Technology Development Stages and Market Readiness

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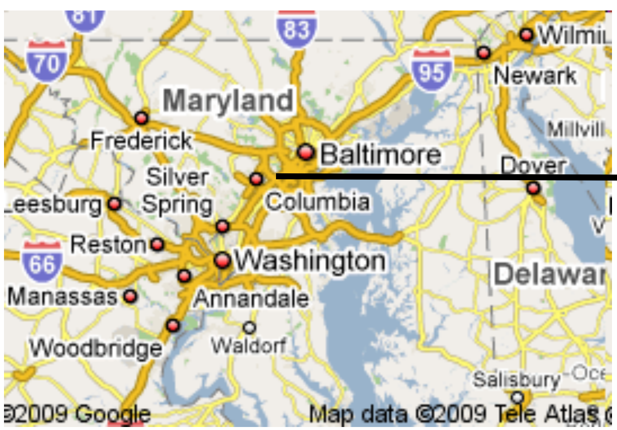


Our goals for this hour

Understanding Technology Readiness Level (TRL)

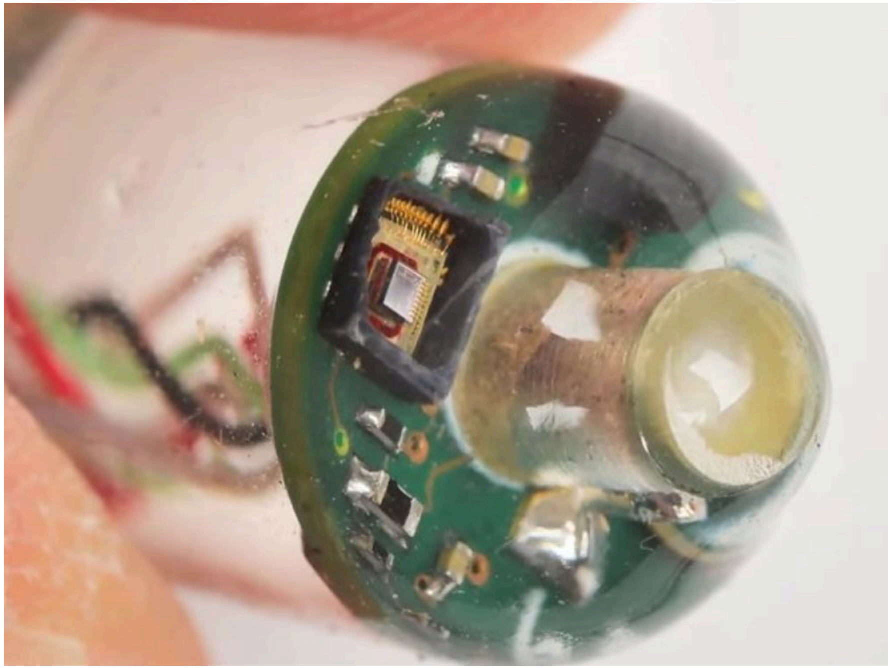
Measuring or tracking progress in technology development

Using TRL for Risk and Valuation for marketing of technology and investment by investors

Quiz

2016 Popular Science Invention Awards

The EnteroPhone



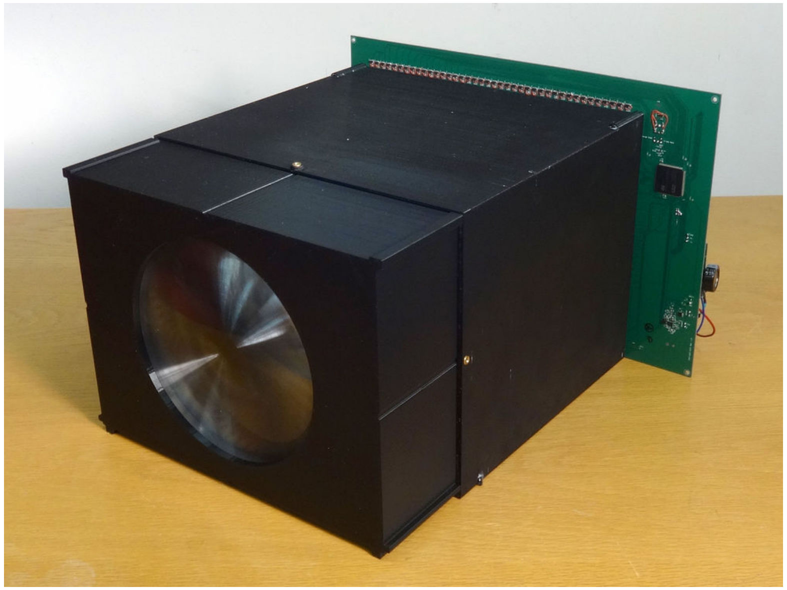
(www.popsci.com)

The EnteroPhone is a pill designed to monitor vital signs from inside the body.

