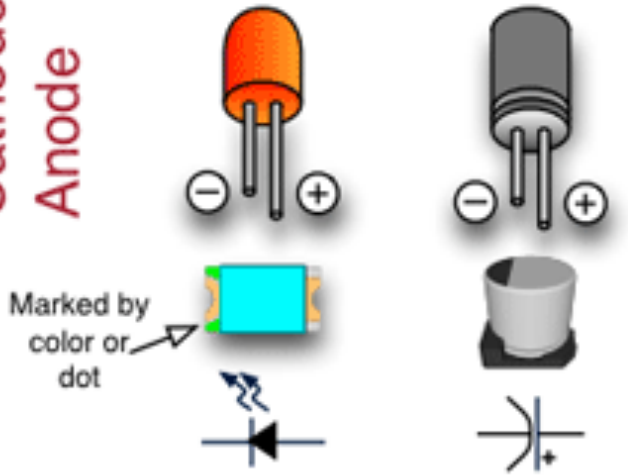
Embedded Systems

赤 akafugu.jp

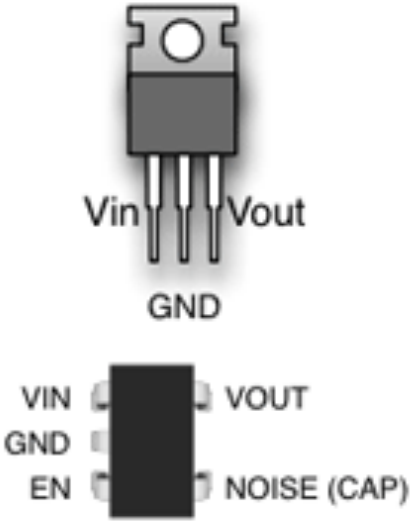
Electronics Reference Sheet v1.1b

LED



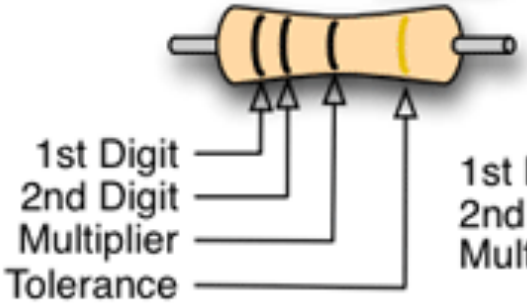
CAPACITOR

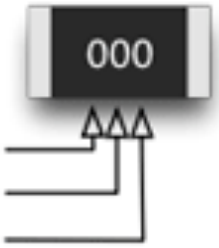
REGULATOR (e.g. LM78xx)



Resistor

	Digit	Multiplier	Tolerance
Silver	-	0.01	±10%
Gold	-	0.1	±5%
Black	0	1	-
Brown	1	10	±1%
Red	2	100	±2%
Orange	3	1k	-
Yellow	4	10k	-
Green	5	100k	±0.5%
Blue	6	1M	±0.25%
Violet	7	10M	±0.1%
Gray	8	-	-
White	9	-	-





