



RANSOMWARE

PROTECTION PLAYBOOK

ROGER A. GRIMES

WILEY

Ransomware Protection Playbook

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Roger A. Grimes

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This book is dedicated to my wife, Tricia. She is always the brightest light in any room, blotting out the sun with her smile, beauty, kindness, brilliance, and laughter. People like me better after meeting her.

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and is usually the smartest person in the room on any Microsoft technology subject she's interested in.

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Introduction

I've been doing computer security since 1987, for more than 34 years now. I remember the first ransomware program I, or anyone else alive at the time, saw. It arrived in December 1989 on a 5-1/4" floppy disk and quickly became known as the *AIDS PC Cyborg Trojan*.

Wess didn't call it ransomware then. You don't make up entirely new classification names until you get more than one of something, and at the time it was the first and only. It remained that way for years. Little did we know that it would be the beginning of a gigantic digital crime industry and a huge blight of digital evil across the world in the decades ahead.

It was fairly simple as compared to today's ransomware programs, but it still had enough code to thoroughly obfuscate data, and its creator had enough moxie to ask for \$189 ransom in order to restore the data. The story of the first ransomware program and its creator still seems too strange and unlikely even today. If someone tried to duplicate the truth in a Hollywood hacker movie, you wouldn't believe it. Today's ransomware creators and gangs are far more believable.

Dr. Joseph L. Popp, Jr., the creator of the first ransomware program, was a Harvard-educated evolutionary biologist turned anthropologist. He had become interested in AIDS research and was actively involved in the AIDS research community at the time of his arrest. How he got interested in AIDS research isn't documented, but perhaps it was his 15 years in Africa documenting hamadryas baboons. Dr. Popp had co-authored a book on the Kenya Masai Mari Nature reserve in 1978 (<https://www.amazon.com/Mara-Field-Guide-Masai-Reserve/dp/B000715Z0C>) and published a scientific paper on his baboon studies in April 1983 (<https://link.springer.com/article/10.1007/BF02381082>). AIDS is thought to have originated from nonhuman primates in Africa, and those theories were starting to be explored more around the same timeframe as people searched for "patient zero." Dr. Popp was in the right place at the right time. His study of one could have led to the other.

Back in the late 1980s, AIDS research and understanding was fairly new and very rudimentary. There was still a widespread fear of the relatively new disease and how it was transmitted. Unlike with today's treatments and antivirals, early on, getting HIV/AIDS was a death sentence. At the time, many people were afraid of kissing or even hugging people who might have AIDS or were in high-risk groups. There was great interest for the latest information and learnings, inside and out of the medical community.

No one besides Dr. Popp knows why he decided to write the world's first ransomware program. Some have speculated he was disgruntled at not getting a much-desired job in the AIDS research industry and wanted to strike back, but it can just as easily be stated that he just wanted to make sure he got paid for his work. Still, there are definite signs of hiding and malevolent intent from a man who knew his creation would not be taken well. It's hard to say you didn't know something was illegal when you try to hide your involvement.

Dr. Popp purchased a mailing list of attendees from a recently held October 1988 AIDS conference in Stockholm put on by the World Health Organization and purportedly also used the subscriber lists of a UK computer magazine called *PC Business World* and other business magazines.

Dr. Popp created the trojan horse program using the QuickBasic 3.0 programming language. It must have taken him months of code writing and testing. When he was finished, he copied it onto more than 20,000 disks, applied labels, printed accompanying usage instructions, applied postage manually, and then mailed them to unsuspecting recipients in the United States, United Kingdom, Africa, Australia, and other countries. Dr. Popp must have had help doing all of this, because creating 20,000 software packages and manually applying postage would likely have taken weeks and weeks of work by one person. But no other person's involvement was ever declared in court documents or volunteered by Dr. Popp.

The trojan floppy disk was labeled "AIDS Information Introductory Diskette" (see Figure I.1).