Technology Maturity 1/5

2016 Popular Science Invention Awards

A SELF-POWERED CAMERA



(www.popsci.com)

Technology Maturity: 3/5

2016 Popular Science Invention Awards

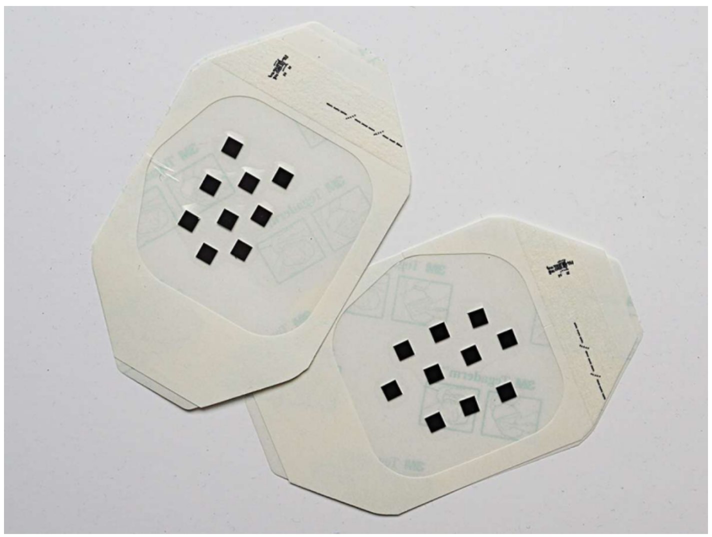
eora 3D

PRECISE 3D SCANNING ON THE GO

(www.popsci.com)

Technology Maturity: 5/5

2015 Popular Science Invention Awards



http://www.popsci.com/2015-invention-awards

Invention Awards

MEDICINE

Needle-Free Vaccination

Inventor: Katarzyna "Kasia" Sawicka

Company: ImmunoMatrix LLC

Invention: ImmunoMatrix

Development cost to date: $100,000–200,000

Maturity

Vaccines save lives, but most of them are delivered by needle. That's a problem for people without access to refrigerated solution, clean syringes, and safe ways to dispose of medical waste. Biomedical engineer Kasia Sawicka invented a painless alternative: a patch, called ImmunoMatrix, that can vaccinate patients without breaking the skin. "This technology can affect how vaccines are delivered, especially during pandemics," Sawicka says.

The skin doesn't absorb large molecules easily, which meant Sawick had to find another way to get vaccines across that barrier. As an undergraduate at Stony Brook

2015 Popular Science Invention Awards


Inventors:
Kevin R. Hart and Laura Moe
Company:
TZOA Wearables
Invention:
TZOA
Development cost to date:
Undisclosed
Maturity:

http://www.popsci.com/2015-invention-awards

2015 Popular Science Invention Awards

HEALTH

Medical Lab in a Music Box

selects a punch
given reaction a
it past gears wit

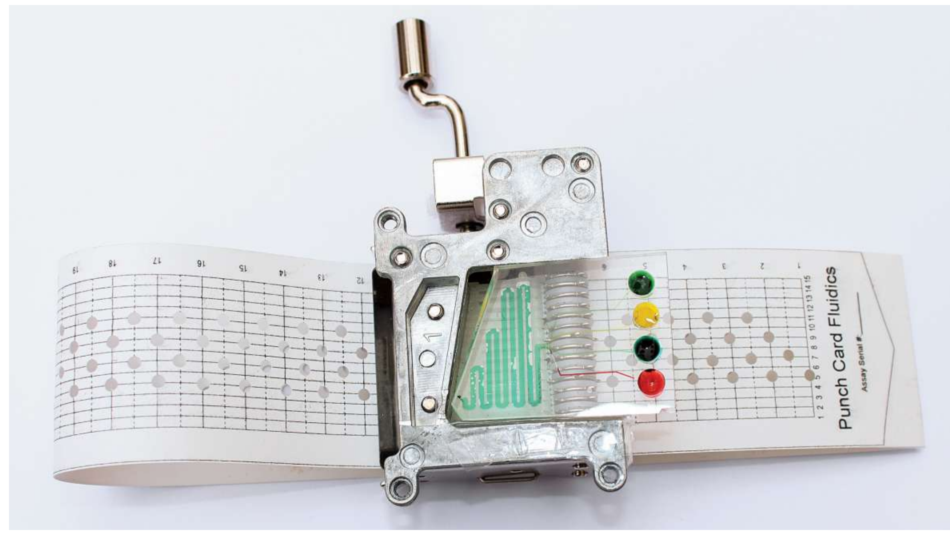
As one tooth slides into a punched hole, another squeezes a fluid channel to pump a chemical through a removable microfluidic chip.

One night in 2011, as Manu Prakash turned the handle on a music box, he realized the simple mechanism—a crank rotating gears—could also run a programmable chemistry set. Most "lab-on-a-chip" devices require computers, technicians, and expensive laboratories to pump precise amounts of liquid through a microfluidic chip. But a hand-cranked mechanism could eliminate all that; Prakash's idea wouldn't even need power. "What we're doing here is steampunk chemistry," he says.

