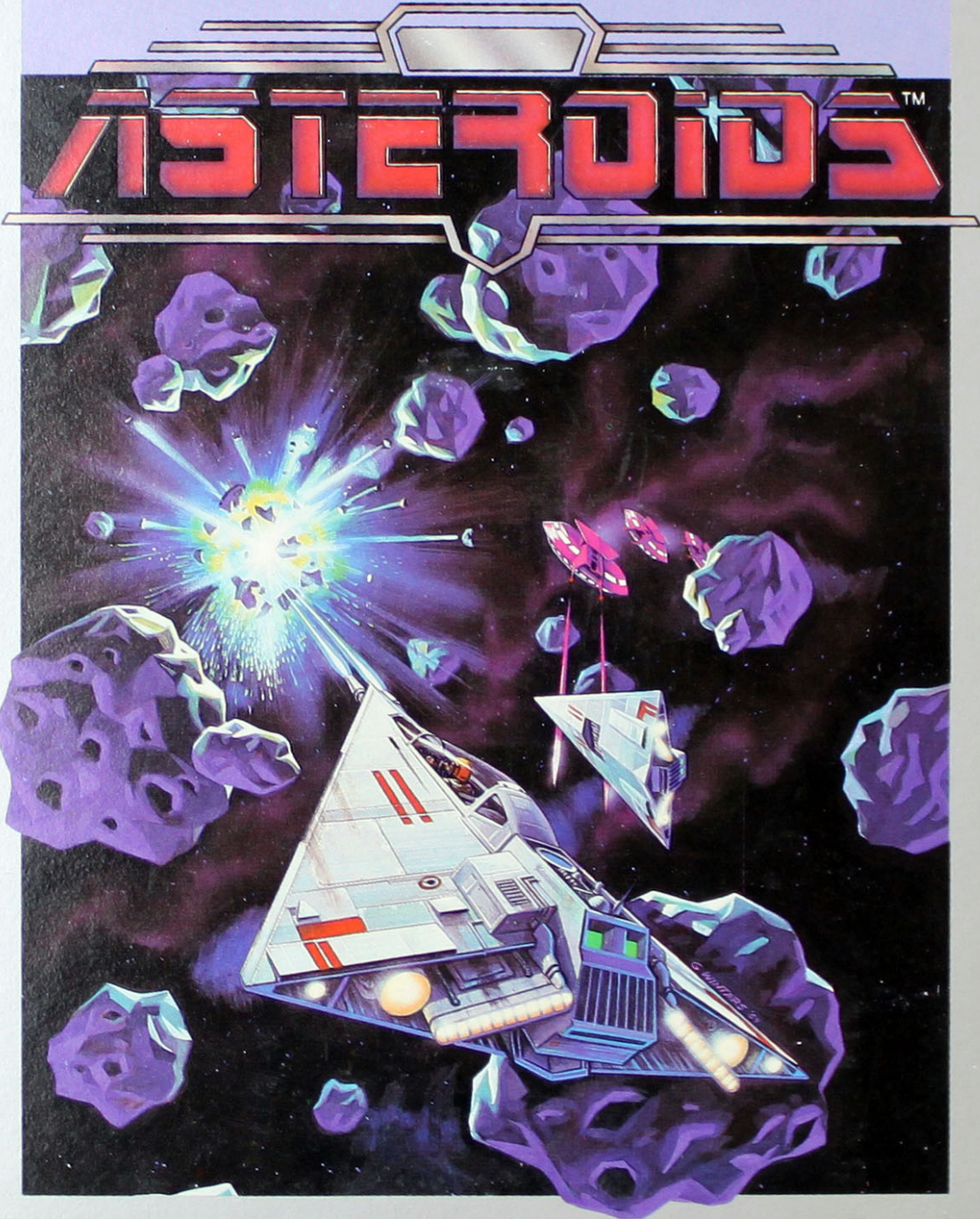


Digital forensics rescues retro video games and software

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ATARI® **7800**TM VIDEO GAME CARTRIDGE

The Ultimate Astral Classic



The box cover for Asteroids for the Atari 7800 gaming system, one of roughly 25,000 titles of vintage video games and productivity software applications in the Stephen M. Cabrinety Collection in the History of Microcomputing. Credit: Department of Special Collections, Stanford University Libraries.

Starting in the mid-1980's, a young man named Stephen Cabrinety filled his home with video games and software. Unopened boxes were piled to the ceilings—everything from early word processing programs such as WordStar to vintage releases of Pong, Doom and SimCity. Although at the time some might have thought he suffered a peculiar obsession, today the Cabrinety collection is considered a priceless snapshot of our culture—one captured just as the digital tsunami that would forever change our civilization was hitting our shores.