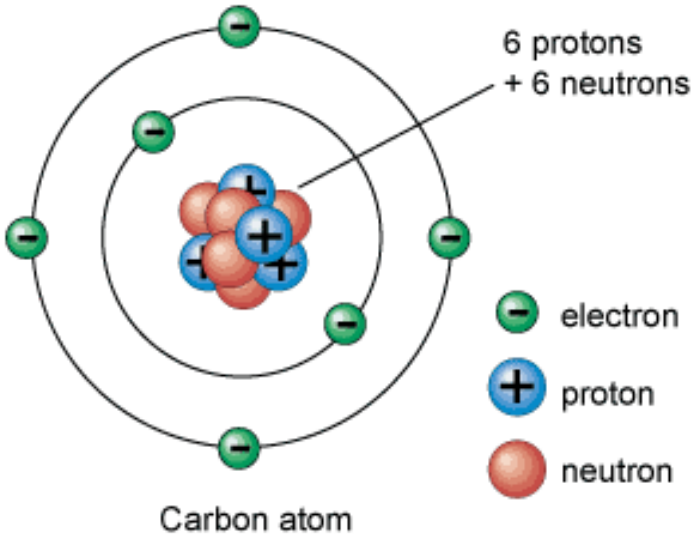
Nuts + Volts

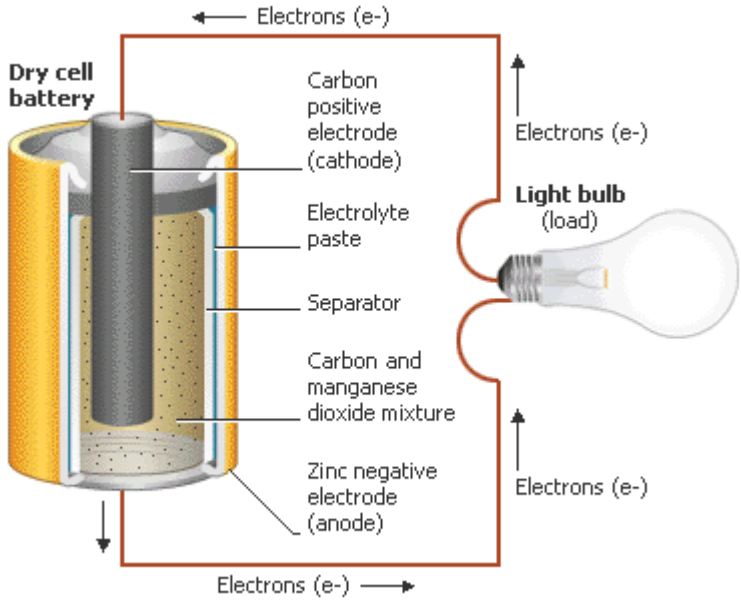
Theory, Components, Circuits

NUTS AND VOLTS N&V

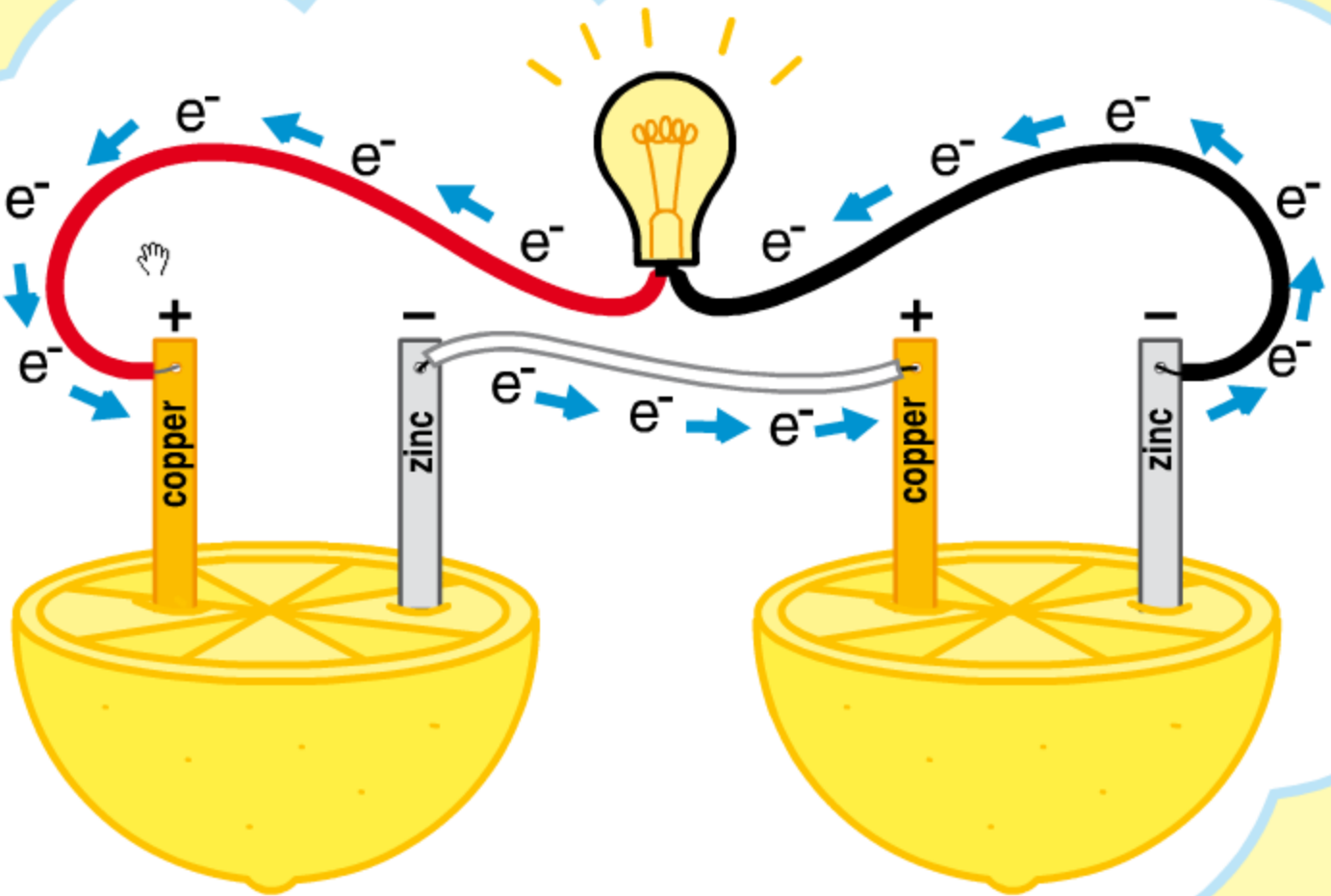
Electronics and Chemical Energy

An **Electron** is a stable subatomic particle with a charge of **negative** electricity, found in all atoms and acting as the primary carrier of electricity in solids.