Prakash, who heads a Stanford University research lab, recruited graduate student George Korir to help create a sophisticated scientific

Inventors: Manu Prakash and George Korir
Affiliation: Stanford University
Invention: Punchcard Programmable Microfluidics
Development cost to date: $50,000
Maturity: ◆◆◆◆◇

device that works li
First, the duo had t
paper punched wit
holes—each keyed
chemical reaction—
tiny mechanical pu
to generate nanolit
Twenty-some prot
they're preparing t
invention, Punchca

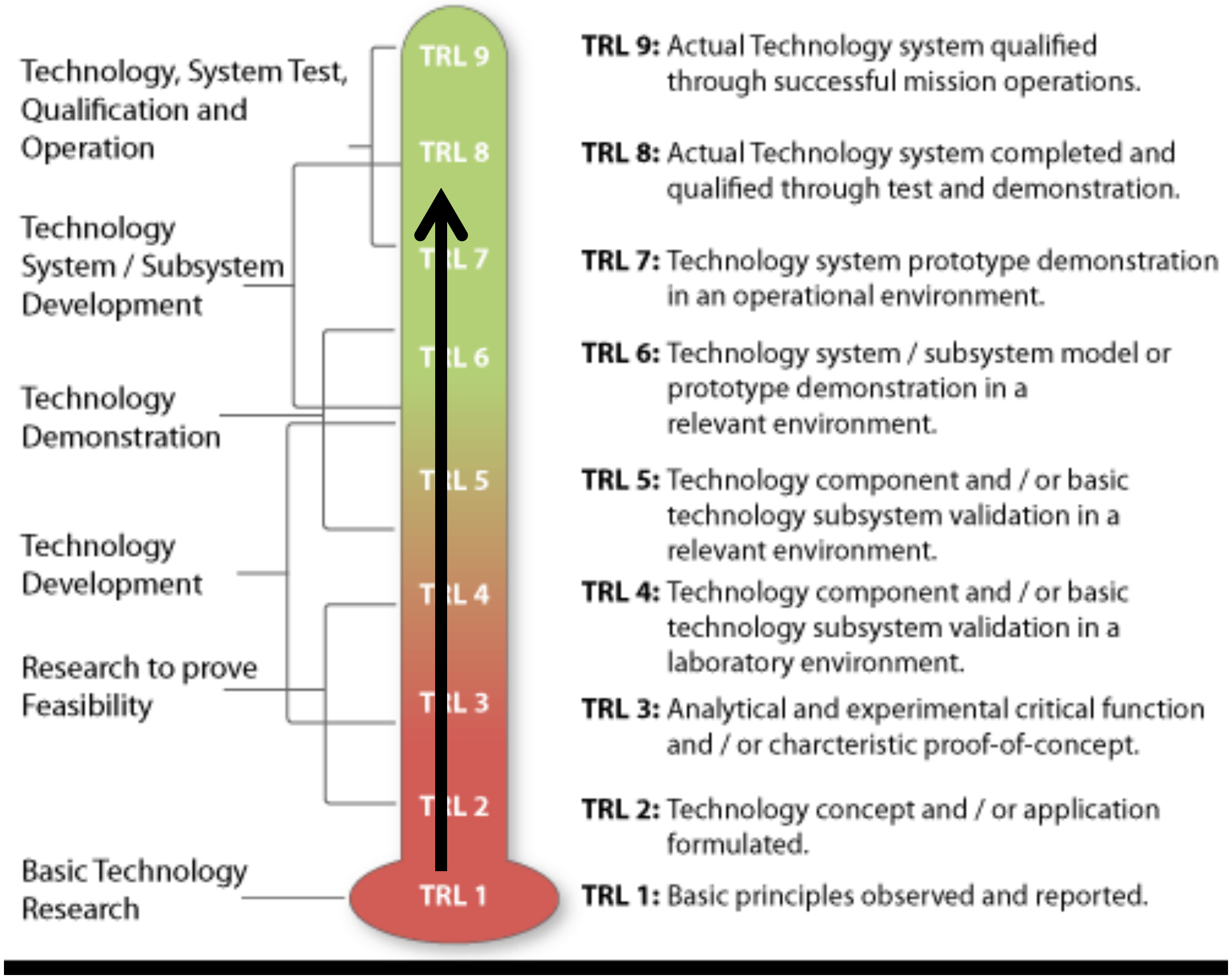


http://www.popsci.com/2015-invention-awards

Technology Development and Technology Readiness Levels (TRL)

TRL Table: Developed by NASA and commonly used in the US (and more recently in Europe) for technology development programs to measure the maturity of a technology. Also important in the valuation of the product/company.

NASA Technology Readiness Levels (TRL)



