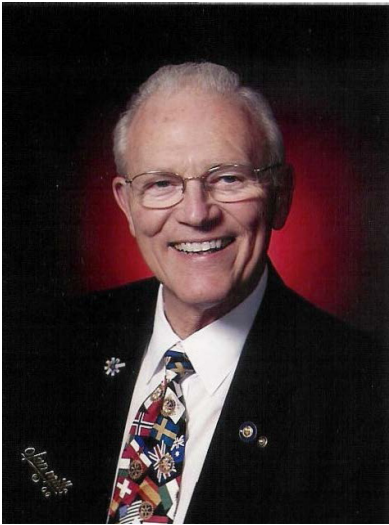




## Documenting the ABC Replica Project and its Contributors --Del Bluhm, Project Director

As Director of the ABC Replica Project, I thought you might appreciate a little background in more detail than you might have read to date. As we first thought about an ABC Replica Project in 1992, I was encouraged by initial discussions with George Strawn in 1993 & 1994, who was then the Department Chair of Computer Science at ISU, to undertake the ABC Replica Project as soon as possible since he had plans to leave ISU in the near future. He also stated that if we could establish a construction plan and project cost, he could find a patron for the ABC reconstruction project. This ABC Replica Project was conceptually important since a working replica of the ABC had to be tested to prove that it did in fact work properly and therefore was the World's First Electronic Digital Computer.

The 1973 decision in the patent litigation *Honeywell v. Sperry Rand* was extremely important since this lawsuit in US District Court resulted in a ruling by Judge Earl R. Larson declaring that the ENIAC patent was both invalid and unenforceable. The claim by the ENIAC team at the unveiling of that computer in 1946 as 'the first electronic computer' was no longer true, and that actually the ENIAC had been derived from the ABC. We at Ames Lab started to develop a reconstruction plan and project cost. In discussions with George I told him this reconstruction project would be very large, long lasting and costly. So when I asked to discuss the project idea with a possible future funder, George suggested Charles W. Durham, who was a visionary student of John V. Atanasoff here at ISU in the class of 1939. We setup the only available time we could find for this ABC Replica discussion, which took place during the Veishea Parade of 1994 when I met Chuck and his grandson for about 2 hours (My wife, kids and grandkids all watched the parade without me on that date.) I believe we were all impressed with our thoughts and ideas for this project and I heard later that he had told George and other ISU officials that he would offer to contribute 90 percent of the estimated reconstruction costs. The ABC Replica project, including our reconstruction plan and project estimated cost, was then soon approved by my Ames Lab Officials and finally approved by ISU Officials as well.

The ABC Replica Project, with encouragement and support from the ISU Computation Center and the ISU Department of Computer Science, was conceived by scientists and engineers of the Research and Development Engineering Services Group at the U.S. Department of Energy's Ames Laboratory, which is operated by Iowa State University. After several months of initial activity a project plan was developed and approved by the Laboratory in April of 1995.

The initial stage of the project was funded by a major private donation to the project by Charles Durham via the ISU Foundation. The remaining funding came from a wide variety of sources including individual donors, various Iowa State University Departments and private foundations. The work essentially remained on schedule for completion of design, procurement, fabrication, debugging, testing and demonstration of the ABC Replica by late September of 1997. Fund raising activities were handled by Dr. George Burnet, retired professor of Chemical Engineering and Acting Chairman of the ABC Replica Review Team and by Phyllis Lepke, Vice President of Giving Programs of the ISU Foundation.

The objective of the project was to build a full-scale, working replica that resembles the original Atanasoff Berry Computer in appearance and functions exactly as the original using as many identical parts as possible.



The ABC Replica Project Team included many staff members. Some of them shown here seated are Del Bluhm, left, and Joel Snow. Standing, left to right, Skip Derra, Jennifer Augenstein, John Erickson, John Gustafson, Al Read, Gary Sleege, Harold Skank, Jeff Etringer and Dave Birlingmair



It was decided early in the project that the use of modern technology or hardware in concealed spaces would not be allowed. This involved a major technical detective job, since the original computer no longer existed and the engineering documentation was far from complete. Most of the original plans and notes had long since vanished. We had to rely on old photographs, recollections, and limited descriptive papers from Atanasoff's personal files. Dr. Atanasoff died in June of 1995 at the age of 91; however, we were fortunate in that we had visited his home in August of 1994 to obtain copies of any existing documentation or records.