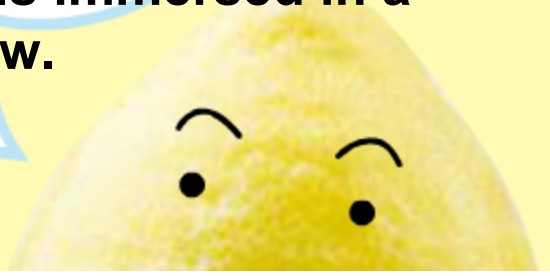




Metals, or conductive materials, allow electrons to move from atom to atom

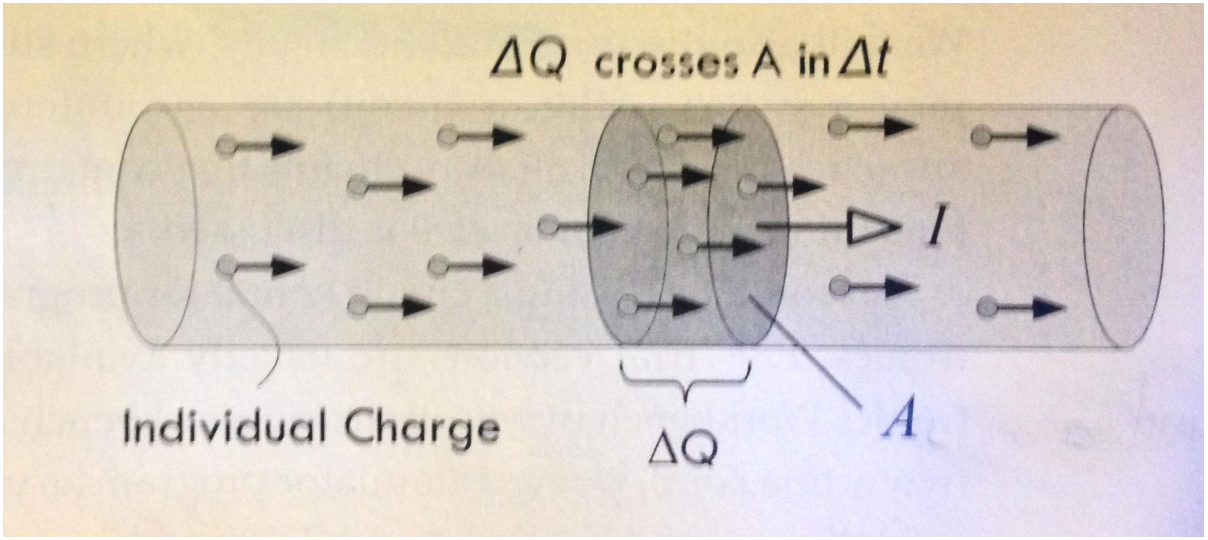


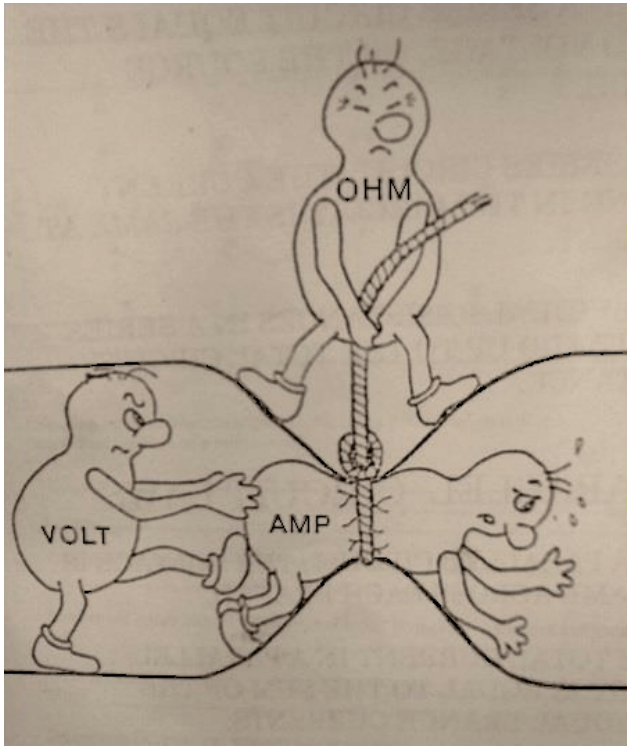
This age old experience works because the metals immersed in a aqueous solution or solvent, allowing them to flow.



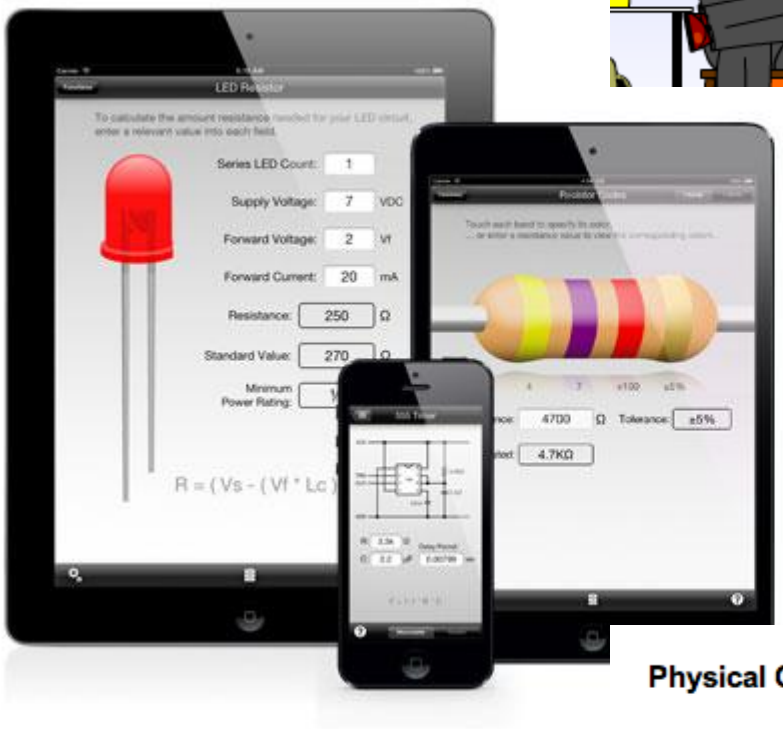
Electrical Current is the total charge that passes through some cross-sectional area per unit time.

- Voltage: measurement: **volt**
- Current: measurement: **amp**
- Resistance: measurement: **ohm**





A Few Resources



CIRCUIT PLAYGROUND

Available on the App Store

adafruit INDUSTRIES

Physical Computing

A collection of resources, examples, and lecture notes for the physical computing courses at ITP.

Q: HOW IS THAT RELEVANT TO ME?

A:

A:

Q: HOW IS THAT RELEVANT TO ME?

A: You are harnessing this energy for creative and productive purposes.

A:

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A: The innovation of how this energy is harnessed effects:

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Emerging and Current Academic Fields

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Emerging and Current Academic Fields
Job markets

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Technological Progression

Emerging and Current Academic Fields

Job markets

Interactions and Interfaces within contemporary society

COMPONENTS: I/O DEVICES

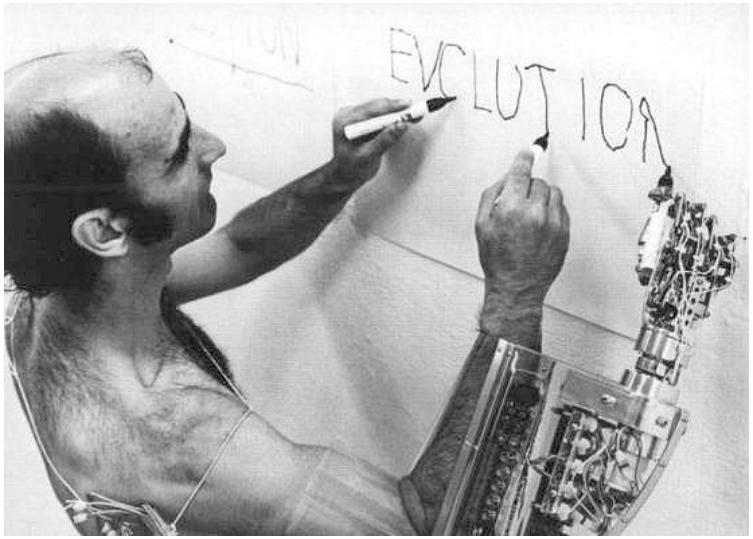
I/O = Input Output

a device that converts variations in a physical quantity, such as pressure or brightness, into an electrical signal, or vice versa