http://www.aof.mod.uk/aofcontent/tactical/techman/content/trl_applying.htm

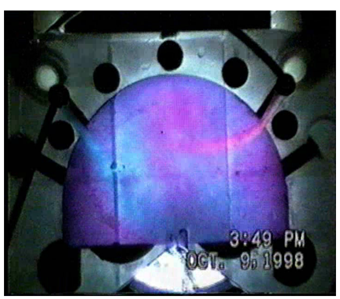
ET International

ADVANCED FLUIDICS

Automotive Windshield Washer Nozzle

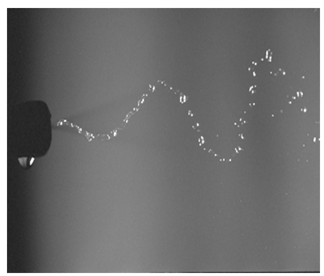
Technology Readiness Level

TRL 2



Invention

TRL 3

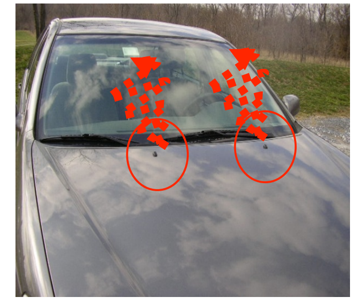


Application/ Innovation Technology Development

TRL 7

Product Development

TRL 9

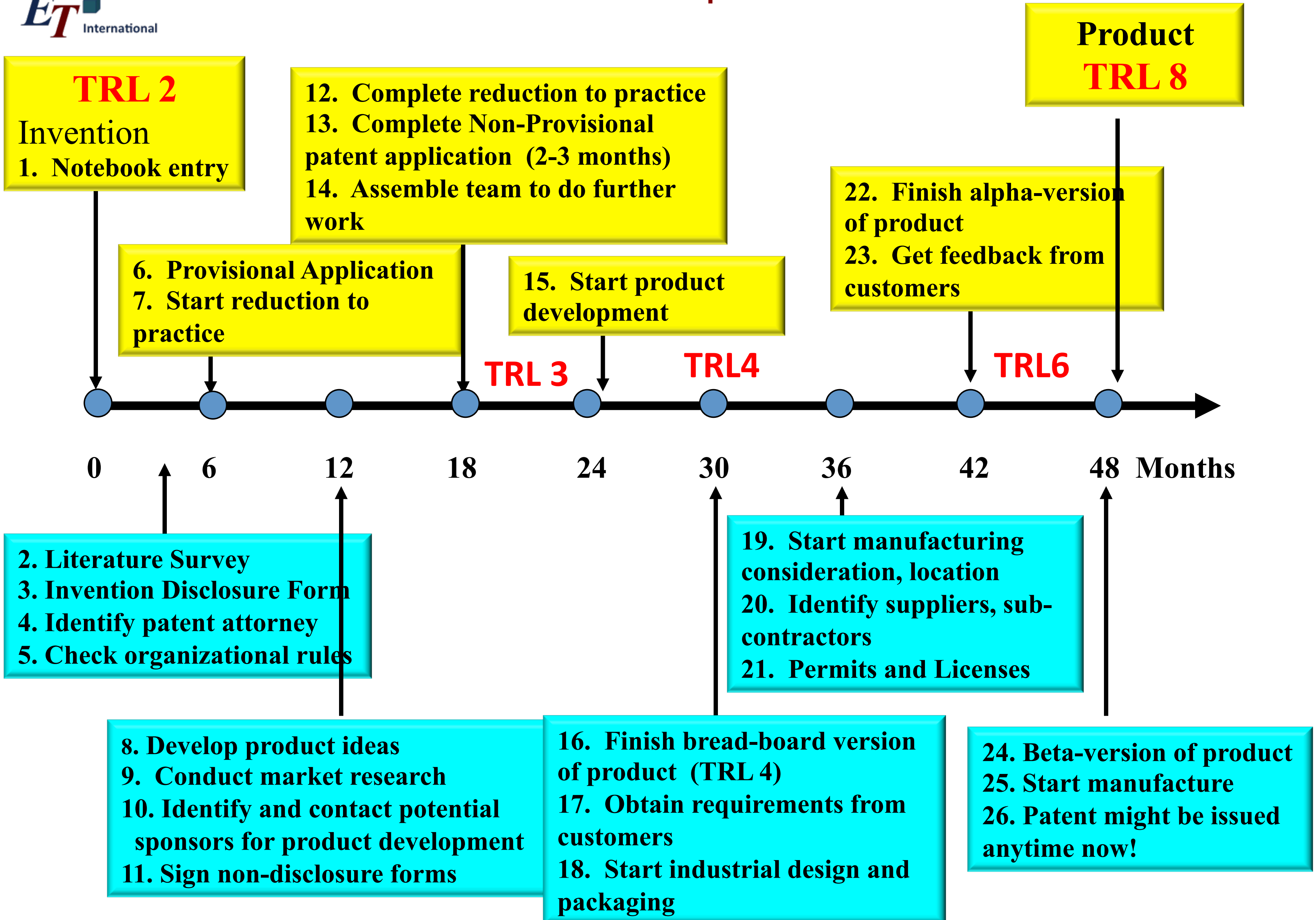


Market

40 million nozzles/year
Used in GM,Ford, Chrysler, Volkswagon, Mercedes Saab, Jaguar Toyota, Honda

Time

Invention to Product: Steps and Time-Line



Corrosion Health Monitor

Product (2008)

www.electrawatch.com

(2007)

TRL 8

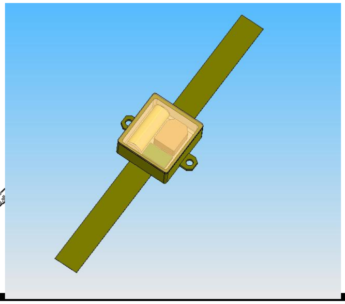
TRL 6

Prototype 1

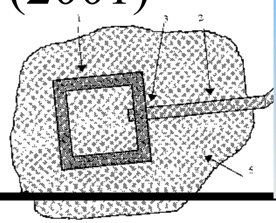
"mock-up" (2006)

