COMPUTER HISTORY MUSEUM

2014 Fellow Awards Nomination Form

Please email completed form to: nominations@computerhistory.org by August 19, 2013

1. Nominator (all fields required):			
Name:	William Robert (Bert) Sutherland		
Title:	Retired – former Manager PARC SSL, then consultant, then Director, Sun Labs		
Companies:	Xerox PARC, Sutherland, Sproull. & Associates Inc. and Sun Microsystems Inc.		
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Nominators must agree to respond to any requests for clarification from the selection committee.			
2. Fellows Candidate *(* = required field. Please include all other requested information if known)*			
* Name:	Lynn Conway		
Title:	Retired		
Companies:	IBM ACS, Memorex, Xerox PARC, DARPA, University of Michigan		
Admin Assistant	Email:		Phone:
Address:	5154 Page Avenue,		
City:	Jackson	State:	MI
Zip:	40201	Country:	USA
* Phone:	H (517) 764-4452 M (517) 879-9899	* Email:	lynn@ieee.org

3. Additional documentation being submitted with nomination: (optional)			
☒ Brief biography	☒ List of publications	☒ Reprints of representative papers (up to 5)	☒ Other

4. As nominator, what is your relationship to the candidate? (25 words or less)

I was Lynn's direct manager at Xerox PARC during her major 1970s VLSI chip design methodology research triumph. I hired Caltech Prof Carver Mead to be her project's consultant.

4. Theme of principal contribution for which the candidate is nominated: *(Please summarize the candidate's contribution(s) in 25 words or fewer)*

Leading the development, demonstration, validation, and teaching of a paradigm shifting style of silicon chip design and creation. The economic impact of her work has been amazing!

5. Ultimate impact of candidate's principal contribution(s): (*Please summarize ultimate impact of the candidate's contribution(s) in 50 words or fewer)*

The *Mead-Conway VLSI Revolution* has had an enormous effect on the world's electronics industry! Lynn was the principal driving force behind the creation of "the book", the chip implementation methods, and all the teaching material that enabled the rapid validation and world-wide adoption of the new design paradigm!

6. Reasons for nomination: *(Please explain why the candidate meets the Museum's selection criteria for the Fellow Award. The guideline for this section is 500 to 1500 words)*

I make this nomination for CHM Fellow to correct a longstanding imbalance in the recognition given to the two developers of the 1980s silicon revolution that has changed the world's computing technology. Lynn Conway did most of the work, and Carver Mead has been nominated for most of the formal recognition. In the years immediately after her seminal work, Conway was reticent about credit because

of the looming threat of exposure about her prior gender transition, 40 years ago a culturally sinister event! With this nomination I aspire in a small way to even up the existing credit and recognition imbalance.

The contributions of Lynn Conway and Carver Mead to the history of computing have been widely recognized, as exemplified by Carver's awards for his portion of this joint work - specifically by Carver's CHM Fellow award. What has been missing for the past 30 plus years is a nomination for such award to Lynn Conway - now being corrected by me! Mea culpa for this delay!

At PARC as Lynn's manager I watched the project's progress, evolution, and development as the PARC/Caltech research group struggled with their new concepts and ideas. I arranged with MIT for Lynn's initial 1978 MIT course that validated the simplified VLSI design concepts, and Lynn arranged for the subsequent quick-turnaround fabrication at HP's nearby Integrated Circuits Laboratory. Lynn's focused leadership and effort in developing the concepts, writing many chapters of the book, editing the entire emerging textbook, creating the course syllabus and class notes, devising the rapid chip implementation of the student designs - all were essential to the resounding success of the first MIT *VLSI design* course project results in 1978. Her continuing personal energy and drive then led the subsequent astoundingly rapid spread of the VLSI course to students at more than 100 universities world wide in the following **two** years.

I point out that while developing the concepts behind the Mead-Conway design methodology shift was truly a joint effort by Lynn and Carver, the subsequent surprisingly rapid adoption of the new methodology is primarily attributable to Lynn's efforts. She organized and ran the two subsequent validation demonstrations called MPC79 and MPC580. These two "ARPANET adventures" as she has called them provided unassailable evidence to a skeptical technical audience of successful designs of new and unusual working systems. Ordinary engineers without specialized silicon fabrication knowledge could create, fabricate, and then operate interesting systems on silicon chips of their own design: The Geometry Engine by Jim Clark led to Silicon Graphics, Inc; Guy Steele's Scheme LISP microprocessor implemented a very unusual LISP instruction set: Patterson's UC Berkeley RISC processor demonstration chips started a whole new microprocessor trend; Rivest's MIT encryption chip demonstration led to the founding of RSA, Inc; Stanford's RISC processor transitioned into MIPS, Inc.

It is most unusual to see a successful research project developing important new technical concepts and methods **simultaneously** with creating the teaching material and novel implementation methods needed to convince a change-resistant technical public of the value and utility of new ways of accomplishing old tasks. Creating effective change is very hard to do! Indeed the current effects of the design paradigm shift are a visible tribute to Lynn's monumental success in gaining wide acceptance of new design and fabrication methods!

I quote a few selected paragraphs from Lynn's 1983 talk "*The Design of VLSI Design Methods*" to illustrate her deliberate choice to foster acceptance of the new design paradigm": (my **emphasis**)

"We had thus created a hypothetical new design methodology appearing to have great promise. But what could we do with this knowledge? I was very aware of the difficulty of evolving and bringing forth a new system of knowledge **by just publishing bits and pieces of it in among traditional work.**" .....