- LEDs
- LCD
- Speakers
- Buzzers
- Motors
- Solenoids
- Antennas

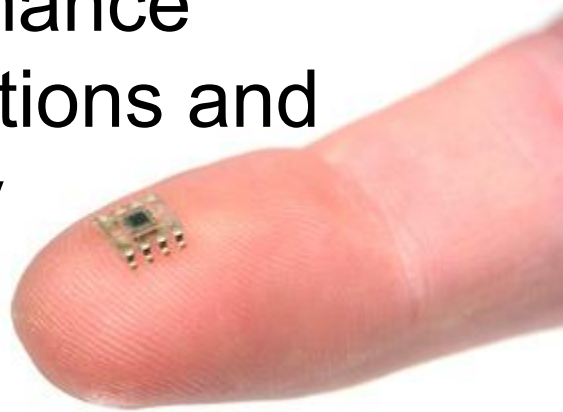
HOW ELECTRICAL ENERGY IS HARNESSED

- Components
- Input/Output Devices
- Integrated Logic Circuits



HOW THIS AFFECTS INNOVATION

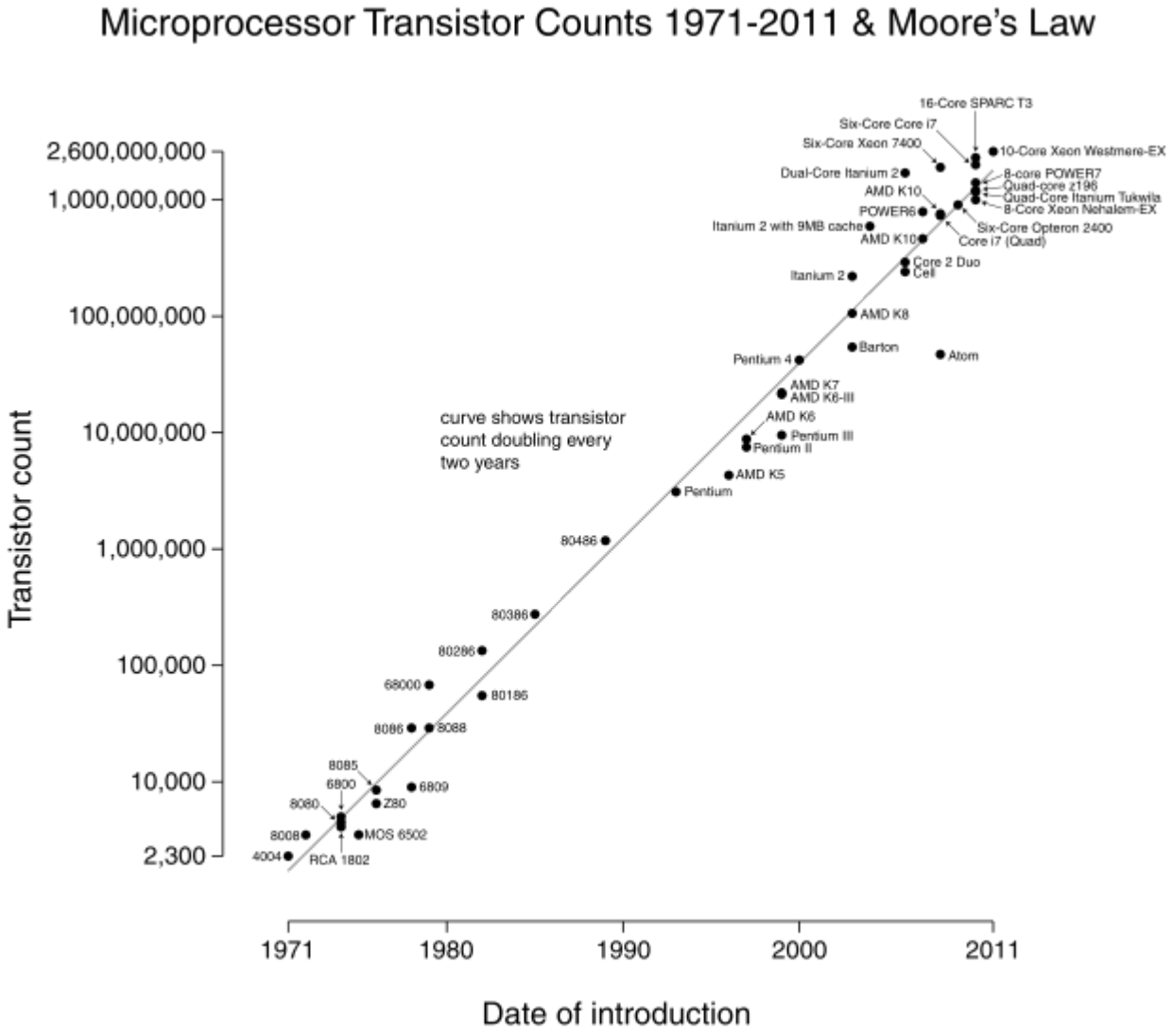
- Miniaturization
- New materials
- Lower Cost
- Democratized Innovation
- Enhanced performance
- Regulations and Privacy



Landscape

Moore’s Law, The Singularity

Moore's law is the observation that, over the history of computing hardware, the number of transistors on integrated circuits doubles approximately every two years.