TRL 3

Product concept (2005)



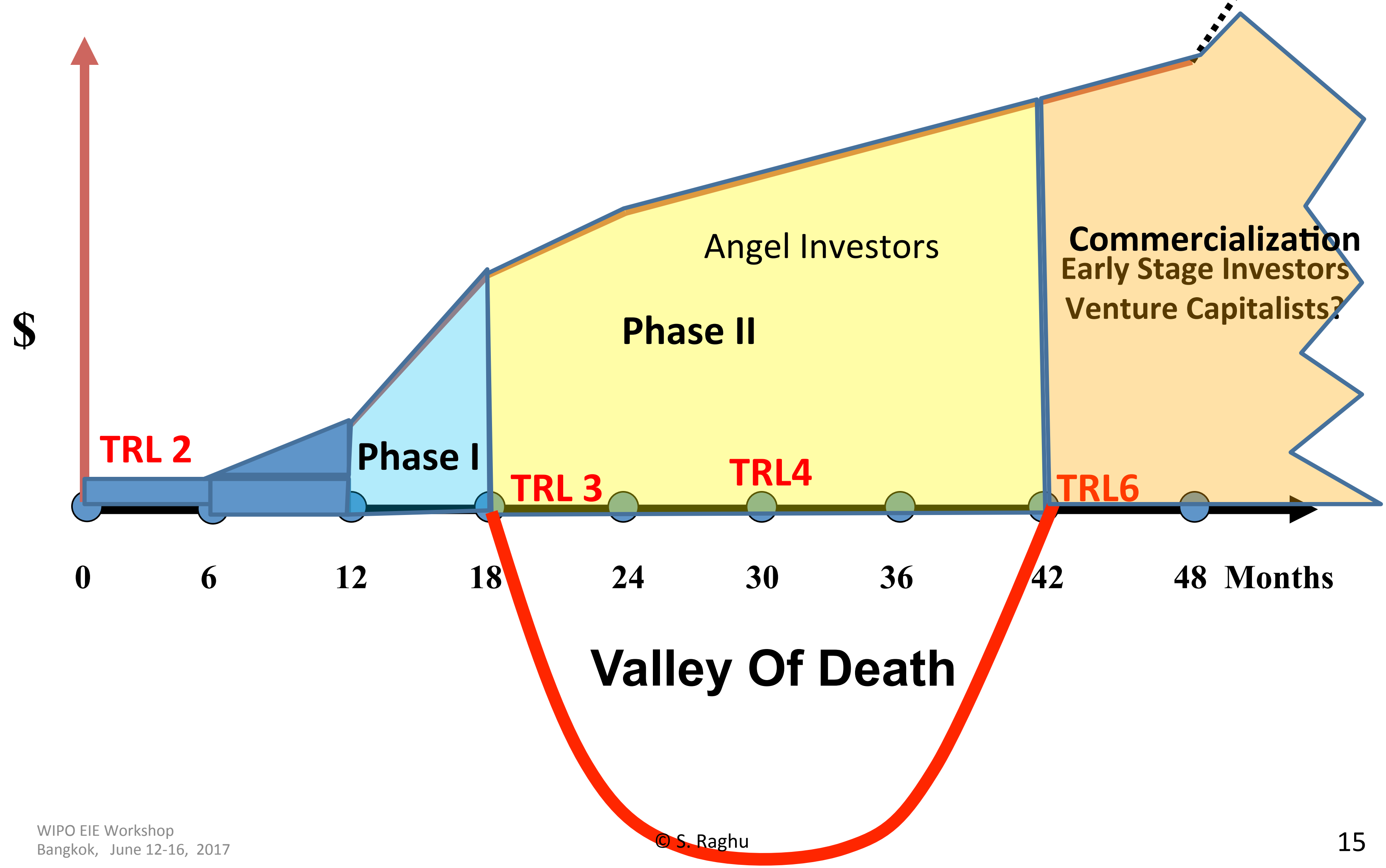
Patent (2001)



