

Whirlwind, the Physical Artifact

Supplemental material for

Recovering Software for the Whirlwind Computer

Author: Guy Fedorkow

Affiliation: Independent Scholar

Email: fedorkow@mit.edu

Version 05a, Oct 16, 2020

Abstract

The late 1940s were seminal years in the development of electronic digital computing machines, as researchers began to realize the enormous potential held by these machines. One of these new generation of computing devices was the vacuum-tube Whirlwind computer, designed in the late 1940s at the Massachusetts Institute of Technology. Designed from the start for real-time control applications, Whirlwind evolved to be a key element in a proof of concept for national air defense. The paper starts with a review of Whirlwind and its evolving software environment, goes on to describe the current effort to decode some of the Whirlwind software artifacts remaining in museum archives, and then describes some of the material the work has made accessible, allowing us to further study some of the innovative procedures developed during that formative decade.

1. Introduction

The late 1940's were seminal years in the development of electronic digital computing machines. ENIAC was showing what could be done with vacuum tubes, the famous *First Draft of a Report on the EDVAC* was published, both EDSAC and EDVAC were being built to embody the stored-program paradigm. At the same time, World War Two and the subsequent Cold War demonstrated the critical value of faster methods of doing massive computations.

Design of the vacuum-tube Whirlwind computer was also undertaken in the late 1940's, at the Massachusetts Institute of Technology. Unlike other machines of the day being designed to compute mathematical functions such as ballistic firing tables, the Whirlwind program had its start at the Servo Mechanisms Laboratory, with funding from the US Office of Naval Research, as a means of solving mathematical equations in real time for man-in-the-loop aircraft simulation.

This note gives a brief summary of the Whirlwind hardware, and the fate of this one-of-a-kind research machine.

1.1 The Physical Artifact

Whirlwind was a large machine; aside from a notorious price tag,¹ it occupied a lot of floor space. The machine was assembled in a building used to house the Whirlwind development and team, known as the Barta Building². About 2,500 square feet of space on the second floor was dedicated to the CPU, with additional space on the first floor for magnetic drum storage, and power conversion equipment in the basement. Figure 2 shows the floor plan as of 1952 (while Electrostatic memory was still in use, before installation of magnetic core memory).

Although the term would not be invented for decades, Whirlwind could be thought of as a *bit-slice* machine, modularized into racks that contained all the functions needed for a single bit of the sixteen required to make the full machine.

This can be seen in Figure 2, the machine room floor plan, where each of the three central rows of racks contain sixteen identical racks, each providing one bit worth of processing. Figure 3 shows the physical partitioning superimposed on the block diagram.



Figure 1: Flip-Flop and Electrostatic Storage Racks

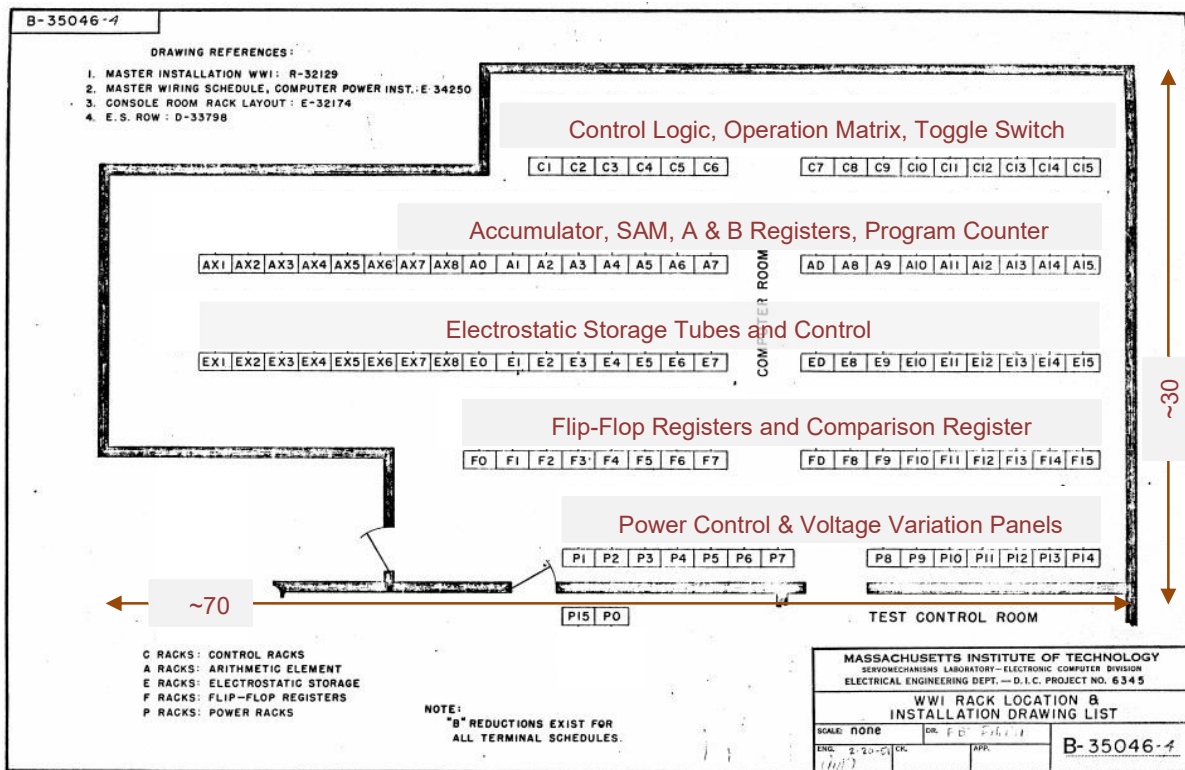


Figure 2: Barta Computer Room Floor Plan

¹ See https://dome.mit.edu/bitstream/handle/1721.3/45943/MC665_r28_L-11.pdf. The expenditures up to Jun 30, 1949, plus the estimated budget to June 30, 1950 add up to \$3,864,000, much more than any contemporaneous computer development.