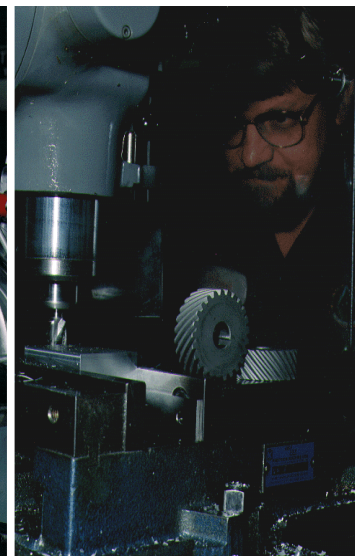
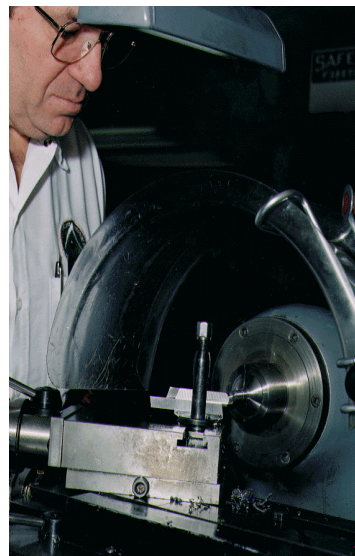
We found that most of the needed parts were no longer made. How these parts went together into components and how the components interacted had to be re-established. Our effort involved not only reproducing parts from limited original designs, but also re-engineering designs after interviewing those people who either worked on the original computer or saw the prototype in operation. Our ABC Replica Project was known and followed worldwide. People who were interested in the progress of our work did in fact contact us by written letters, email or by calling us by telephone with questions and/or suggestions as to where to find needed information. Many contacts came from people who were very proud of Dr. Atanasoff and lived in his home country of Bulgaria; they wanted the ABC Replica to be a functioning computer so they had suggestions, comments and wishes of good luck to our Team. The progress of work increased dramatically during the summer of 1996 when all fact finding, re-engineering, and most significant designs were complete; thus fabrication of the replica could proceed at full production levels.

Several factors made the execution of this project urgent and timely. At Ames Laboratory, we were fortunate to still have a pool of long-time staff engineers and retired university staff members who were experienced in the skills of the trade i.e., assembling stock 1937-1941 vintage vacuum tubes and electrical devices into working components. In a few years, as these individuals retired, this talented team would have no longer been available to perform a task such as the ABC Replica Project. In fact, as of March 1, 1997, three of these team members had retired but some of them were still donating time to the ABC Replica Project.

Additionally, the 50th anniversary of the Association for Computing Machinery, the principal technical and professional organization of the computer world, occurred in 1996. Iowa State University participated in anniversary events held that year at the University of Pennsylvania relative to their first general purpose computer known as the ENIAC (-1946) and here in Ames focusing on the ABC Replica (-1941). The ABC Replica, in its almost completed state, was featured at the Order of the Knoll celebration to a group of Iowa State University supporters in September of 1996. Also, it was pre-unveiled nationally (in its non-working



Finding parts was a particular challenge...once found, figuring out how they went together posed yet another challenge. Below: Gary Sleege of Ames Laboratory enters ABC circuit components in to a CAD system to create ABC schematics; Jerry Hand turning components on a lathe; Steve Lee cutting parts on a CNC milling machine



state) at a press conference and at a historical display for the Supercomputing '96 Conference held in Pittsburgh, PA in November of 1996.

The resulting ABC Replica, about the size of an office desk, was completed as planned by the end of April of 1997. It was turned over to Dr. John Gustafson, Project Manager, during the spring, summer and fall of 1997 for debugging, testing and demonstration. There were numerous operational details which by necessity had been left to this final phase of the project as well as any discovered bugs all requiring resolution at this time. These efforts were accomplished in the remaining time before the national unveiling. This occurred at the National Press Club in Washington DC on October 8, 1997, where it was demonstrated publicly that the ABC Replica, and therefore the original ABC computer, did in fact compute. The unveiling in Central Iowa occurred at a reception given by President Martin Jischke held at the Scheman Building, Iowa State Center at the Iowa State University campus on October 22, 1997. This Ames event was the launching of the Iowa Tour, which continued for about one year, showing the completed, working and tested Atanasoff Berry Computer Replica-The World's First Electronic Digital Computer!

Finally the ABC Replica – Reconstruction Team members are all extremely honored and proud of their involvement with this project. I list their names here in recognition of all team members who contributed. They took on this task as a challenge and a quest and they were successful. Thanks again for your interest, suggestions and support.