TRL 1

Time

Cost of Taking the Product to Market



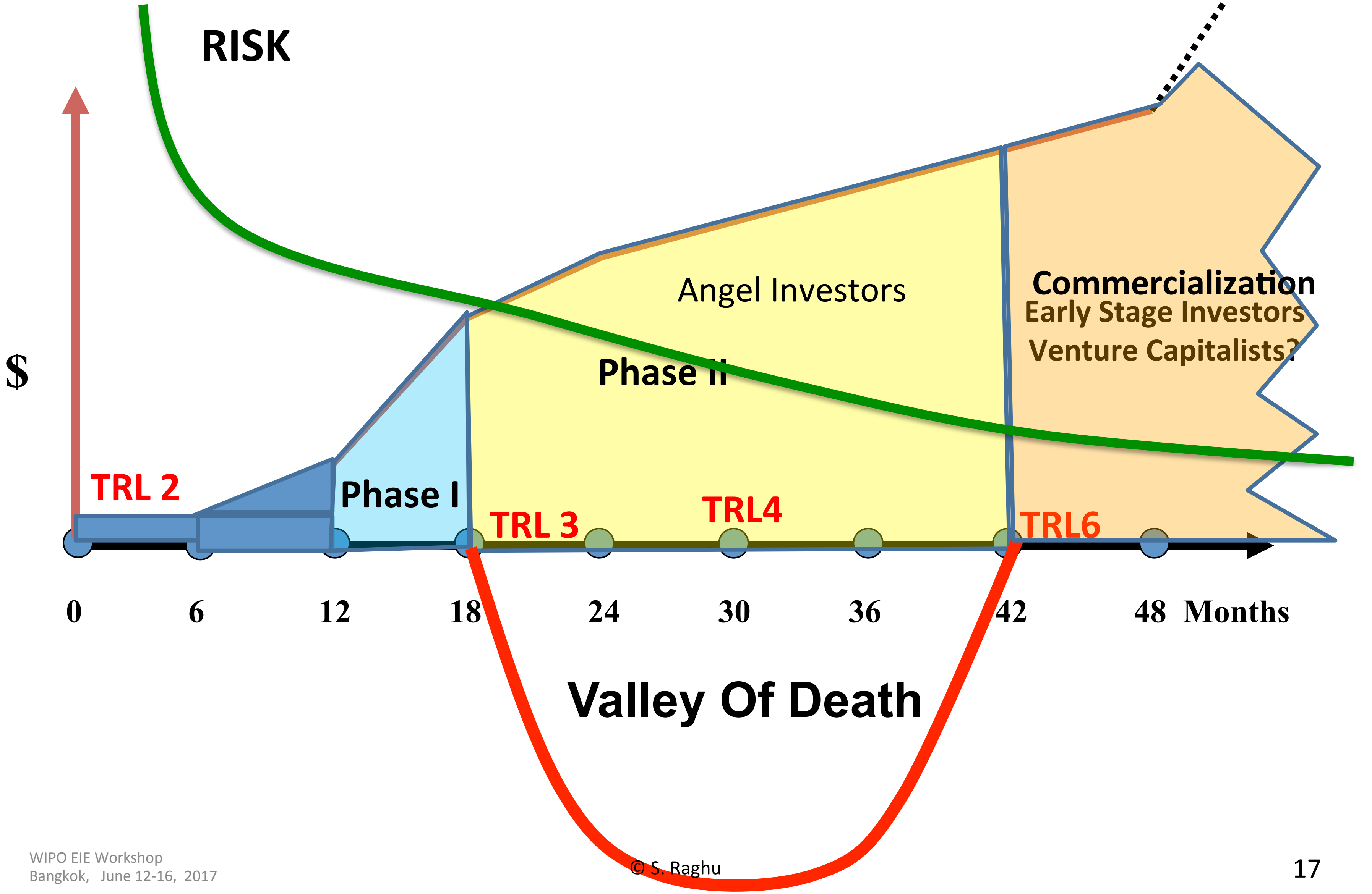
Why use TRL metrics?

"Almost Ready" ≠ Ready

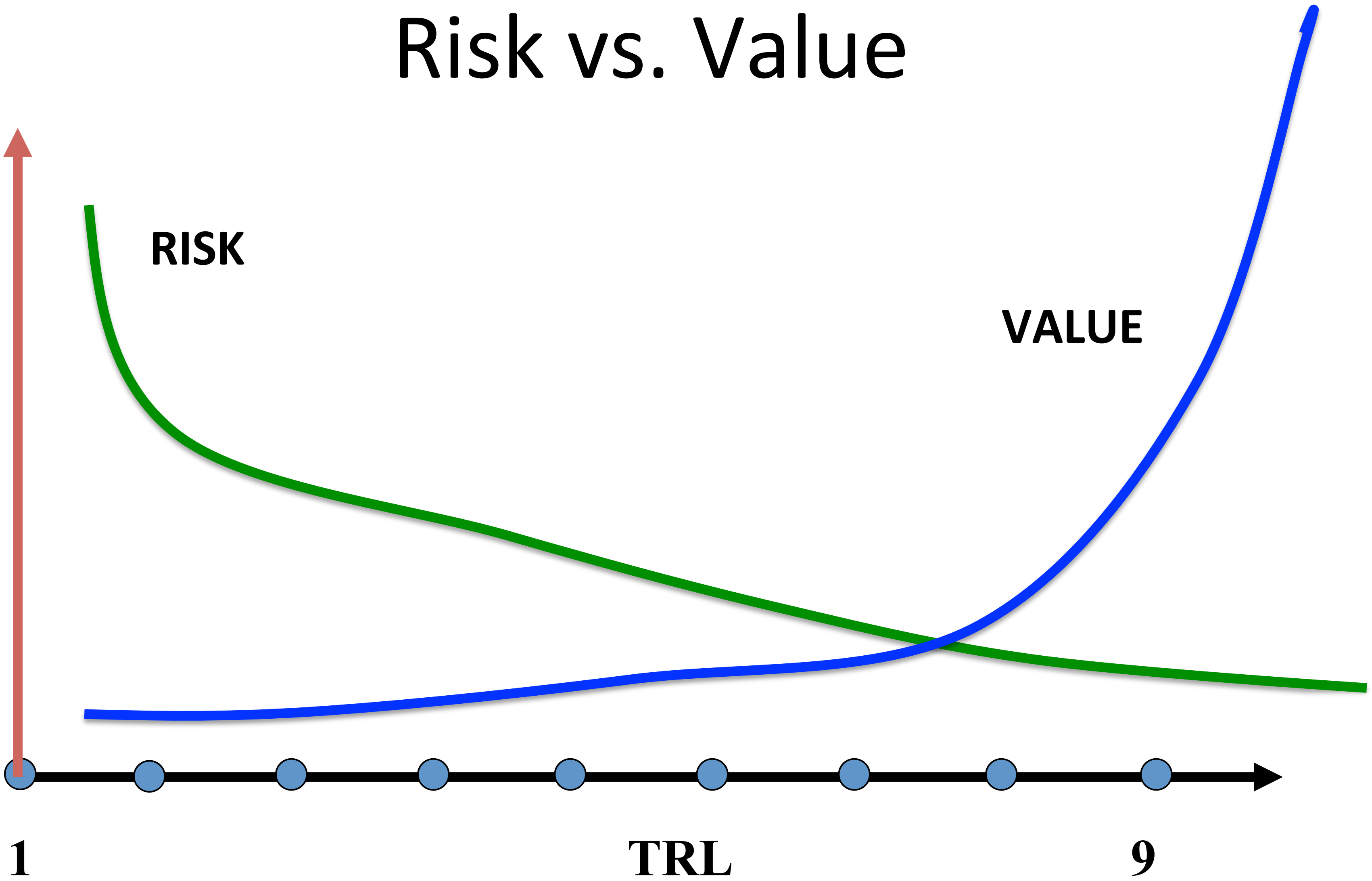
Understanding the risk of adoption of technology