Ray Kurzweil and The Singularity

Ray Kurzweil TED Talk - Singularity University

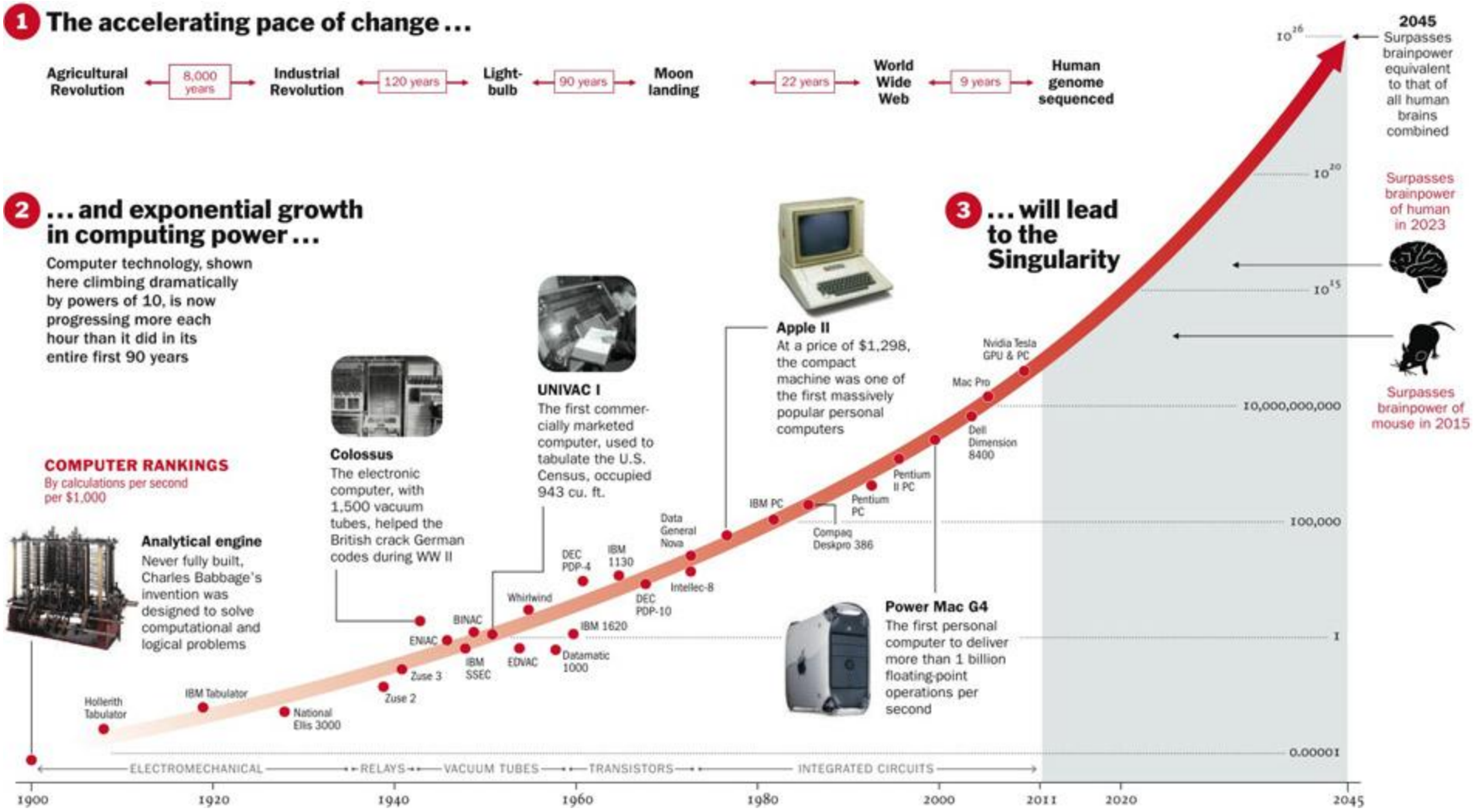


Image Source: [The Year Man Becomes Immortal]

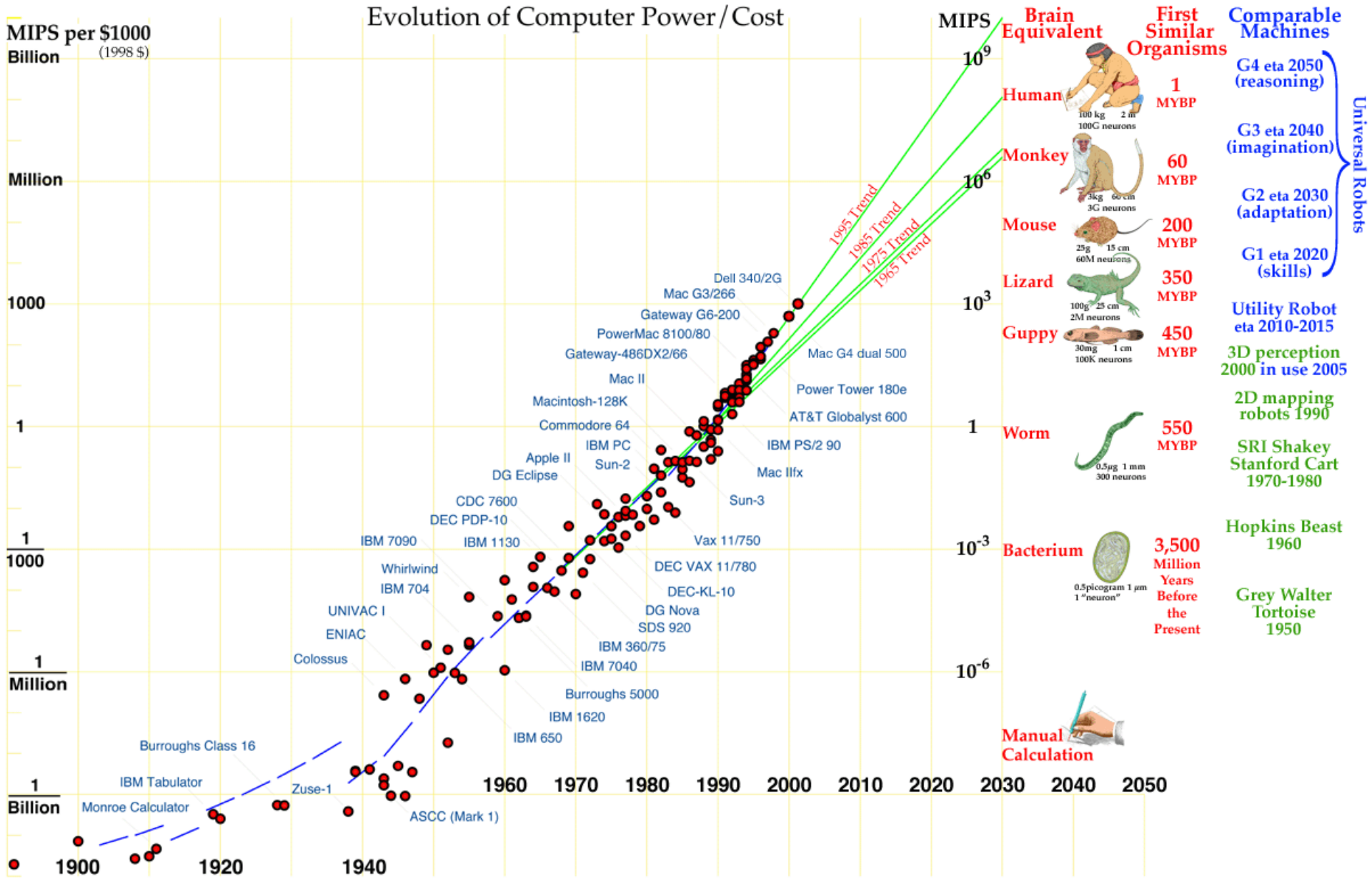
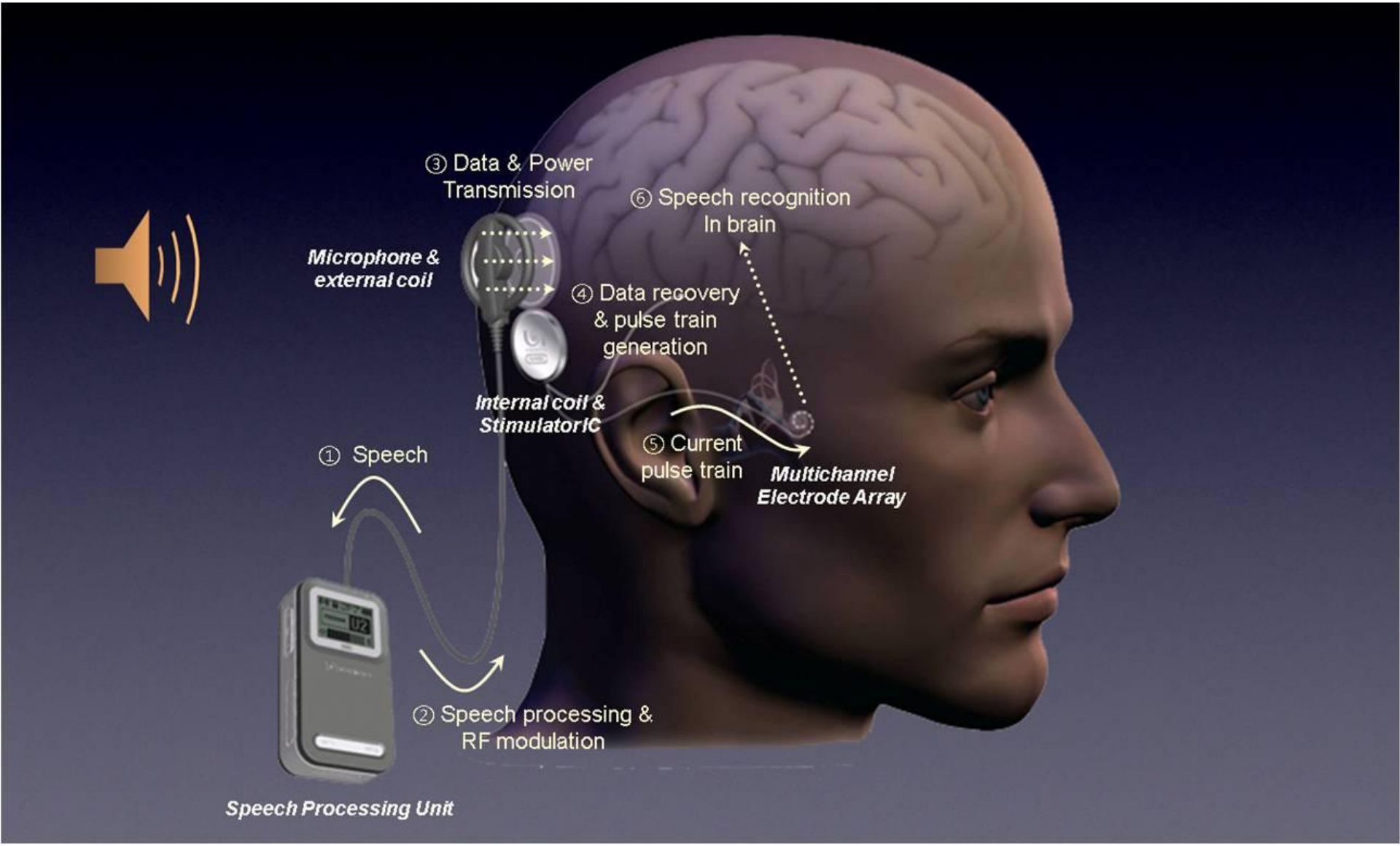