Suggested readings which might interest you are *Atanasoff, Forgotten Father of the Computer* by Clark R. Mollenhoff and "Dr. Atanasoff's Computer" by Dr. Allan R. Mackintosh: *Scientific American*, August 1988 p. 90-96.

**For more information, please visit [www.atanasoff.org](http://www.atanasoff.org)**

**All historical photographs and pages 14-17 have provided courtesy of the Scalable Computing Lab, Ames Laboratory, ISU.**

## **ABC REPLICA TEAM ROSTER**

**(Titles listed indicate status or employment at the time of the reconstruction project)**

### **PROJECT DIRECTORS**

Del Bluhm, Ames Laboratory  
John Gustafson, Ames Laboratory

### **ELECTRONIC DESIGN TEAM**

Al Read, Iowa State University  
Gary Sleege, Ames Laboratory  
Mike Stock, student, Iowa State University

### **ELECTRONIC SUPERVISION**

John Erickson, Ames Laboratory

### **ELECTRONIC FABRICATION**

Lee Harker, Ames Laboratory  
John Hjortshoj, Ames Laboratory  
Jerry Musselman, Ames Laboratory  
Clare Tweedt, Ames Laboratory  
Terry Forgette, student, Iowa State University

### **MECHANICAL DESIGN**

Dave Birlingmair, Ames Laboratory  
Jennifer Augestein, student, Iowa State University  
Jeff Etringer, student, Iowa State University

### **PROJECT ADMINISTRATION**

Connie Bates, Ames Laboratory  
Jeanine Crosman, Ames Laboratory

### **MECHANICAL SUPERVISION**

Jerry Hand, Ames Laboratory

### **MECHANICAL FABRICATION**

Jim Berninghaus, Ames Laboratory  
Charlie Bug, Ames Laboratory  
Steve Lee, Ames Laboratory  
Bill Wing, Ames Laboratory

### **DEBUGGING AND TESTING**

John Erickson, Ames Laboratory  
Guy Helmer, Ames Laboratory  
Gary Sleege, Ames Laboratory  
Charles Shorb, student, Iowa State University

