IEEE Milestones:
Have Fun and Meet Cool People

Brian A. Berg

IEEE History Committee Vice Chair

IEEE Milestones Subcommittee Chair

IEEE Region 6 History Chair

17 May 2024

People-Centered Internet

Thanks to IEEE.tv for Streaming This Event!

- We thank IEEE.tv for streaming this event throughout the world right now
- Two more IEEE.tv streaming events:
- *Sun, 19 May, Noon-3:15pm PT:*
  - **A Celebration of 50 Years of the Internet** with Vint Cerf, Bob Metcalfe, John Shoch, Sally Wentworth (Internet Society), Greece's Prime Minister, IEEE 802 Committee, & others
- *Mon, 20 May, 1-4pm PT:*
  - **IEEE Milestone Celebration: TCP, 802 Standards Committee, and PageRank and the Birth of Google** with Vint Cerf, Bob Metcalfe, Frank Kuo (ALOHAnet), John Shoch, Ron Rider, Google/DeepMind Research Scientists, and many others
- *Above events highlighted at top of **IEEE.tv** website*

The IEEE Milestone Program

- Milestones honor an achievement or a location, not a person
- Achievement must be at least 25 years old
- Funding: IEEE Foundation
- Here is the CDMA Milestone plaque at Qualcomm, San Diego

- This plaque greets visitors to Qualcomm's HQ
- SRI's visitors will be greeted similarly!

IEEE Milestones in Electrical Engineering and Computing

- 249 Milestones dedicated since 1984, incl.:
  - Maxwell's Equations, 1860-1871
  - Stereo Sound Recording, 1931 (EMI Studios, later renamed Abbey Road Studios)
  - Bletchley Park Code Breaking, 1939-1945
  - SPICE Circuit Simulation Program, 1970
    - Larry Nagel's work; plaque at UC Berkeley
  - CD Audio Player (The Netherlands), 1979
  - Bullet Train (Japan), 1964
  - Today's Milestones are #250, 251, and 252

SRI's 9 IEEE Milestones

3 from RCA's David Sarnoff Labs in 1987:

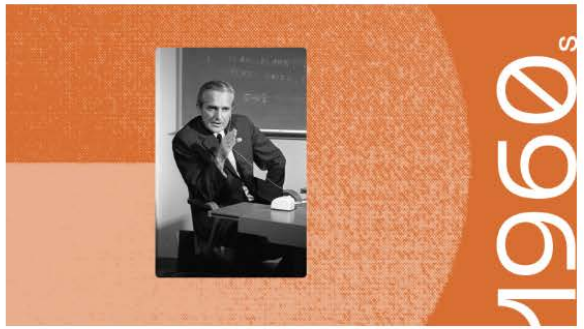
Color TV

Liquid Crystal Displays (LCDs)

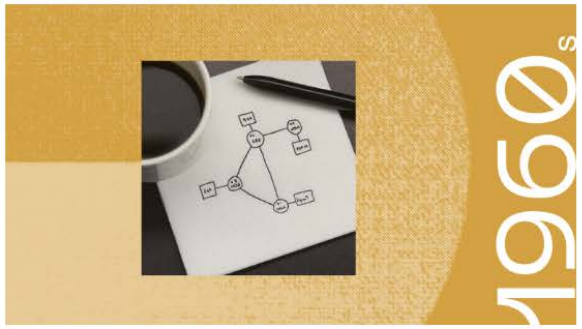
TIROS I Weather Satellite

Color television

Shakey the Robot

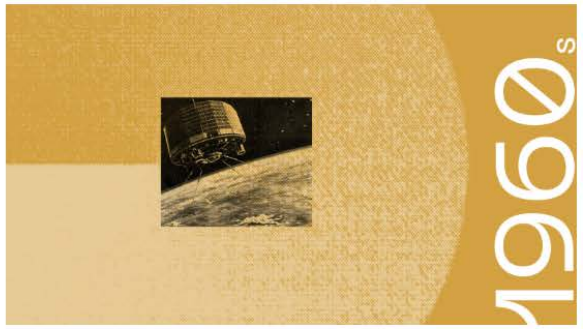


Mother of all Demos

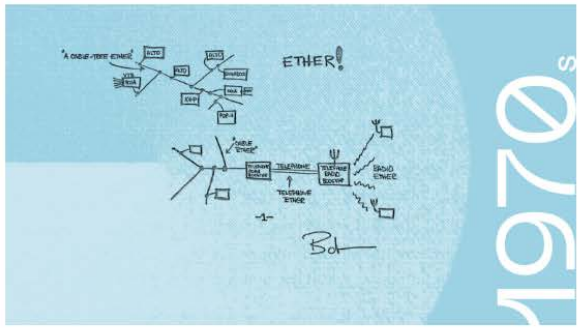


ARPANET

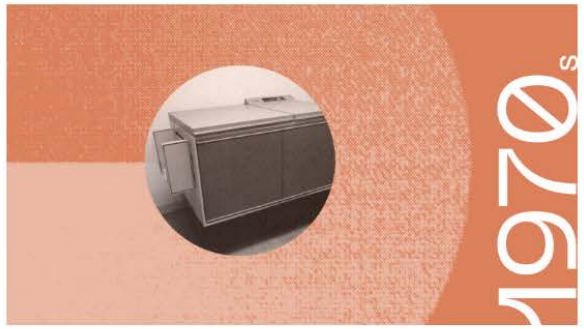
Liquid Crystal Displays (LCDs)