² As of 2020, the Barta Building is still there, at 211 Massachusetts Ave in Cambridge, MA, although it has been renovated several times. The Whirlwind development in the Barta Building is marked by an IEEE plaque, Dedication #124

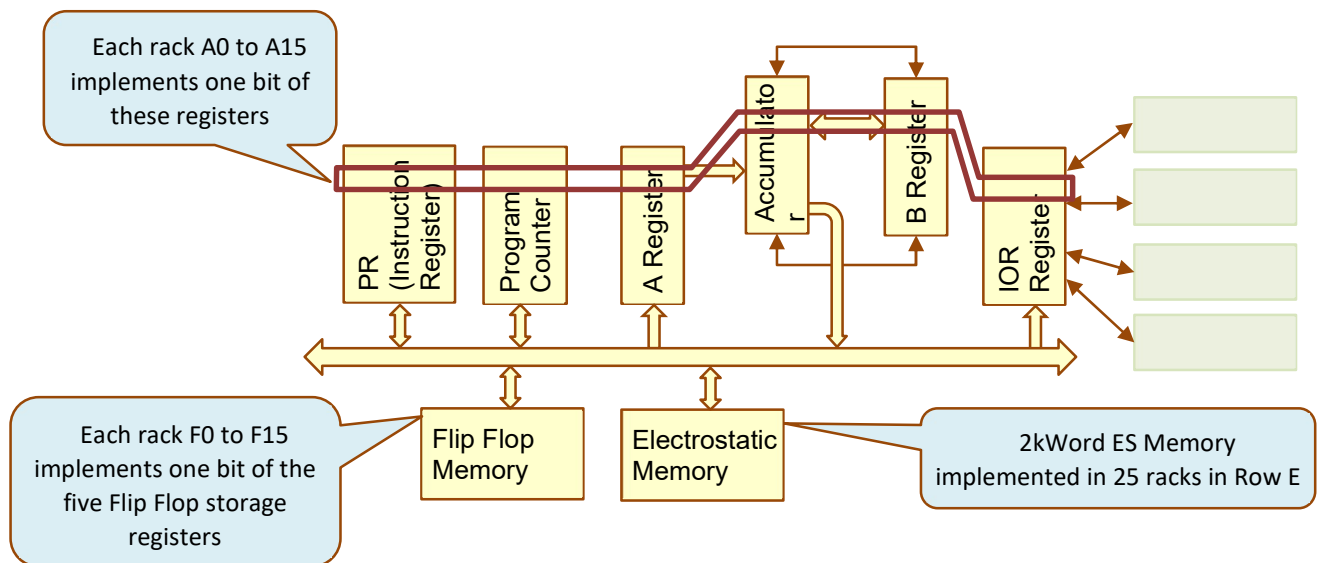


Figure 3: WW Physical Partitioning

1.1.1 Where's Whirlwind?

Whirlwind was built in the Barta building at MIT, and stayed there through its MIT life, until the official decommissioning in May of 1959, after almost ten years of service.

Following the shutdown at MIT, a former Whirlwind programmer William M. Wolf³, who by then had gone on to found an engineering firm,⁴ leased the machine from the Office of Naval Research. Wolf moved and reassembled the machine, using it in a variety of engineering projects until almost 1970, at which point he was obliged to reclaim the real estate for other uses. This time, Whirlwind was decommissioned for good.

Another Whirlwind staffer, Kenneth H. Olsen, had gone on to found Digital Equipment, and had storage space, so a fraction of the machine was saved. Some of the artifacts went on to a display at the new Smithsonian National Museum of American History, while some stayed at DEC to form the core of The Computer Museum in Boston.⁵ Additional artifacts were donated to the MIT Museum in Cambridge, MA.

As of this writing, less than a third of the racks that made up Whirlwind still exist in the three museums, plus a scattering of other elements in various private collections.

By the time of decommissioning in 1959, Whirlwind had 6K words of core memory -- the two original 1K-word core modules, plus a third unit developed during early SAGE research, scaled up to 4K words. All three units still exist, with one 1K unit at the Computer History Museum, and the other at the Smithsonian. The 4K-word unit is in the collection at the MIT Museum in Cambridge MA.

³ Wolf's memoir is titled "No e". William M. Wolf, No "e" (US: Xlibris, 2005), pp. 63-67. See http://www.bitsavers.org/pdf/mit/whirlwind/history/Wolf_No_E_2005.pdf

⁴ Wolf Research and Development Corporation, Baker Ave, West Concord, MA. See <http://www.bitsavers.org/pdf/computersAndAutomation/196606.pdf>

⁵ See <https://www.microsoft.com/en-us/research/wp-content/uploads/2011/04/Bell-Origin-of-the-Computer-History-Museum-v2.pdf>. The original Computer Museum in Boston evolved into the Computer History Museum, now in Mountain View, California (<https://www.computerhistory.org/chmhistory/>).