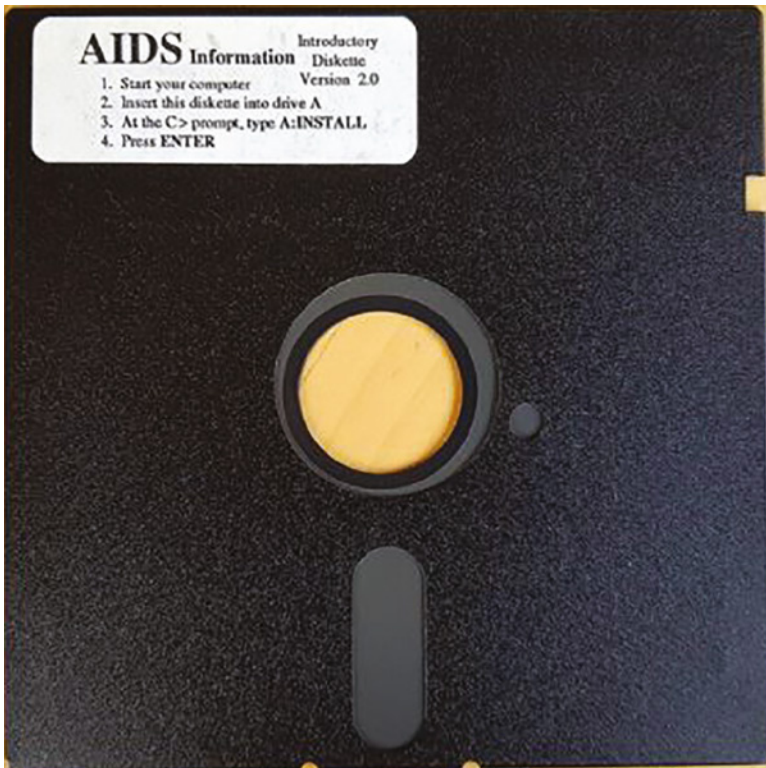


Figure I.1 Picture of disk that AIDS PC Cyborg trojan arrived on
Courtesy Eddy Willems

The floppy disk instructions introduced the disk as purporting to be a program with information about AIDS. After viewing, the user would be asked a series of personal behavior questions. The answer to those questions would be used to give the user a report on their personal risk of getting AIDS along with recommendations on how to avoid getting it.

The instructions included the warning, "If you use this diskette, you will have to pay the mandatory software licensing fee(s)." This latter warning would later be used by Dr. Popp in his defense as to why his program should not be considered illegal extortion. You can see the instructions and ominous warning in Figure I.2.