Image Source: [Singularity Point; Heaven or Hell]

MEDICINE

Implants, Brain Imaging, Biopolitics

IMPLANTS and NANOTECHNOLOGY



Articles

- Aimee Mullins: My 12 pairs of legs
- Teen's inexpensive 3D-printed prosthetic could aid amputees in the third world
- How 3D Printing Gave This Man His Life (and Face) Back

SCIENCE

Machines, Biominicry, Research

NASA Mars mission

The Curiosity rover is designed to travel Mars studying climate and geology. The rover is looking for signs of carbon, the building blocks of life. Some of the rover's features:

Robotic arm
Used to examine and manipulate soil and rocks; it also has two scientific instruments, one uses X-rays to determine materials' composition and the other is a magnifying camera

Laser
Burns small holes in rocks and soil up to 23 feet away and identifies chemical elements

Color cameras
Stereo mastcams on either side of the rover's mast take color pictures and movies in 3-D

UHF antenna
Primary transmission antenna

Plutonium power source
A nuclear battery that converts heat into electricity

Neutron detector
Detects water in rocks and soil

Photo courtesy of NASA

Weather station
Records wind speed/direction, air pressure, humidity, temperature and UV radiation

Radiation detector
Measures radiation from the sun, supernovae and other sources

Inside:

Chemistry lab
Analyzes rock and soil samples for organics

Mineral detector
Shines an X-ray beam at a rock or soil sample to identify types of minerals

SOURCE: NASA

AP

Image Source: [Curiosity Mission in Pictures]