TIROS 1 Weather Satellite



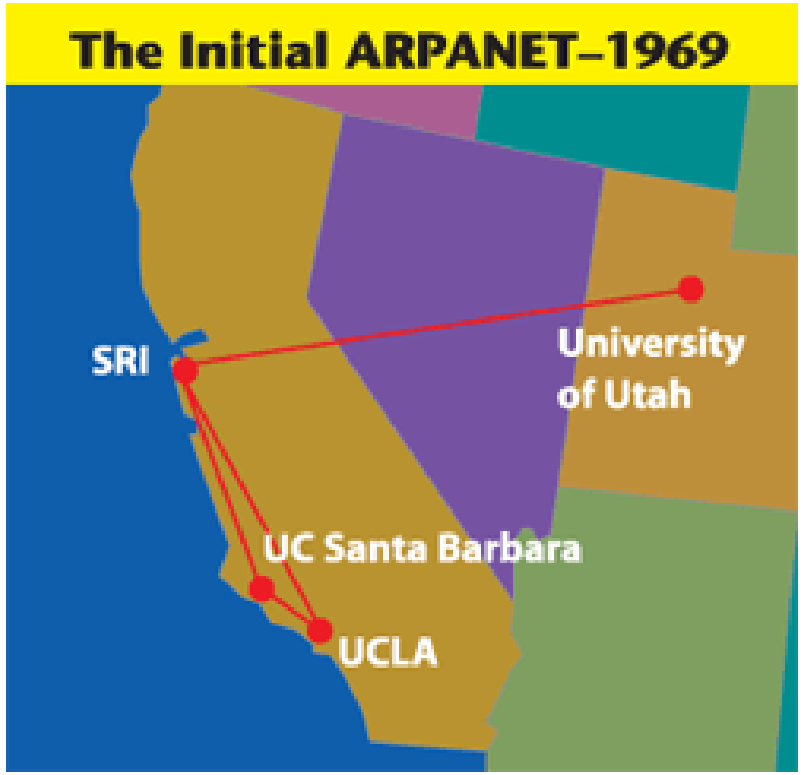
Ethernet

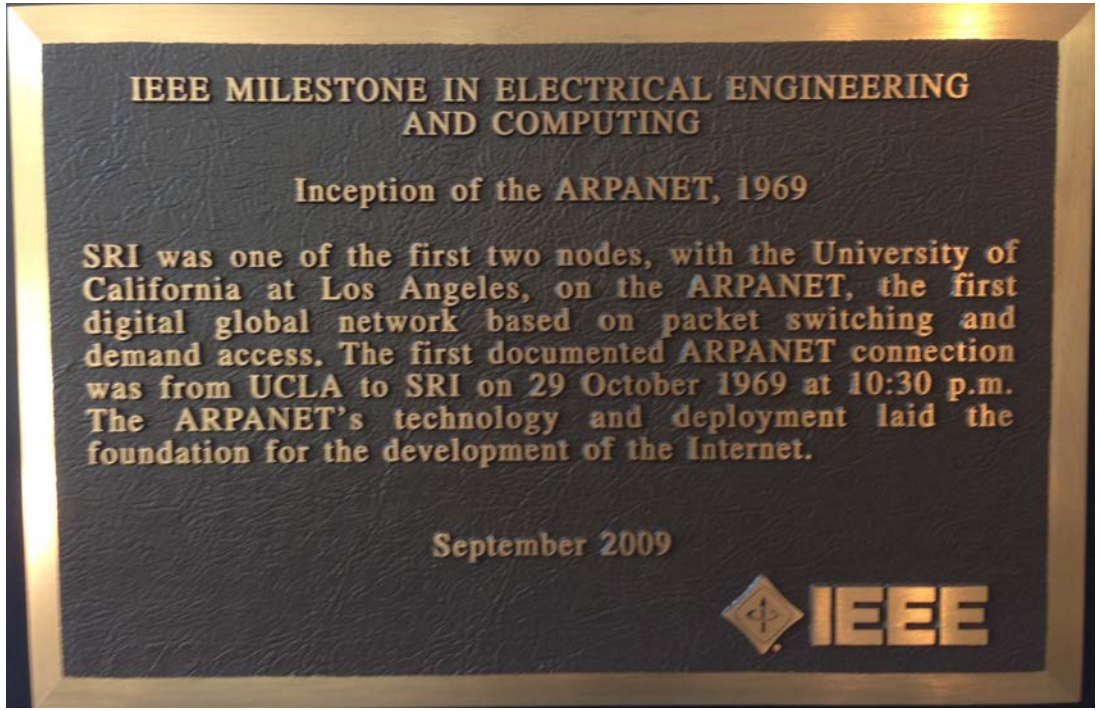


The Laser Printer

Alto personal computer

Inception of the ARPANET, 1969: First transmission, from UCLA to SRI



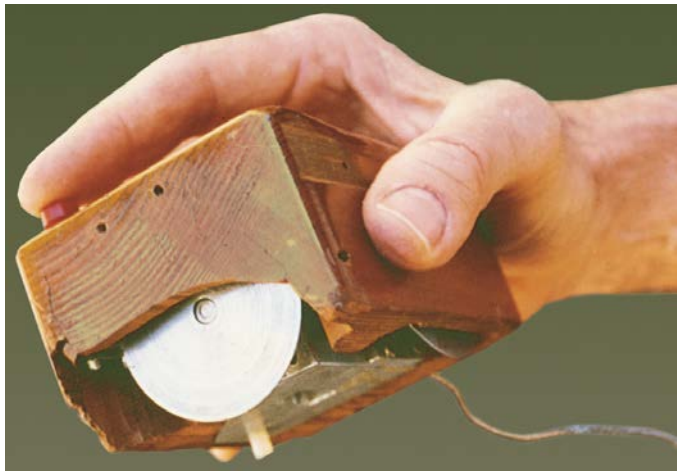


This is one of 3 plaques in SRI's Visitors Lobby in Menlo Park

Dedicated in 2009 for ARPANET's 40th anniversary, in conjunction with IEEE's 125th anniversary at the Computer History Museum, where Vint Cerf spoke