Valuation of technology for licensing, sale, etc.

Risk of Taking the Product to Market



Risk vs. Value



Who uses this metric -TRL?

Possibly University Technology Transfer Office

Government Funding Agencies

Industry – to see the ease of adopting to application

Investors – to decide investments on technology – duration of TRL1 – TRL9

Anyone else who uses TRL?

Beyond TRL

System or Integration Readiness Levels
(Form, Fit and Function)

Manufacturing Readiness Levels
(Manufacturing set-up, Supply Chain, Human Resources, etc.)

Market Readiness Levels
(Consumer feedback, Market Launch, etc)

Valuation of Technologies

“Market Pull” Technologies are easier for valuation because there is data on the market size, cost of comparable products, etc.

“Technology Push” type is much difficult for valuation because of unknown consumer/customer/market response.

Some tough decisions for licensing

1. Large company (with many products) or a start-up/SME?

2. Local, regional, national or multi-national company

3. Company with small market share or large market share

4. Difficult or nice company to work with?

5. Reputation/Track record & Values of the company

CONCLUSIONS

TRL – Technology Readiness Level – metric for measuring the status of a product getting ready for market/implementation

NASA Technology Readiness Levels 1-9

Other Metrics come into play beyond TRL

Risk and Value assessment using TRL

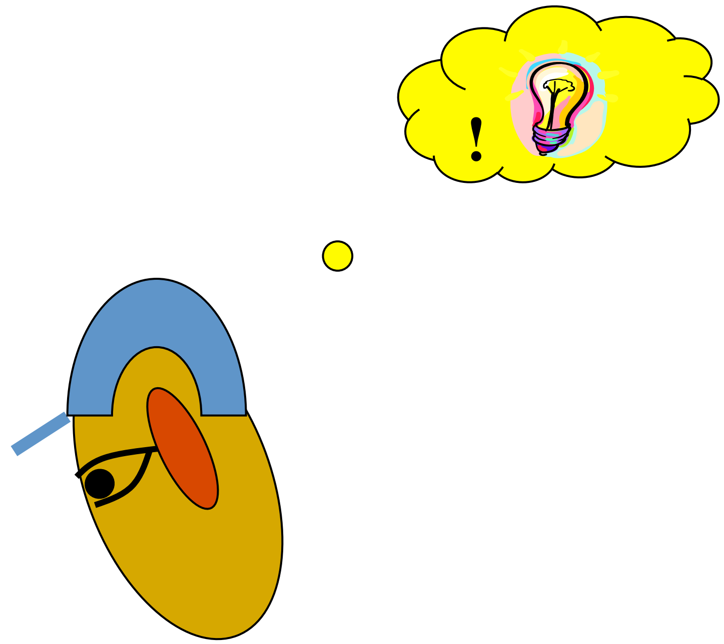
Choices for Licensing

Activity?

For all the invention disclosures that you have received – would you be able to make a judgment on their TRL?

THANK YOU!

Additional Material



TRL1

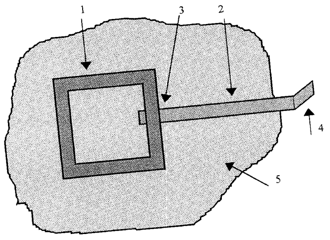
Lowest level of technology readiness. Research begins to be translated into applied research and development. Examples might include

a) Paper studies of a technology's basic properties (at the level of a proposal to a funding agency)

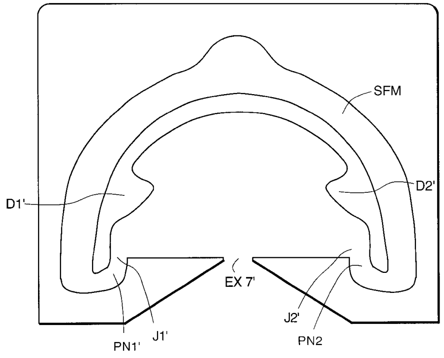
b) An exploratory idea that could potentially generate a new product/technology

TRL 2

Invention begins. Once basic principles are observed, practical applications can be invented. Applications are speculative and there may be no proof or detailed analysis to support the assumptions. Examples are limited to analytic studies.



