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# History of MEMS Activity

## Participant Guide

### Description and Estimated Time to Complete

This Activity provides

- A crossword puzzle which tests your knowledge of MEMS history
- Research activity questions that allow you to delve deeper into the history of MEMS

Allow at least 15 minutes to complete the crossword puzzle.

Allow up to 3 hours to complete the research activity questions.

### Introduction

There are many events and milestones which occurred in the development of microsystems technology. This activity will exercise your knowledge of many of these historical events.

### Activity Objectives and Outcomes

#### Activity Objectives

- Exercise your knowledge of MEMS history by completing a crossword puzzle
- Exercise your knowledge of MEMS history by answering the research activity questions

#### Activity Outcomes

After the completion of this activity, you will have strengthened your knowledge of the milestones which have occurred in MEMS history.

### Dependencies

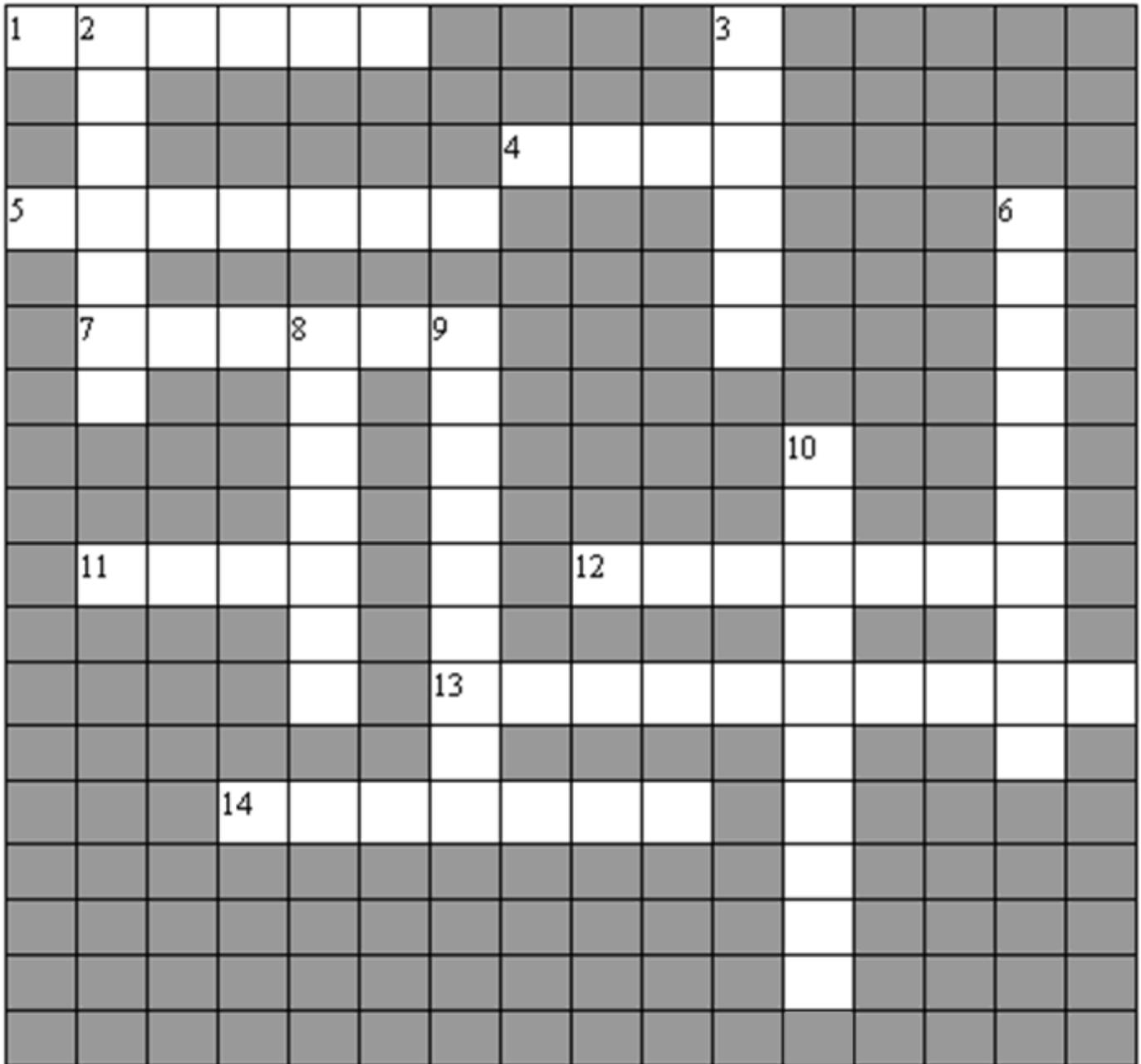
It would be helpful to review the following material:

- History of MEMS Primary Knowledge

### Supplies

- A printout of the crossword puzzle
- Pencil
- The Research Activity Questions

**What Do You Know About MEMS History?**



*MEMS History Crossword Puzzle*

**Across**

1. Richard Feynman's talk was entitled "There's Plenty of Room at the \_\_\_\_\_".
4. \_\_\_\_\_ micromachining utilizes the anisotropic etching of silicon.
5. This crystalline material is commonly used as a MEMS substrate.
7. The first high volume surface micromachined accelerometer is used in this common automotive safety device.
11. This high aspect ratio anisotropic process creates deep trenches.
12. The resonant gate transistor demonstrated \_\_\_\_\_ micromachining techniques.
13. This type of circuit includes the transistors, resistors, capacitors, and wires needed to interface with a micromechanical device.
14. The LIGA process was developed in this country.

**Down**

2. Lucent developed this type of network switch.
3. This type of printer uses MEMS technology.
6. The atomic force microscope uses this type of MEMS structure.
8. This area of study combines biological concepts with MEMS technology.
9. C. S. Smith discovered the piezoresistive effect in silicon and \_\_\_\_\_.
10. The \_\_\_\_\_ grating light modulator is a MOEMS device.

## Research Activity

Locate the transcript of a talk given by Richard Feynman entitled "There's Plenty of Room at the Bottom". Read the transcript and answer the following questions. Some of the questions require the use of the web for additional information. Please cite references when necessary and feel free to quote passages with proper references.

1. What does Feynman mean when he says "The resolving power of the eye is about 1/120 of an Inch"?
2. If the diameter of a human hair is approximately 80 microns, what is the diameter of hair in angstroms?
3. What do you think Dr. Feynman implied when he commented that lubrication may not even be necessary as a machine gets very small?
4. In this paper, Dr. Feynman mentions that the internal combustion engine would not function if made very small. Why?
5. Can our current technology "rearrange atoms"? (Justify your answer with an explanation and supporting sources.)
6. What is "Van der Waals" attraction? What were Feynman's concerns about Van der Waals in reference to micro systems?
7. What did Dr. Feynman's friend, Albert Hibbs, suggest as a possible use of these relatively small machines?
8. In Feynman's paper what do servo motors and pantographs have in common?
9. Feynman mentions the possibility of biological computers. Do they exist today, and if so, what is their current level of technology and what are their applications?
10. Who is William McLellan and what connection does he have to Microsystems?

## References

“There’s Plenty of Room at the Bottom”. Richard P. Feynman.  
<http://www.zyvex.com/nanotech/feynman.html>

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