Biomimicry / Biomemetics

Robert Full: Robots inspired by cockroach ingenuity

FILMED FEB 2002 • POSTED JUN 2008 • TED2002

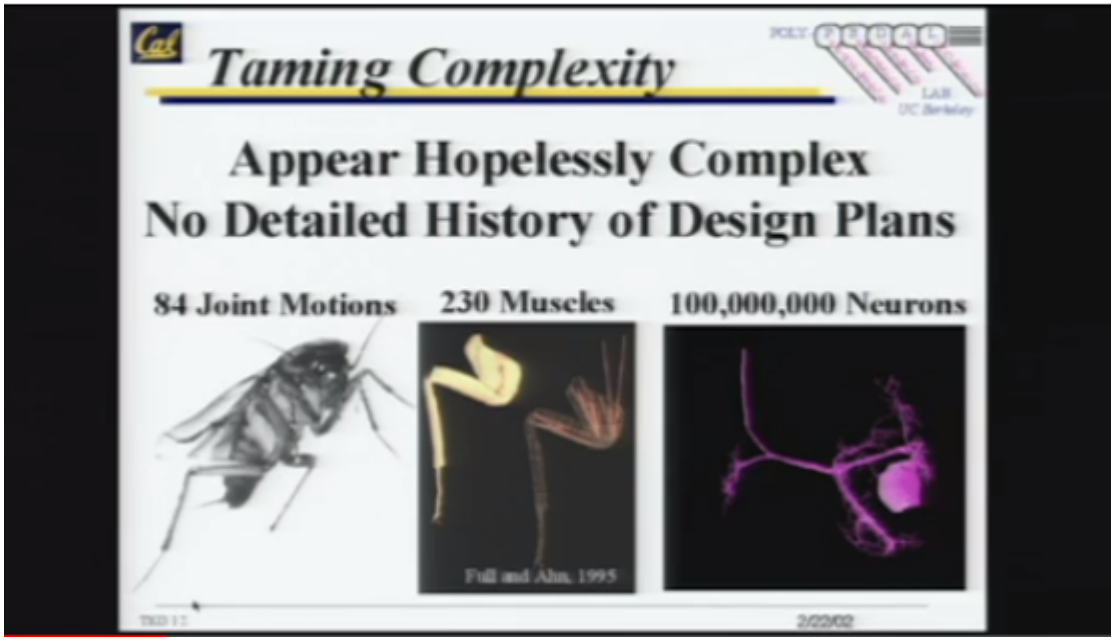
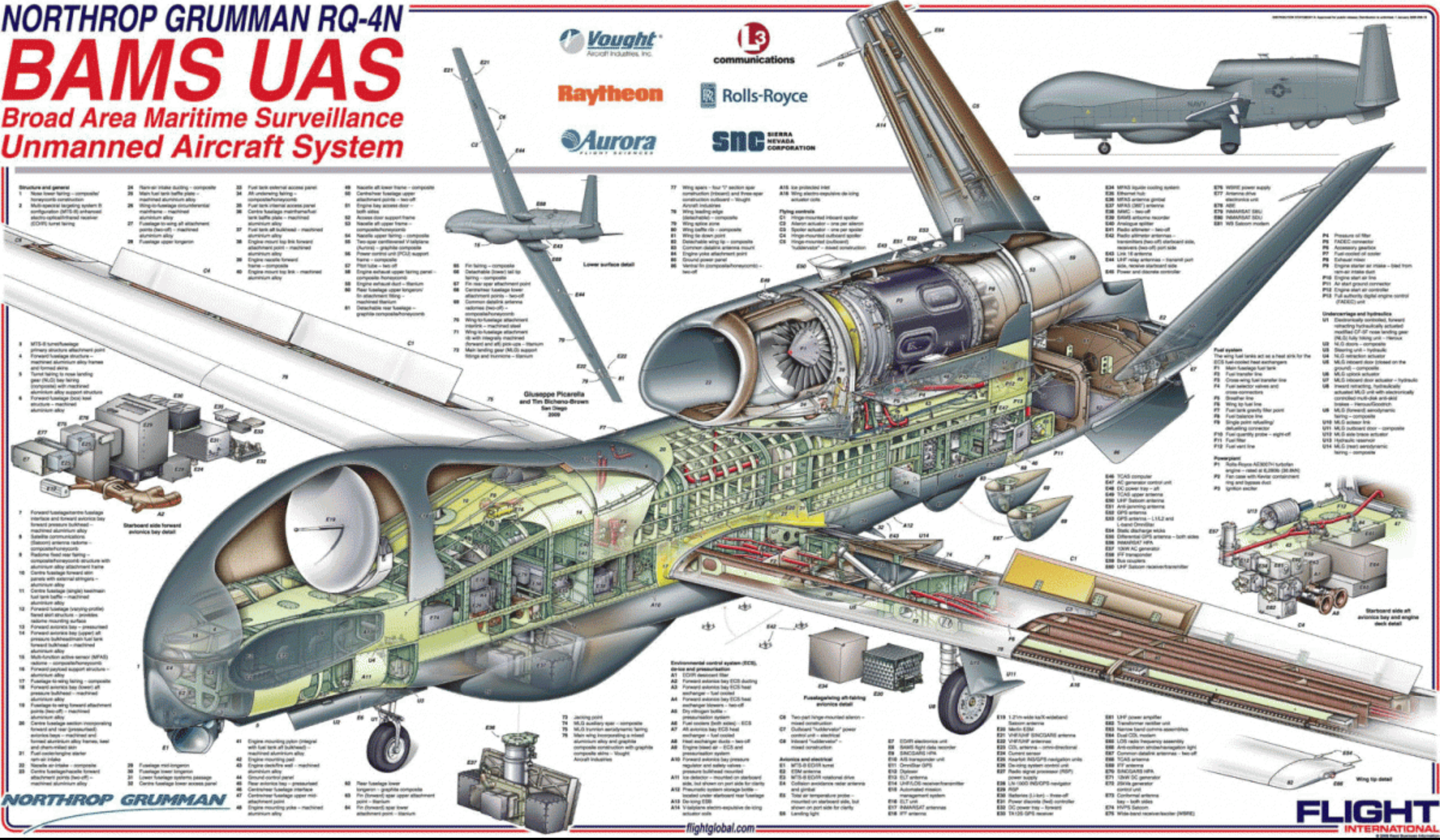


Image Source: BIOMIMICRY/BIMIMETICS: GENERAL PRINCIPLES AND PRACTICAL EXAMPLES

Research

- BIOMIMICRY/BIMIMETICS: GENERAL PRINCIPLES AND PRACTICAL EXAMPLES
-



MILITARY

IDE, UAV, Modern Warfare

Image Source: [DIY Drones; The Leading Community for Personal UAVs]