"When new design methods are introduced in any technology, a large-scale exploratory application of the methods by many designers is necessary in order to evaluate and validate the methods. The more explorers involved, and the better they are able to communicate, the faster this process runs to completion. However, even if design methods have been proven useful by a

community of exploratory designers, there remains the challenge of taking methods that are new and perhaps considered *unsound methods*, and turning them into *sound methods*. Here numbers are important again: A lot of usage is necessary to enable sufficient individual viewpoint shifts and social organization shifts to occur to effect the cultural integration of new methods, in a process bearing similarities to those involved in the integration of new paradigms in natural science." .....

"Under such circumstances, **for whom should we design the design knowledge?** The selection of a receiving community in which to test our new methods would be a key decision. **We decided to bypass the fragmented world of traditional practitioners in industry.** Our hypothetical new synthesis of knowledge would appear **too simple** and **non-optimal**, and any systematic advantages it had would remain invisible, when viewed from any particular specialized perspective in that world. We chose instead to create a new **"integrated system" design community** by propagating the knowledge into a community of students of digital system design in selected key universities. In this way we hoped to experiment with the methods, refine them, and propagate any useful results at least into the **practices of the next generation** of system designers." .....

Very unusual to see "technology transfer" seriously considered well before the research results were complete! Lynn has a long view of the future! And indeed the practices of her "future generations of systems designers" have brought computing to it current state.

This tangible proof of working silicon artifacts created by ordinary engineers had some interesting effects in the early 1980s.

First, these surprising successes unleashed a flow of significant government support for additional research in microelectronics. Lynn's method for implementing remote system designs was transferred from her PARC group to USC/ISI and supported by ARPA. The USC/ISI MOSIS service has ever since then for 33 years been continuously turning out remotely designed chips, first for US researchers and subsequently as a commercial public service. ARPA and NSF also supported many research activities of national significance to the tune of 10s of millions of dollars. Foreign governments also entered the global competition with similar increased support. **Researchers do follow the scent of available funding!**

Second, These successes also encouraged the investment of private civilian funds into the electronics industry. Venture capital funds poured into many of the startup companies that followed. Commercial "Silicon Foundry" companies were formed to serve the rapidly expanding cadre of chip-designing engineers being educated in the university Mead-Conway courses. These foundry operations were created to implement the emerging plethora of new designs from the expanding ranks of chip designers.

Lynn's memoir about those days was the lead article in the recent IEEE Fall 2012 *Solid-State Circuits* publication (attached) with associated comment articles by Chuck House (HP), Carlo Sequin (UC Berkeley) and Ken Shepard (Columbia). I quote excerpts from Chuck House's article on the impact of Lynn's demonstration efforts: (my own **emphasis** below)

"Clearly a new design paradigm had emerged – rendering discrete circuit design as irrelevant as Quine-McCluskey minimization rules. Importantly, **imaginative support** in terms of **infrastructure** and **idea dissemination** proved as **valuable** as the concepts, tools, and chips. The "electronic book" and the "foundry" were both **prescient** and **necessary** providing **momentum** and **proof points**." .....

The resultant methods would convulse an industry—but fame would accrue to the people who built the products using the chips, rather than to those who did the incredible breakthroughs to create the methods and even the chips themselves. Paradigm shifts seem to be universally resisted—this one was no different. Virtually all mainframe and minicomputer companies (ironically, even Intel leadership), struggled to comprehend. .....

"Jim Gibbons .... further states that Lynn Conway, from his perspective, was the singular force behind the entire "foundry" development that emerged." .....

Conclusion

I believe that the historical value and record of the work by Lynn Conway and Carver Mead has already been fully demonstrated. In my words here I have tried to point out the important activities for their overall success that were jointly performed and those activities where Lynn's efforts were predominant. The intellectual aspects of the new design methods were fully a result of joint achievement by Lynn and Carver in hammering out differing views and arriving at a common group understanding. Capturing and refining this new knowledge into a seminal book was a project for the whole team under Lynn's leadership with team members and guest authors providing written input. The subsequent validation by practical proof demonstrations in MPC79 and MPC580 came mainly from Lynn's personal drive and persistence. Think of how easily the strange new "possibly unsound and non-optimal" design and foundry fabrication scheme could have been ignored without all those demonstrably working early example chips created by just ordinary engineers who were not semi-conductor specialists!

The Mead-Conway VLSI revolution has been very significant for computing. There is plenty of credit to go around. Presenting some well-deserved formal credit to Lynn will not diminish Carver's status at all. I have included a copy of the *IEEE Solid–State Circuits Fall 2012* issue with the other material requested. Reviewing the relevant articles may provide helpful insight into these hard-to-remember happenings nearly 40 years ago. I have not found any significant errors in these articles. They are fascinating reads!

I now suggest my version of an appropriate citation should the Committee choose to decide in favor of a Fellow award to Lynn Conway. Different from but similar to Carver's citation.

Carver Mead 2002 Fellow

For his contributions in pioneering the automation, methodology and teaching of integrated circuit design.

Lynn Conway 2014 Fellow

For her contributions in developing, demonstrating, and successfully validating new means for automation, methodology and teaching of integrated circuit design.

/s/ William R. Sutherland

Additional information submitted as part of this nomination in an envelope mailed in Mountain View to the Computer History Museum on August 18, 2013:

Paper copies of:

1. CHM 2014 Fellow nomination document for Lynn Conway.
2. The *IEEE Solid-State Circuits Fall 2012* magazine with relevant articles by: Lynn Conway, Chuck House, Carlo Sequin, and Ken Shepard.
3. Biography of Lynn Conway from her website.
4. Lynn Conway's 1983 presentation - "*The Design of VLSI Design Methods*".

A CD Rom and a USB memory stick both with digital versions of the printed information listed above

[... continue on additional pages]