“Mother of All Demos” by Doug Engelbart, 1968: Menlo Park (SRI)

- First public demo of:
  - the mouse
  - collaborative online editing
  - Hypertext, video conferencing
  - word processing, spell checking
- Demo in San Francisco
- Computer and team members in Menlo Park
- Photo at right during Demo prep at SRI:
  - Stewart Brand was Asst. Stage Manager
  - Stewart later edited the *Whole Earth Catalog* and founded the WELL and the Long Now Foundation



“SHAKEY: The World’s First Mobile, Intelligent Robot, 1972” at SRI

a mobile automaton

STANFORD RESEARCH INSTITUTE

MENLO PARK, CALIFORNIA

8 January 1965

Stanford Computer Science Department was founded the same year

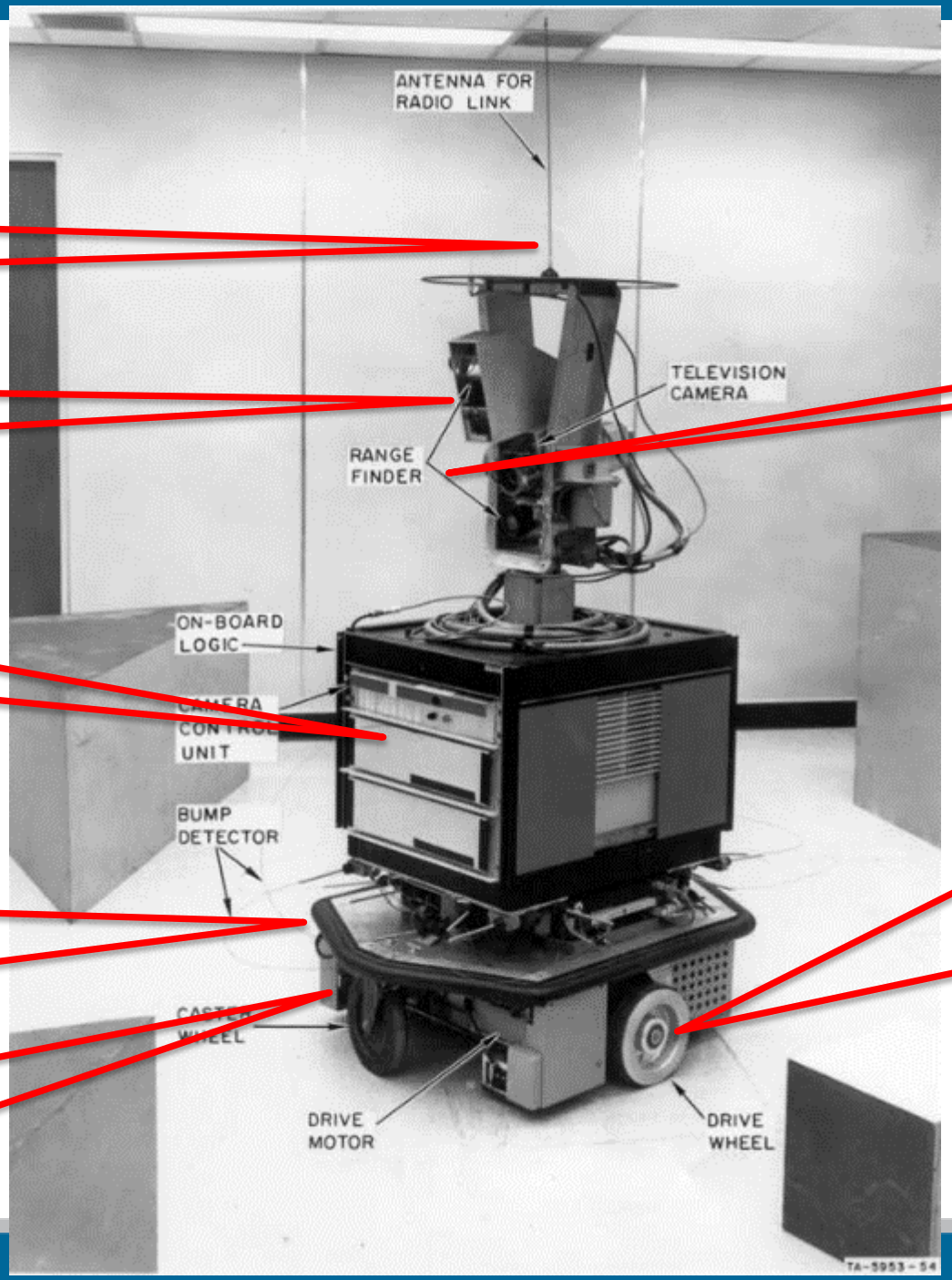
Proposal for Research

SRI No. ESU 65-1

A RESEARCH AND DEVELOPMENT PROGRAM IN APPLICATIONS OF INTELLIGENT AUTOMATA TO RECONNAISSANCE--PHASE I

Prepared for:

Information Processing Branch
EMIR
Rome Air Development Center
Griffiss Air Force Base, New York