Cabrinety did not live to see what would become of his efforts—he died of Hodgkin's lymphoma in 1995 at the age of 29—but his collection has achieved a sort of digital immortality. The Stanford University Libraries, which acquired the collection in 2009, and the National Institute of Standards and Technology (NIST) have just completed a multi-year effort to rescue the collection's digital content from the Atari game cartridges, 5-1/4 inch floppy discs, magnetic tape and other deteriorating storage media that held it. That salvaged data is now safely archived on servers at the Stanford Digital Repository and has been added to NIST's National Software Reference Library, a resource that supports digital forensic investigations.

The Cabrinety collection includes some 25,000 software and [video game](#) titles, as well as the original box covers and other period artwork they shipped with. The collection also includes game consoles, magnetic tape

readers, bulky hard drives, and other relics of the era.

This collection has obvious appeal for retro gamers, but its value is much more than nostalgic.

"Most of human culture today is created and consumed using digital software," said Henry Lowood, who, as curator of the History of Science and Technology Collection at the Stanford University Library, led the library's effort. "How we write has changed. How we communicate has changed. Art, education, entertainment have all been changed by the advent of computing and software. We wouldn't be able to say much about the evolution of human culture in the late 20th century without collections like these."

Digital Forensics Meets Cultural Preservation

Every time a book is published, a copy is deposited at the Library of Congress. Other institutions are dedicated to archiving music and film. But there is no single repository where software goes to be preserved for the ages.

There is one that comes close, however: NIST's National Software Reference Library (NSRL), a vast and constantly updated archive of software titles in their numerous versions. The NSRL is the largest collection of its kind in the world that is publicly known.

NIST maintains this collection not to preserve cultural history but to provide a forensic tool for law enforcement and national security investigators. NIST runs every file in the NSRL through a hashing algorithm that generates a virtually unique digital fingerprint for each—over 180 million of them so far—and makes them publicly available. When investigators seize a computer as evidence, they use those digital fingerprints as a known file filter, so they can quickly

separate irrelevant files from those that might contain evidence.

For instance, after Malaysia Airlines flight MH370 disappeared somewhere over the Pacific in March 2014, the FBI called NIST. "They wanted every hash of every file associated with every flight simulator we had," said Doug White, the NIST computer scientist who runs the NSRL. "All the maps. All the routes. They wanted every flight path the pilot might have practiced on, so they could figure out where he might have gone."



The box cover for SimCity for Macintosh computers, one of roughly 25,000 titles of vintage video games and productivity software applications in the

Stephen M. Cabrinety Collection in the History of Microcomputing. Credit: Department of Special Collections, Stanford University Libraries.

A Dream Assignment

It takes a particular personality to spend one's life feeding the NSRL. You would need the passion of a collector, the sensibility of a curator, the technical skill of a computer scientist, and the ability to find satisfaction in a job that you know will never be done.

In other words, you'd have to be a bit like Stephen Cabrinety. And in fact, White does share a number of traits with the man whose collection he's helped to preserve.

"We're just one year apart in age. We both grew up in East Coast suburbs. And I'm also a bit of a collector," White said, gesturing sheepishly at the towering piles in his office.

So when NIST and Stanford University teamed up on the project, it was a dream assignment for White. He remembers the day in 2012 when the first box from Stanford arrived at the NIST campus in Gaithersburg, Maryland. Inside were early versions of Doom and SimCity, still in their shrink-wrapped boxes.

"For me, it was like opening King Tut's tomb," White said.

Those titles were printed on 5-1/4 inch floppy discs, and extracting the data was relatively straightforward. Other titles presented greater challenges, such as those that were published on audio cassette tape. To load up those programs, you play the sound into a computer.

"It sounds like a modem squeal, with all the hiss and static," White said. Different manufacturers formatted the sound differently, and White had to find documentation for each. "Sinclair computers stored it one way. Commodore stored it another."

A Visionary's Legacy is now Secure

So, can you log in to the Stanford University Library server and play the earliest version of Activision's Pitfall! in your browser?

Not yet, said Lowood. "Our first priority was to make sure that the data survived." Now that it has, the Stanford team hopes to begin working on systems that will load the games and applications. In the meantime, the collection is available for viewing at the Stanford University Library.

The partnership between Stanford and NIST was a boon to both. Stanford benefited because, even though the NSRL is principally used for forensic investigations, it turned out to be perfectly suited for this type of cultural preservation. And NIST benefited by adding a large volume of [software](#) to the NSRL, some of which still turns up when old hardware is included among evidence seized in an investigation.

But for all the work by experts at NIST and Stanford, the most important partner in this project was the one who came first. Cabrinety was more than a collector. His dream was to create an educational and research archive for future generations to study. In 1989, when he was all of 23 years old, he founded CHIPS—the Computer History Institute for the Preservation of Software, arguably the first nonprofit institution of its kind. Cabrinety died too young, but with his collection now saved for posterity, his dream lives on.

More information: www.nsrl.nist.gov/

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