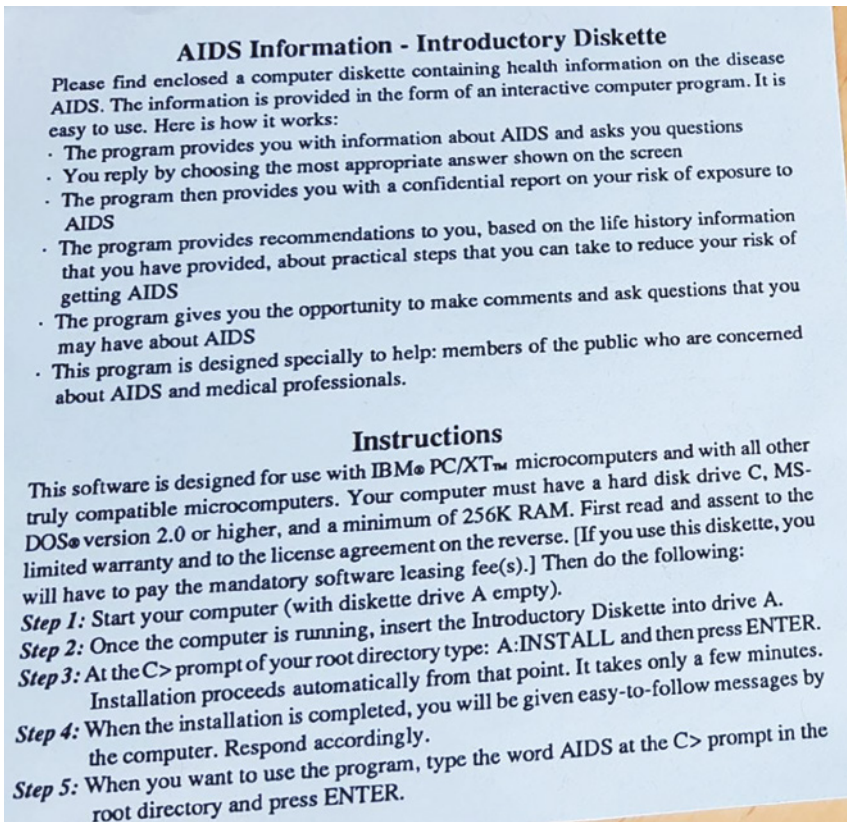


Figure I.2 Picture of AIDS PC Cyborg Trojan disk program instructions
Courtesy Eddy Willems

Further, when the trojan program was first run, it printed a license and invoice to the screen and to the printer if the PC was connected to a local printer. The license told users they must pay the software license and even included another ominous warning that you are unlikely to see on any legitimate software program:

“If you install [this] on a microcomputer. . .

then under terms of this license you agree to pay PC Cyborg Corporation in full for the cost of leasing these programs. . .

In the case of your breach of this license agreement, PC Cyborg reserves the right to take legal action necessary to recover any outstanding debts payable to PC Cyborg Corporation and to use program mechanisms to ensure termination of your use. . .

These program mechanisms will adversely affect other program applications. . .

You are hereby advised of the most serious consequences of your failure to abide by the terms of this license agreement; your conscience may haunt you for the rest of your life. . .

and your [PC] will stop functioning normally. . .

You are strictly prohibited from sharing [this product] with others. . .”

Just like today, most people didn't read software license agreements. Normally it's not a problem, but in this case not reading the license agreement with its unusual dire warning would take on special importance. In the late 1980's, a large percentage of users also didn't pay for any commercial software they were not forced to pay for. Software was routinely illegally copied and traded. It was incredibly common for people to copy disks for their friends or even sell (even if they hadn't paid the original developer). Local computer clubs held monthly disk swaps. If you didn't have to pay for software, you didn't. In response, some developers created “copy protection” routines that prevented easy, standard disk copying.

The author has seen other malicious programs and sites include similar “fair warnings” in their licensing information. It never hurts to read your end-user license agreements instead of simply trying your best to ignore and quickly get by them.

Dr. Popp either didn’t know how to do legitimate copy protection or he counted singularly on his peculiar ransom enforcement for people who ignored his licensing instructions. Maybe he got the idea from an earlier malware program. In 1986, the first IBM PC-compatible computer virus, Pakistani Brain ([https://en.wikipedia.org/wiki/Brain_\(computer_virus\)](https://en.wikipedia.org/wiki/Brain_(computer_virus))), was created as a copy prevention mechanism. Its Pakistani creators were tired of people illegally copying without paying for disks they had themselves often illegally copied. You can’t make this stuff up. It caused boot problems and indirectly might have caused some people to pay money to the inventors to resolve. The malware, however, did not encrypt anything nor directly ask for a ransom.

There is a chance that Dr. Popp saw his ransomware program as simply a way to legally enforce his copyright and software license. There were warnings in at least two places clearly visible to users who used his software. In comparison, today’s ransomware programs never give any warning. So perhaps, in only that way, Dr. Popp’s creation was a slight bit more ethical than today’s ransomware programs. But being a slight bit more ethical criminal among more unethical criminals is not a particularly high standard that anyone should want to be measured against.