Radio link to mainframe

Triangulating rangefinder

Controllers, on-board logic

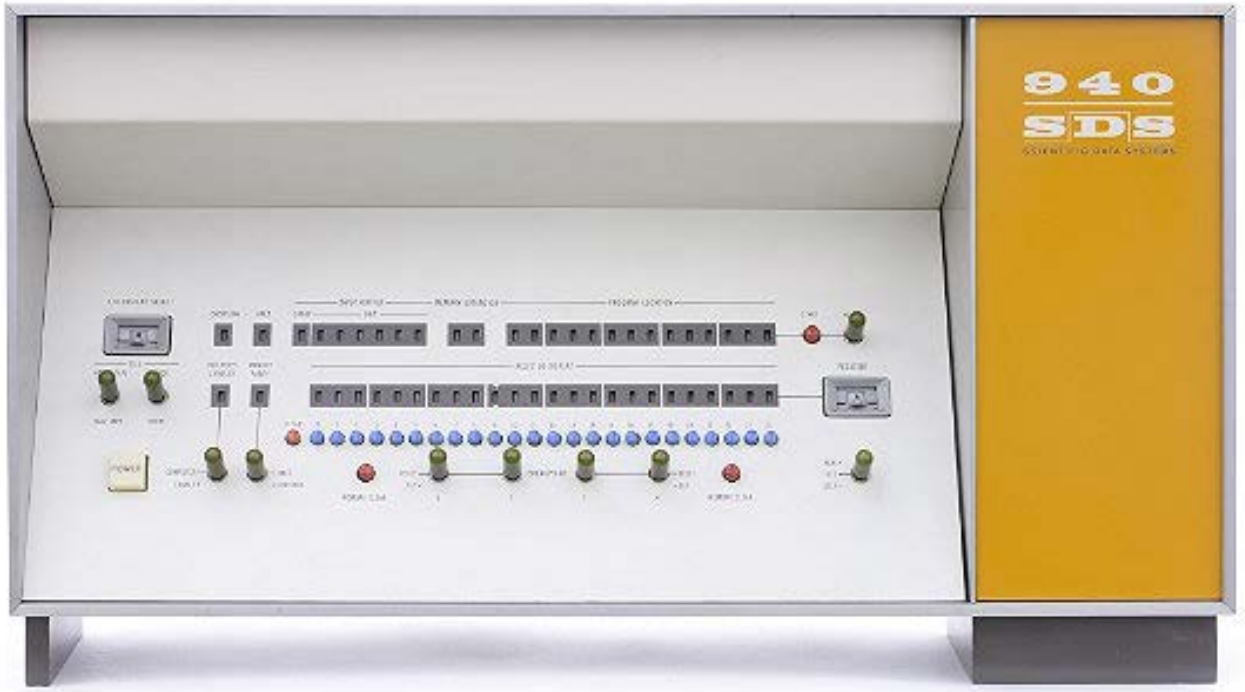
"Cat-whisker" bump detectors

Push-bar with micro-switches added later

TV camera

Drive wheels driven by stepping motors, steer by pivoting

Shakey Communicated with and was Controlled by an SDS 940



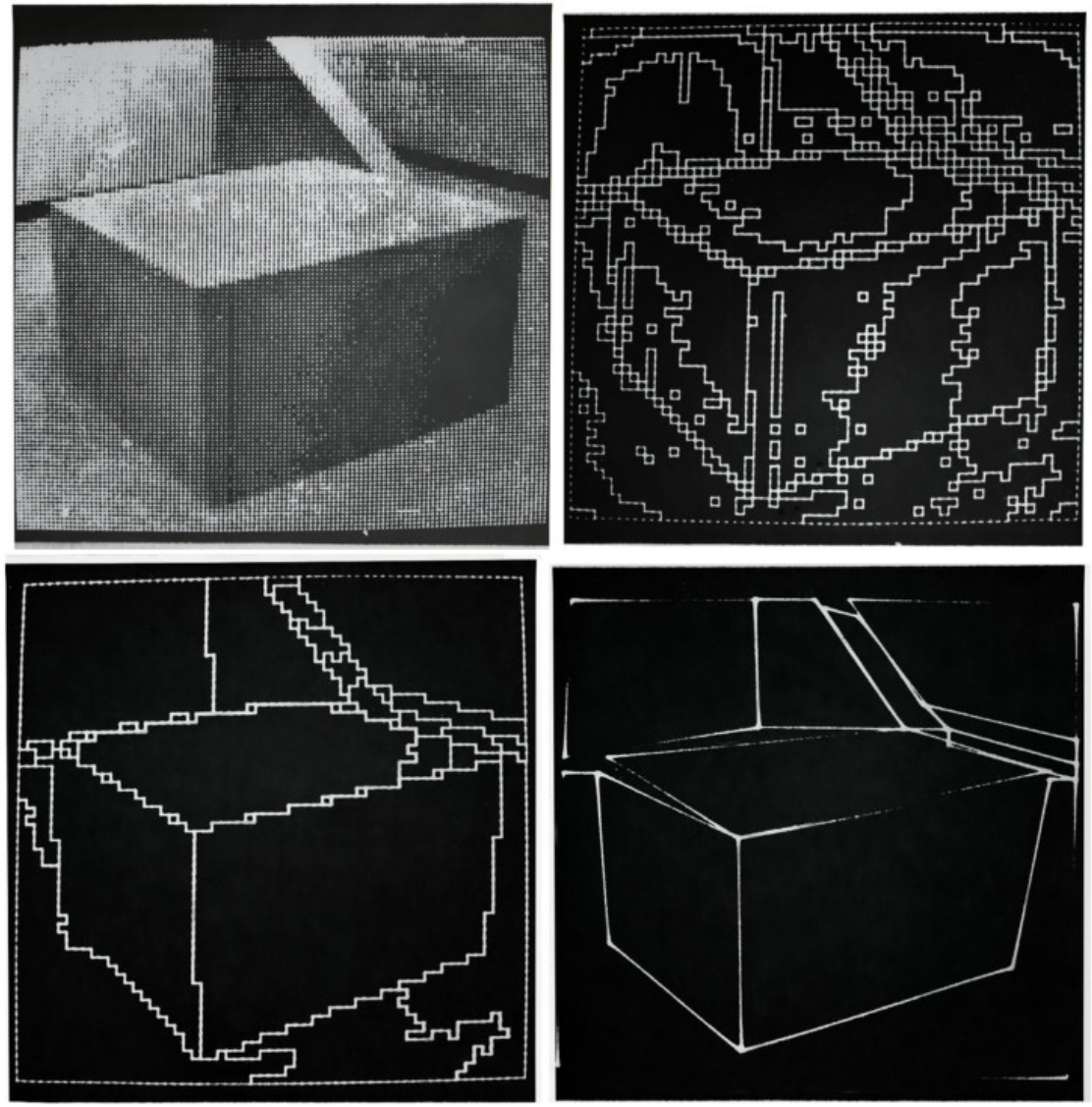
192 KB of main memory

SHAKEY's Development Environment

- Helen Chan Wolf (in foreground) has been called the "Lady Ada Lovelace of Robotics programming"