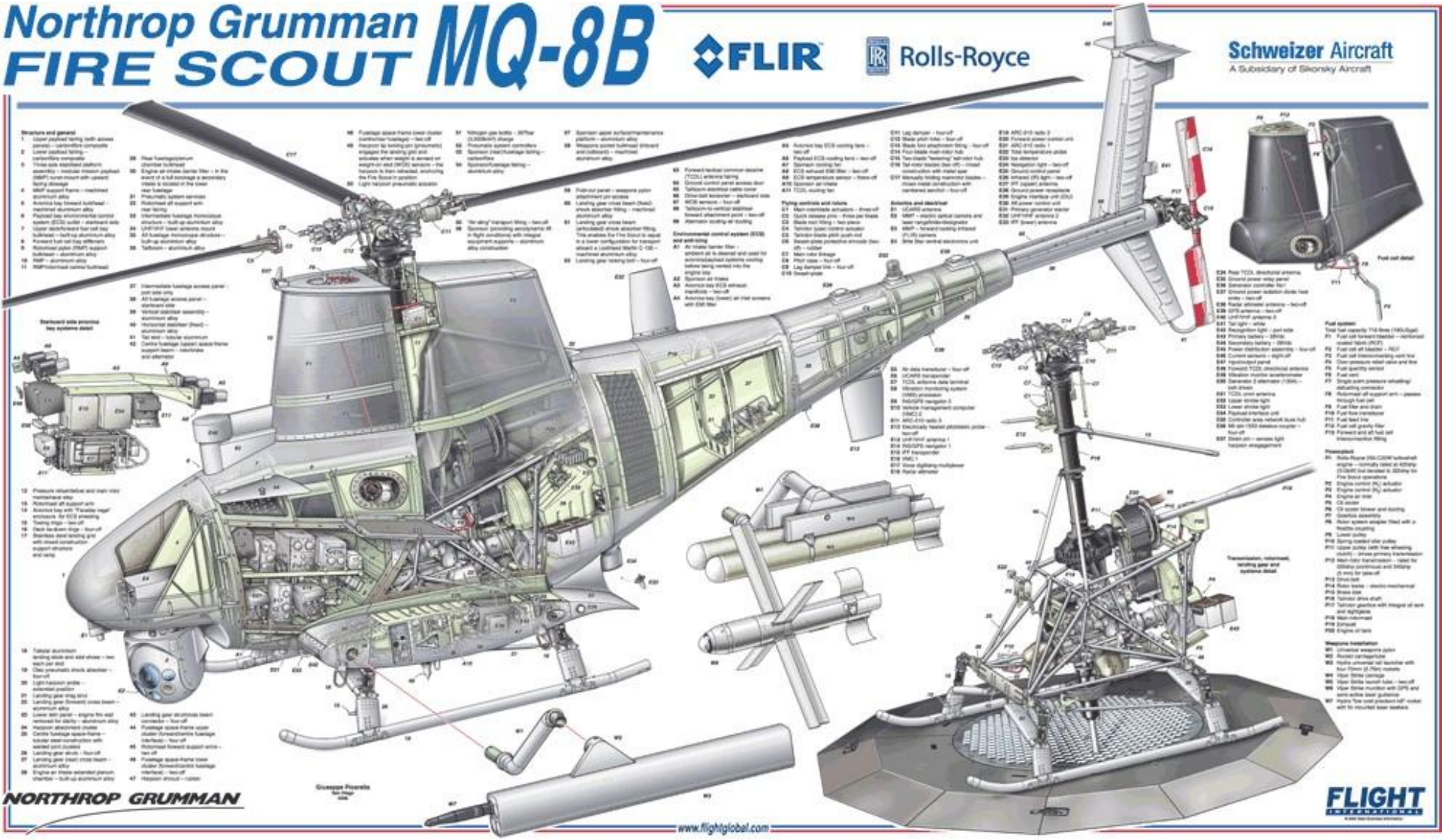


Image Source: [DIY Drones; The Leading Community for Personal UAVs]

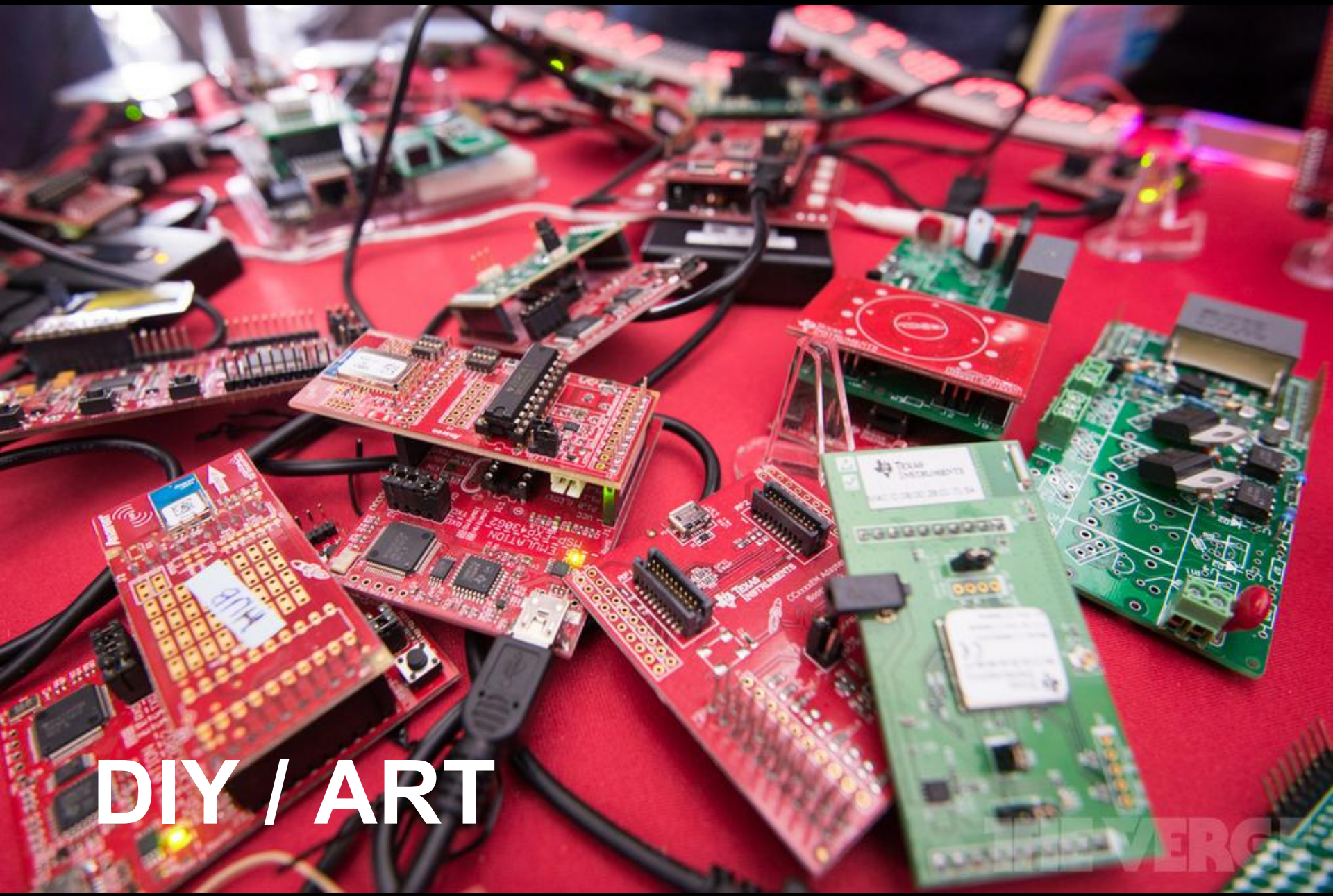
Modern Warfare

- How Unmanned Drones are Changing Modern Warfare
- CIA: Drones Document Count Would Damage National Security
- Drones: A New Chapter in Modern Warfare

CONSUMER

Gaming, Mobile

Image Source: iFixit



3D Printing, Maker Faire, Democratized Innovation

3D-PRINTING

Robohand is focused on developing open-source designs for mechanical finger prosthetics. Thanks to Makerbot generously providing two Replicator 2's to the project, we are now exploring the ways in which 3D printing can be applied to our efforts

DEMOCRATIZED INNOVATION

Maker Faire®

Click for list of makers

Class Sequence EMBEDDED SYSTEMS

Nuts and Volts

-electricity

-components

Science

-machines

-biomimicry

-haptics?

Medicine

-implants

-biopolitics

Military

-IDE

-UAV

NextFest: smart fabrics

-modern warfare

Consumer (game, mobile)

-iPhone 5s/c fingerprint

-Kinect

-gesture tv

DIY / ART

-3D printers

-production

-Maker Faire

Art

-computational fashion