Cossosion Sensor Patent
(Dacre &Davis, 2001)

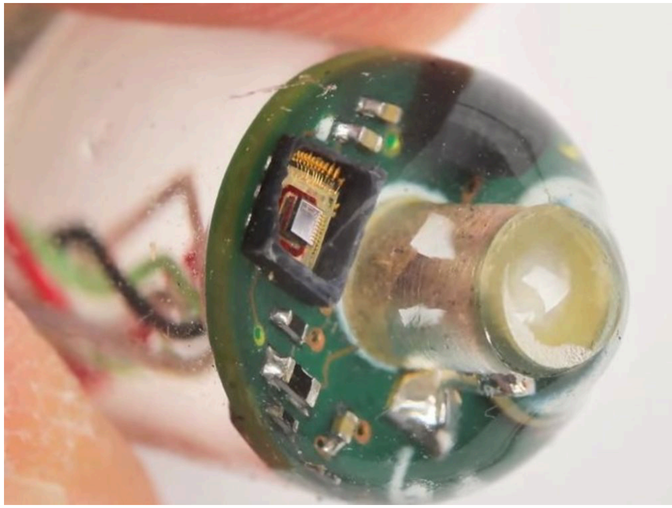


Windshield Washer Nozzle Patent
Raghu (2001)

TRL 3

Active research and development is initiated. This includes analytical studies and laboratory studies to physically validate analytical predictions of separate elements of the technology.

Examples include components that are not yet integrated or representative – bench-top or "warm-feeling" experiments.



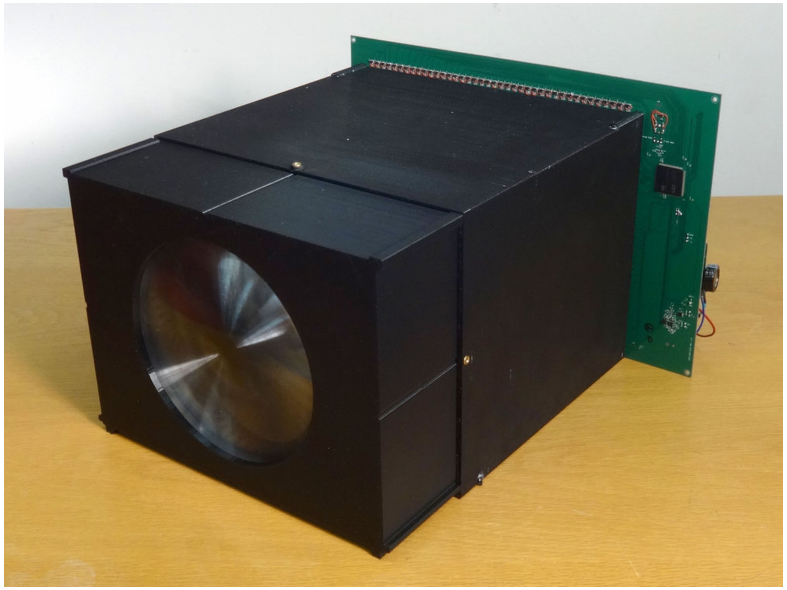
TRL 4

Basic technological components in the intersect areas are ***integrated in a similar fashion*** to establish that they will work together. This is relatively "low fidelity" compared to the eventual system.

Examples include integration of "ad hoc" hardware in the laboratory.

Device fabricated in the lab and either glued or attached with fasteners.

Breadboard circuits.



TRL 5

Fidelity of breadboard technology increases significantly. The basic technological components are integrated with reasonably realistic supporting elements so it can be tested in a simulated environment.

Examples include "high fidelity" laboratory integration of components.

TRL 6

Similar but not necessarily the same system, which is well beyond that of TRL5, is tested in a relevant environment. Represents a major step up in a technology's demonstrated readiness.

Examples include reliability and satisfactory performance characteristics in a high fidelity laboratory environment or in simulated operational environment (operating range of temperature, humidity, pressure, etc.)

Reduces

- Product liability
- Product recalls

Corrosion Sensor

TRL 7

Prototype near or at planned operational system. Represents a major step up from TRL 6, requiring demonstration of an actual system prototype in an operational environment.

Examples include testing the prototype in a mock-up of the final product.

TRL 8

Technology/product proven to work in its final form and under expected conditions. In most cases, this TRL represents the end of true system development.

Examples include developmental test and evaluation of the system in its intended environment to determine if it meets specifications.

TRL 9

Actual application of the technology or product in its final form and under mission conditions, such as those encountered in operational test and evaluation. Examples include using the system under operational mission conditions.

~ 40 million nozzles/year