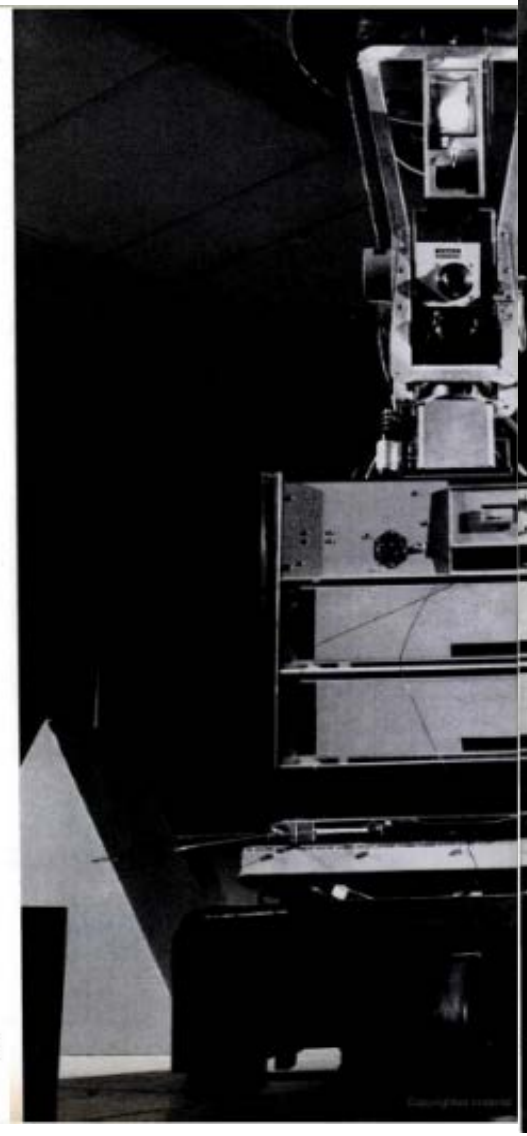
SHAKEY's Early Learning Environment

SHAKEY: Perceiving Regions of What It “Sees”



Meet Shaky, the first electronic person

The fascinating and fearsome reality of a machine with a mind of its own



Computer scientist Charles Rosen communes with Shaky, the intelligent machine he helped create.

by Brad Darrach

It looked at first glance like a Good Humor wagon sadly in need of a spring paint job. But instead of a tinkly little bell on top of its box-shaped body there was this big metallic whangdoodle that came rearing up, full of lenses and cables, like a junk-sculpture gargoyle.

"Meet Shaky," said the young scientist who was showing me through the Stanford Research Institute. "The first electronic person."

I looked for a twinkle in the scientist's eye. There wasn't any. Sober as an equation, he sat down at an input terminal and typed out a terse instruction which was fed into Shaky's "brain," a computer set up in a nearby room: PUSH THE BLOCK OFF THE PLATFORM.

Something inside Shaky began to hum. A large glass prism shaped like a thick slice of pie and set in the middle of what passed for his face spun faster and faster till it dissolved into a glare. Then his superstructure made a slow 360° turn and his face leaned forward and seemed to be staring at the floor. As the hum rose to a whir, Shaky rolled slowly out of the room, rotated his superstructure again and turned left down the corridor at about four miles an hour, still staring at the floor.

"Guides himself by watching the baseboards," the scientist explained as we hurried to keep up. At every open door Shaky stopped, turned his head, inspected the room, turned away and rolled on to the next open door. In the fourth room he saw what he was looking for: a platform one foot high and eight feet long with a large wooden block sitting on it. He went in, then stopped short in the middle of the room and stared for about five seconds at the platform. I stared at it too.

"He'll never make it," I found myself thinking. "His wheels are too small." All at once I got gooseflesh. "*Shaky*," I realized, "*is thinking the same thing I am thinking!*"

Shaky was also thinking faster. He rotated his head slowly till his eye came to rest on a wide shallow ramp that was lying on the floor on the other side of the room. Whirring briskly, he crossed to the ramp, semicircled it and then pushed it straight across the floor till the high end of the ramp hit the platform. Rolling back a few feet, he eased the situation again and discovered that only one corner of the ramp was touching the platform. Rolling quickly to the far side of the ramp, he nudged it till the gap closed. Then he swung around, charged up the slope, located the block and gently pushed it off the platform.