Either way, the first time Dr. Popp’s program was run by a user, it would install itself on the local hard drive (C:) and modify the `autoexec.bat` file to use as a boot counter. After the involved PC was booted 90 or so times, the program would encrypt/obfuscate the user’s files and folders. It would then display the message shown in Figure I.3.

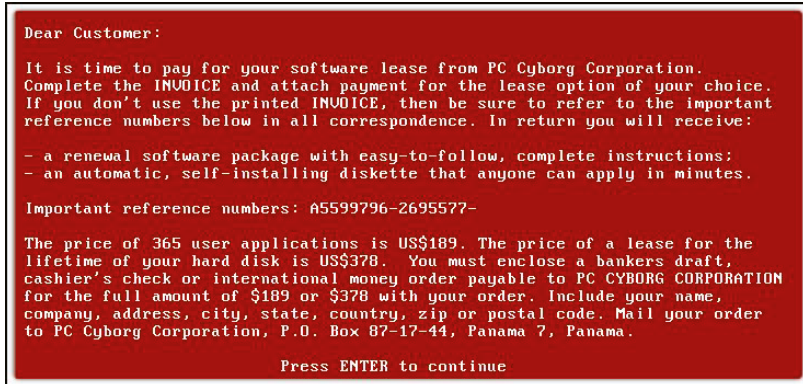


Figure I.3 Picture of AIDS PC Cyborg Trojan ransomware screen instructions
Courtesy Wikipedia

No one knows why Dr. Popp put his trigger counter at 90. Perhaps he estimated that most people booted their PCs about once a day during the work week, and 90 workdays was more than enough time for someone to send payment for their program and for him to return a “block the lock” executable disk.

Dr. Popp had created a company with the name of PC Cyborg, which would lead to the naming of the virus. The name was shown in the original license and in the after-the-fact ransomware warning, along with asking for \$189 for an annual “license” or \$389 for a “lifetime license” to be sent to a Panama post-office box. It was this information that led to his quick identification and arrest. Today’s ransomware purveyors use hard-to-identify-true-ownership cryptocurrencies to avoid the same easy identification and detection by authorities.

Dr. Popp had clearly tried to hide his identity and original involvement with his creation. As is still true today, it is common for unethical people trying to hide their identity and financial gains to

use offshore corporations and accounts. At that time, Panama was popularly used as a financial and tax avoidance safe haven much as the Cayman Islands and other offshore islands are used today.

When the trojan's program payload ran, before the ransom instructions were shown, it did some rudimentary symmetric encryption to the files and folders. It would move all the existing files and subdirectories into a new set of subdirectories under the root directory, rename them, and enable DOS' "hidden" attribute features on each file and folder, which made them seem to disappear. All the files and folders would also be renamed using "high-order" extended ASCII control characters, which made everything appear as being invisible. Even if the DOS hidden attribute was discovered and turned off, the file and folder names looked corrupted. If the impacted user tried to do some common exploratory commands to see what happened, the malicious code brought back a fake DOS screen with fake results to confuse the user.

The main set of malicious subdirectories were created using extended ASCII character 255, which is a control code that looks like a space even though it is not. But like a space, it would not display on the screen or when printed. For all intents and purposes, all the files and folders appeared, to most users, to have disappeared or at least badly corrupted. But, importantly, none of the files were actually encrypted (unlike today's ransomware programs). The names of the files and folders were just renamed and moved.

The ransomware program created a conversion table that could be used to reverse the moving and renaming. If you found the table and understood what the trojan program did, you could convert everything back to the original file and folder names and locations. Several individuals figured this out and wrote "fix-it" programs, including early computer virus expert Jim Bates.

Bates created a free 40-page analysis report of the trojan that he would send to anyone who requested it, and he published a shorter, but still great, analysis in the premier antivirus journal *Virus Bulletin* (<https://www.virusbulletin.com/uploads/pdf/magazine/1990/199001.pdf>.) in January 1990. Bates revealed the many dubious routines of the program including the multiple steps