The Burroughs Corporation and Its Innovative Architecture

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

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INTRODUCTION

THE BURROUGHS CORPORATION

The Burroughs Corporation created computing machines primarily for the banking industry. It evolved from the American Arithmometer Corporation (AAC), which originally sold various types of accounting machines. AAC was formed in 1886 in St. Louis, Missouri to sell the adding machine invented by William Seward Burroughs. In 1903, after having made a profit of $600,000, the company decided to relocate in order to expand its manufacturing capabilities. The move to Detroit, Michigan was completed in 1904 (Gray and Smith 2003).

In 1905, the name was changed to the Burroughs Adding Machine Company (BAMC), in honor of William Seward Burroughs, who had died in 1898. That same year, BAMC sold more than 15,000 machines (Gray and Smith 2003). Over the next fifty years, Burroughs grew into the biggest adding machine company in the United States. It introduced many different products, including assorted variations of the basic adding machine, typewriters, check protectors, and finally, computers.

During World War II, Burroughs applied its manufacturing expertise to producing the Norden bombsight for the U.S. Air Force. This meant that by the end of the war, the company was virtually debt free, but needed a new area of business on which to focus. It was for this reason that John Coleman, then company president, decided to transition the company's manufacturing sights on computers, an up-and-coming technical area. He hired Irven Travis from the University of Pennsylvania's Moore School of Engineering to establish a computer research center in Philadelphia so that the company could draw on the Moore School's expertise (Gray and Smith 2003).

In 1953 the BAMC was renamed the Burroughs Corporation to reflect the broad scope of products, which it manufactured. While it still produced adding and calculating machines, especially for banks and similar institutions, the company began to focus more heavily on the computer field, leading Burroughs Corporation to purchase ElectroData Corporation for its Datatron 205 and 220 models (Morgan 1953).

While Burroughs continued to develop this family and excel in the technology arena, it was losing the battle to IBM's superior sales force in the business arena. A lucrative sector was the Government Systems Division in Paoli, Pennsylvania established in order to compete with IBM, which designed and delivered the D825 for NSA, SAGE, and other government projects.

In order to compete with IBM, Burroughs focused on reducing the semantic gap that existed between programming languages and hardware architectures. Burroughs bridged the gap by aligning hardware with the high-level languages. The resulting B5xxx/6xxx/7xxx series large-scale systems were stack machines that efficiently executed ALGOL. The operating system, called the Master Control Program (MCP), was programmed in an ALGOL-variant called ESPOL - Executive Systems Programming Oriented Language, almost a decade before UNIX, the first OS to be written in a high-level programming language.

The medium-scale machines, the B28xx/38xx/48xx series, were focused at the business world and executing COBOL (thus everything was done with BCD including addressing memory. Figure I-1 presents the Burroughs logo.

Figure I-1. Burroughs Logo
Source: Burroughs 1967bb
Courtesy of Unisys Corporation

The B1700/1800/1900 series, also known as the B1000 series, was perhaps the only "universal" solution from this perspective because it used idealized virtual machines for any language. The B1000 series is described in a forthcoming volume tentatively entitled *Microprogrammed Machines*.

In 1962, Burroughs announced the B5500, perhaps the most revolutionary computer system ever built for computing. Few people realize how many innovations introduced with the B5500 permeate the computer industry today. It was the first commercial computing system to use virtual memory.

Burroughs also abandoned the concept of a machine being oriented to business or scientific applications and sold the machine into both communities. It introduced the concept of programming a computer system in a high-level programming language, ALGOL. And, it was one of the first machines to operate at 1 MHz or better.

Burroughs had worked with System Development Corporation (SDC) of Santa Monica, California in the early development of SAGE. SDC performed research and analysis for many government agencies over the years. Burroughs acquired SDC in 1980, which provided Burroughs with an analytical arm and a possible entry into government agencies where it might be able to sell its machines. This entry did not significantly materialize and Burroughs was unable to gain market share.

In September 1986, Burroughs merged with Sperry Rand Corporation to form the Unisys Corporation, which yielded the second largest computer manufacturing company in the United States. This merger brought together two of the original mainframe companies into a single entity which continues to exist today and still supports both the Univac and Burroughs architectures and operating systems.

A contest was held to name the new company, which emerged as Unisys – from UNited Information SYStems. The name Burroughs disappeared from the ranks of computer manufacturers although its machines continue to be manufactured by Unisys as the Libra series of machines (circa 2022). In the beginning, it was unclear whether the company would thrive given that it had two incompatible computer families. However, it successfully successfully navigated the issues of maintaining two largely incompatible architectures by emulating them on commodity microprocessors.

As at the time of writing, Unisys is one of two mainframe manufacturers – the other, of course, being IBM. It is interesting that both Unisys (from ERA, Remington Rand, Univac, etc.) and IBM were there at the beginning of the computer industry and continue to exist to this day.

William Seward Burroughs (Abt. 1855 – 1898)
In the 1870's, Burroughs began his career as a bank clerk in the Cayuga County National Bank in Auburn, New York. Eventually, he returned to work in his father's shop where he built models for casting. Convinced that there was a better way to do arithmetic computations for banking, Burroughs designed and created a machine to carry out the computations. After his initial machine was found to be impractical, he and several businessmen organized the American Arithmometer Company (AAC) in St. Louis, St. Louis, Missouri. Through trial and error, he developed a machine that was practical and easy to use. He was granted a patent for the machine in 1888. In 1897, Burrough received the John Scott Medal from the Franklin Institute in Philadelphia, Pennsylvania for his invention. It became a commercial success, but he died before seeing much money from it. By the time of his death in 1898, AAC was manufacturing calculators for sale in the U.S. and Great Britain. Source: Wikipedia, History-Computer UNK.

Burroughs developed several families of machines – the B200 series, the B1000 series, the B2500/3500 series, the B5xxx/6xxx/7xxx series, and the D8xx Series. The B8500, based in part on the D8xx series, will be described in this volume. Figure I-2 is a Burroughs advertisement that ran in *Scientific American* in September 1968.

Note: The Burroughs D8xx machines will be described in the forthcoming volume entitled *Special Machines: Military Computers and Unique Architectures*.

Caveat

Any errors are the responsibility of the author alone – whether they be of omission or commission. Comments and suggestions related to edits and amendments to the book are welcomed by the author. They will be acknowledged with appropriate citation.