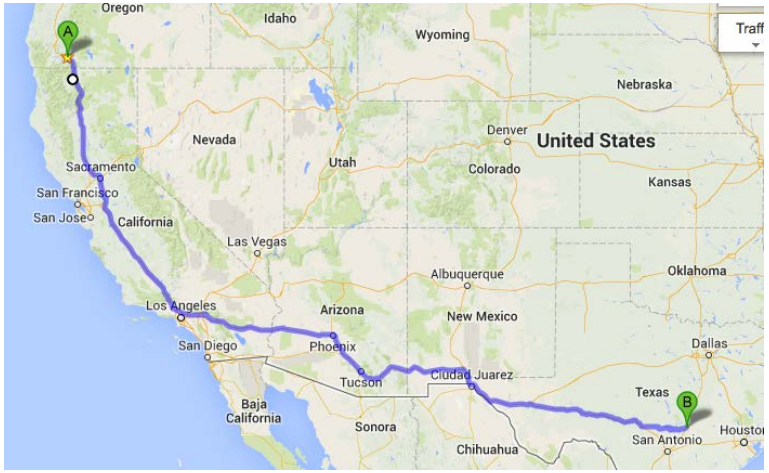
Compared to the glamorous electronic elves who twinkle across television screens, Shaky may not seem like much. No death-ray eyes, no secret transistorized lust for subtle lab technicians. But in fact he is a historic achievement. The task I saw him perform would tax the talents of a lively 4-year-old child, and the men who over the last two years have headed up the Shaky project—Charles Rosen, Nils Nilsson and Bert Raphael—say he is capable of far more sophisticated routines. Armed with the right devices and

CONTINUED

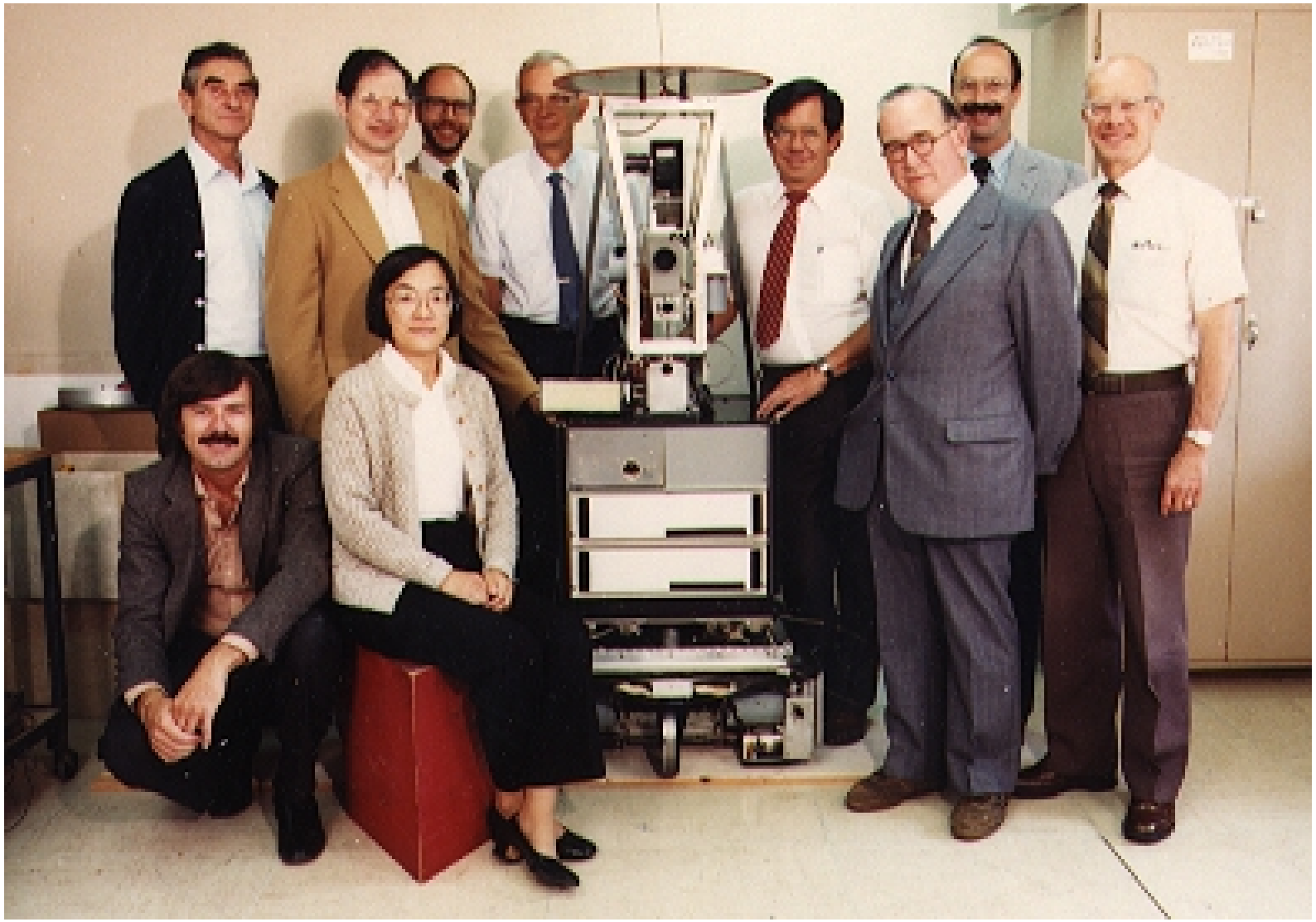
Two Important Techniques that Originated with Shakey

- The modern form of the “Hough” Transform to detect lines and curves in pictures

- The A* shortest path algorithm
  - Used for route finding
  - Google Maps, etc.



