by their initial flat refusal. The bigger issue at the time was the DSP Source Code. Although the examination was scheduled to end at 4:00, CMI finally provided the DSP Source Code at 4:50 on Friday afternoon. The DSP Source Code is substantially smaller than the primary code, weighing in at 2,416 lines of code including 1,066 lines of comments. Despite the smaller size, a thorough examination of the DSP Source Code was rendered impossible by CMI's dilatory tactics in producing it at the eleventh hour.

I was required to sign a non-disclosure agreement with CMI acknowledging that I may be sued for any unsanctioned disclosures of allegedly privileged material I viewed during my trip as a prerequisite for viewing the Source Code. The details provided in this article are from the notes I made during the examination, which CMI read before I left the facility. CMI had the option of stamping my notes as "confidential," which would have prevented me from disclosing the contents thereof; however, CMI elected not to exercise that option with my notes; only Dr. Myler's notes were stamped. While there is certainly more to the story, I am reluctant to relay it for fear of being sued. For now we are anxiously awaiting Dr. Myler's official report, with the expectation that it will provide a new level of understanding about the functionality of the mysterious Intoxilyzer 8000. While further research and Source Code examination is required, it is now evident that the Intoxilyzer 8000 is far from flawless. The next step in the process is quantifying the flaws and determining the extent of their impact upon the citizens of Florida who submit to breath tests. 🏛

[1] This "Source Code" is completely fictional, and used for illustrative purposes only.

ADAM ELLIS practices criminal defense as an Assistant Public Defender at the Office of James Owens in the First Judicial Circuit in Pensacola. He has worked in both the public and private sector as a civil plaintiff's attorney since becoming licensed to practice in 2007. He graduated from Thomas M. Cooley Law School with an honors scholarship before moving back to Florida to sit for the Bar.