### **REVIEW TEAM LEADER**

George Burnet, Iowa State University

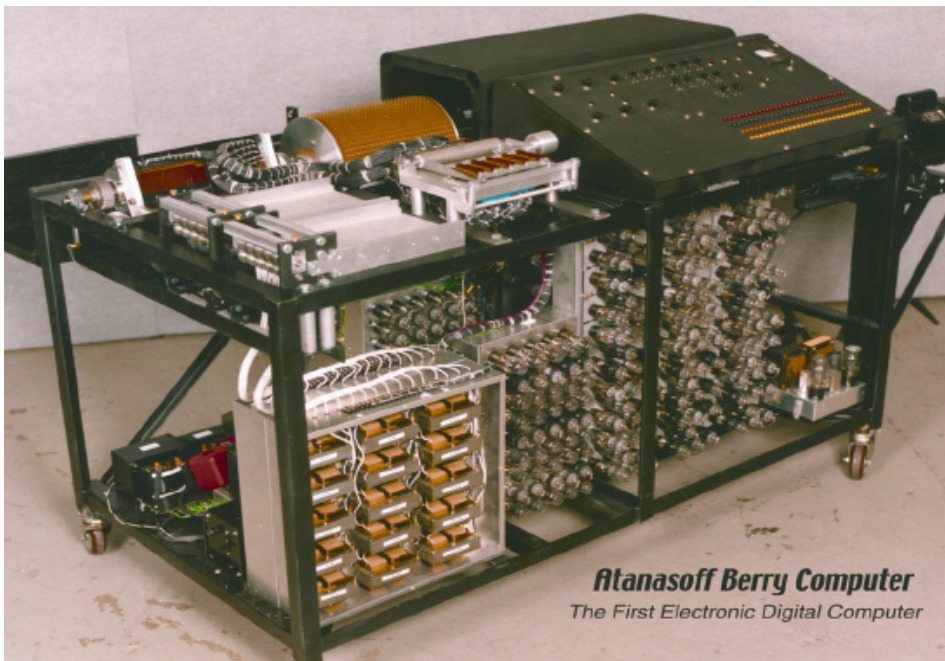
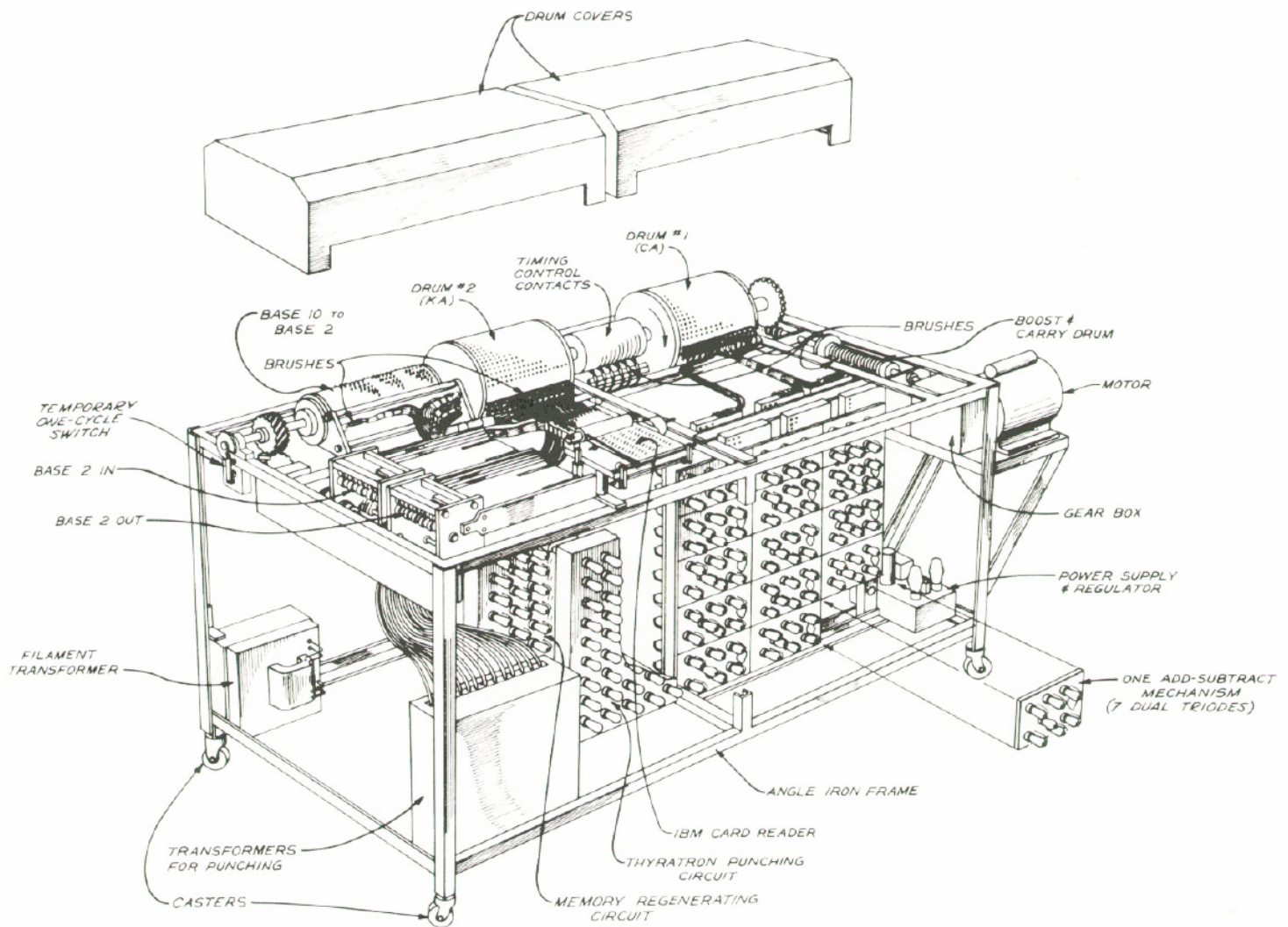
### **REVIEW TEAM**

Murray Blackwelder, Iowa State University  
Arthur Burks, University of Michigan  
Joel Snow, Iowa State University  
George Strawn, Iowa State University/NSF

### **PUBLIC RELATIONS**

John Anderson, Iowa State University  
Carole Custer, Iowa State University  
Skip Derra, Iowa State University  
Geni Greiner, Iowa State University Foundation  
Steven Karsjen, Ames Laboratory





Above: Artist's depiction of the original ABC and its working parts.

Left: The actual ABC Replica, which includes a keyboard of manual controls which are not shown in the Artist's depiction (at the top of the page) probably because it would have covered up items on the top right side of the depiction. The actual ABC finished computer shown in a photograph as of May 1942 does include an almost identical keyboard of manual controls as shown on the actual ABC Replica photograph. The keyboard allowed the operator to input the data of large sets of simultaneous linear equations via binary cards and then operate the process to solve these large sets of equations.