SHAKEY Original Design Team



SHAKEY Milestone Dedication at the Computer History Museum:

9 Original Team Members in Attendance

SHAKEY is at the Computer History Museum

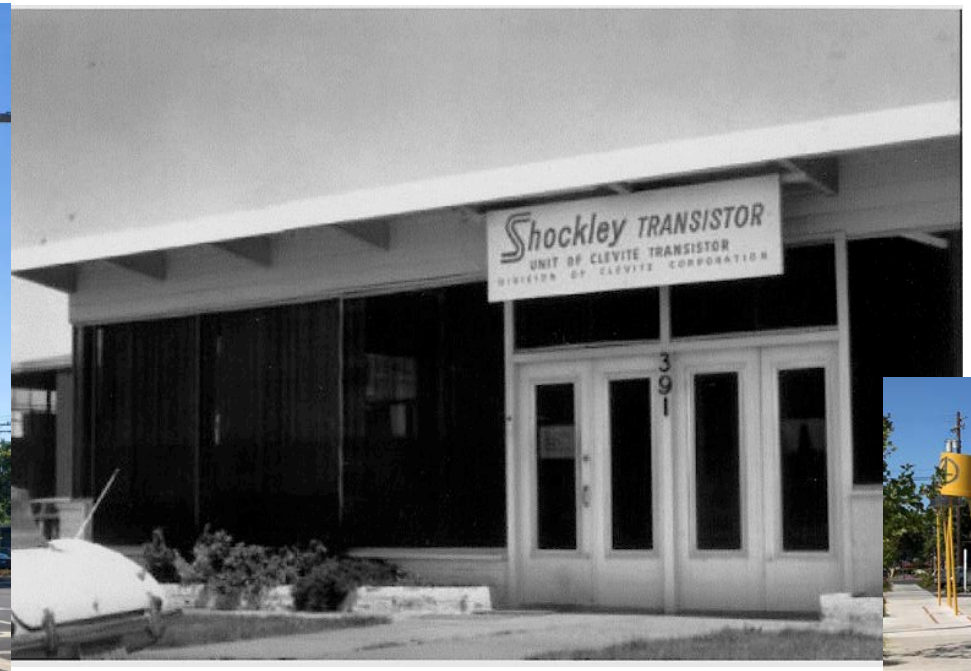
Shakey is the "centerpiece" of the Artificial Intelligence and Robotics portion of the *Revolutions* exhibition

Charles A. Rosen, 1917-2002, and the “mobile automaton”

See
www.ShakeyMilestone.com
for everything you wanted to know about Shakey but were afraid to ask

Milestone: Birthplace of Silicon Valley, 1956

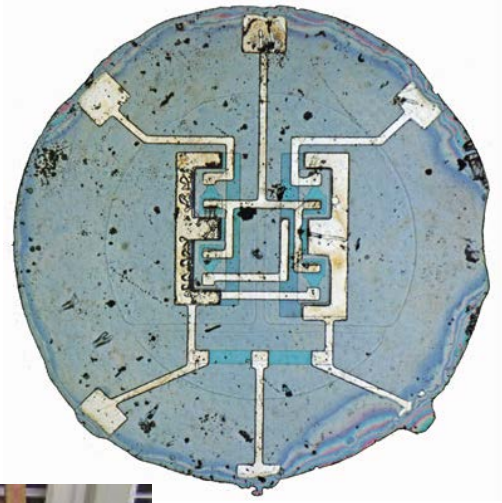
- At Shockley Labs site: corner of San Antonio Rd and California Ave, Mountain View



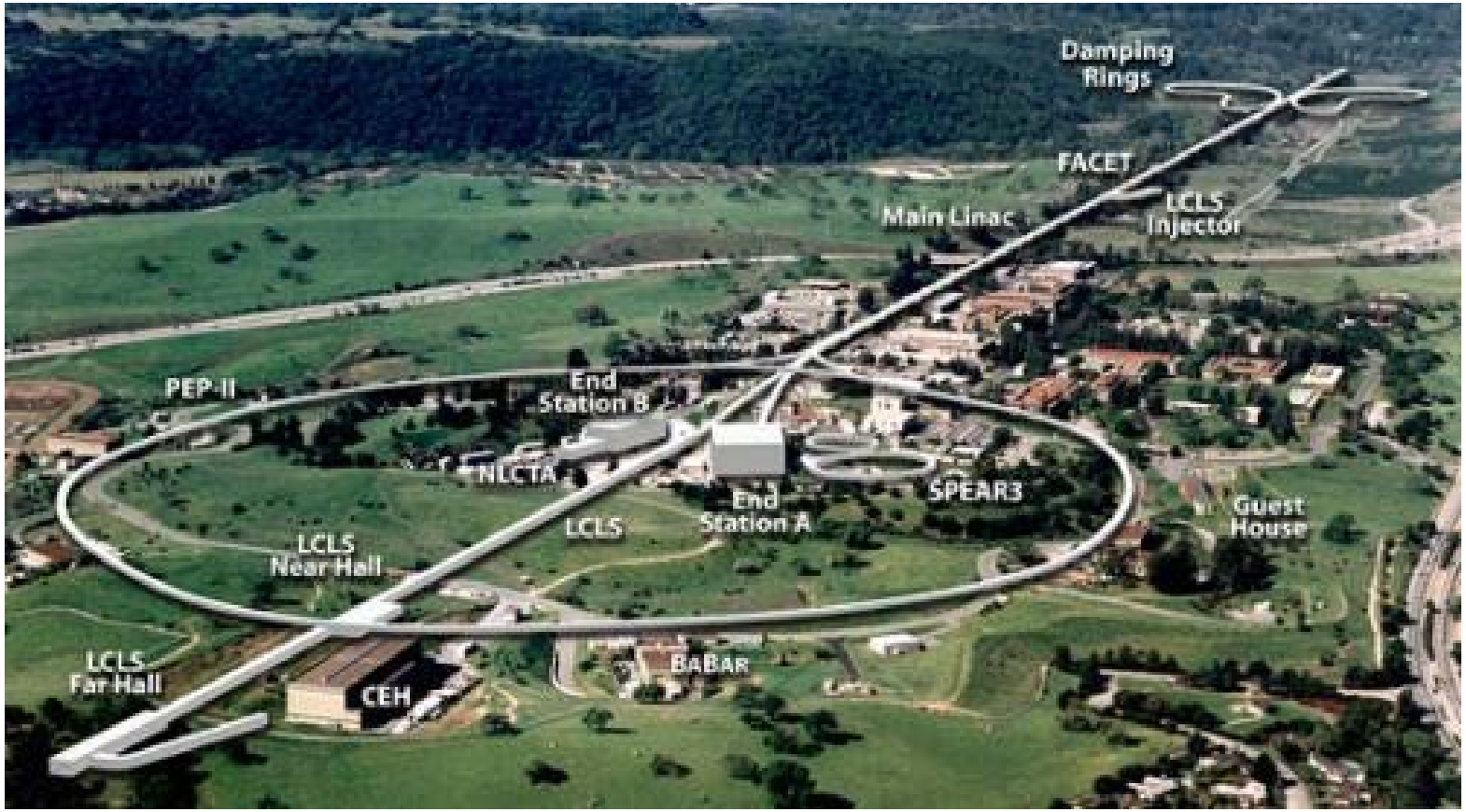
IEEE Milestone: Moore's Law, 1965

Semiconductor Planar Process and Integrated Circuit, 1959:

Fairchild's first office on Charleston Rd, Palo Alto (near San Antonio Rd/US-101)



Stanford Linear Accelerator Center, 1962 (Joint IEEE Milestone & ASME Engineering Landmark)



DIALOG Online Search System, 1966

- Initiated by Lockheed in Stanford's Research Park
- Used initially by NASA and the European Space Agency
- Preceded modern search engines ***by over 2 decades***
- Still **in use today** as a paid service as "ProQuest Dialog"
  - Accesses extensive databases
  - Widely used for research by the pharmaceutical industry
  - Key feature: **iterative search**

AMPEX Videotape Recorder, 1956

1946: Bing Crosby was the first investor in Ampex's audio tape recording system.

The Milestone plaque is at Stanford University's Cardinal Hall in Redwood City

VR1000 1956

1957: Project Team with early version of the recorder, and its Emmy Award (Ray Dolby is 2nd from left)

Utah Computer Graphics and Visualization, 1965-78

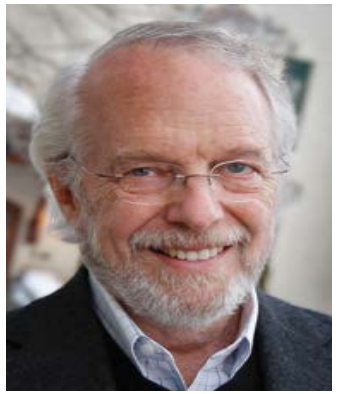
Like for Shakey the Robot and the ARPANET, the University of Utah received ARPA funding. This was used to set up a Center of Excellence for computer graphics research

EVANS & SUTHERLAND

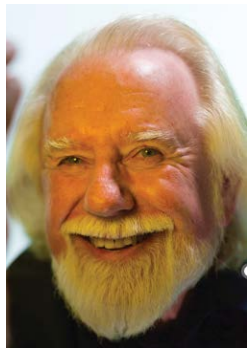
The "Utah Illuminati"

See www.UtahMilestone.com

Warnock Algorithm

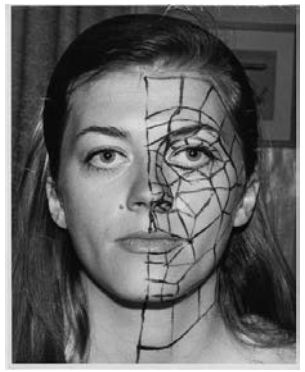


Adobe



Gouraud Shading

Henri Gouraud



Sylvie Gouraud

Catmull-Clark Surface Patch

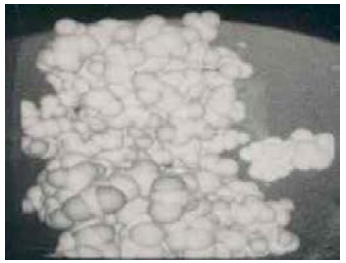
Ed Catmull

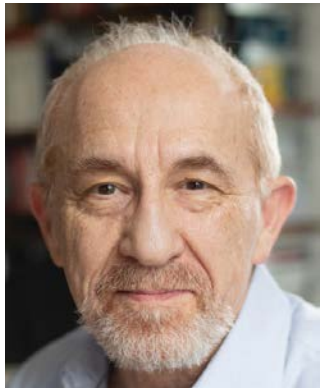
PIXAR

Jim Clark

SiliconGraphics Computer Systems

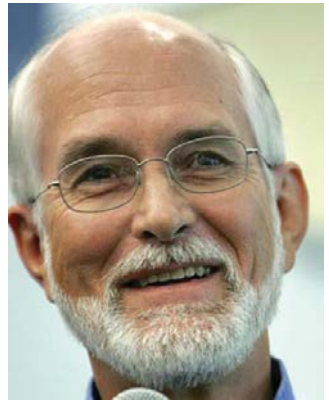
Netscape





Henry Fuchs

Blinn-Phong Reflection Model



Martin Newell

Newell Teapot

Jim Blinn

Alan Kay

Alvy Ray Smith led the Discussion at the Utah Milestone dedication in March 2023

The Development of RenderMan for Photorealistic Graphics, 1981-88

INDUSTRIAL LIGHT & MAGIC

LUCASFILM Ltd

PIXAR

TOY STORY

The Development of RenderMan for Photorealistic Graphics, 1981-88

Milestone “Wall of Fame” at Computer History Museum in Mountain View, CA

26 bronze plaques on the exterior wall

Largest collection of IEEE plaques in the world

Duplicates of the 3 plaques dedicated today, and the 3 that will be dedicated on Monday, are on this wall

CHM Computer History Museum

IEEE Milestones Have Become My “Hobby”

Computer History Museum

I am the “curator” of the plaques on the wall at the CHM

If you have an interest in a new Milestone, I can assist you

Brian Berg / b.berg@ieee.org