# Creativity Workshop

A Concept Development Document


Museum of Science™

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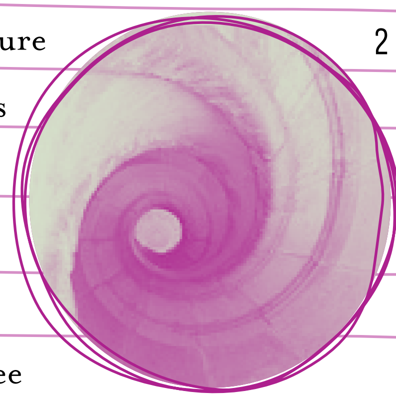




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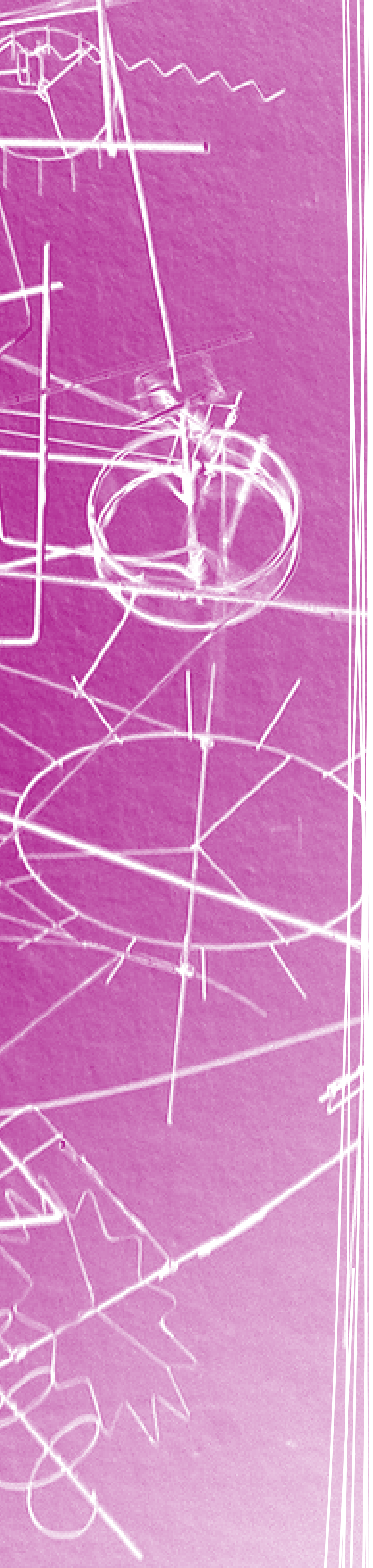


# Introduction

**Creativity Workshop** (working title) will be a four to five thousand square foot permanent exhibit that serves as a core part of Museum's Technology Initiative. The Technology Initiative aims, through the development of a wide variety of exhibits, programs, and educational materials, to increase the technological literacy of the Museum's many audiences.

The National Academy of Engineering defines technological literacy as

> an understanding of the nature and history of technology, a basic hands-on capability related to technology, and an ability to think critically about technological development. (Pearson & Young, 2002).

In *Standards for Technological Literacy*, the International Technology Education Association defines a technologically literate person as someone who understands

> what technology is, how it is created, and how it shapes society, and in turn is shaped by society. (ITEA, 2002).

The informal education aspect of the Museum's Technology Initiative is organized around six educational themes:

1. What is technology?
2. What's going on in technology today?
3. How are technologies created?
4. How can I use technologies to do creative things and solve problems?
5. How do technologies affect society and the environment?
6. How can we make good decisions about technology?

Creativity Workshop will be the primary exhibit vehicle for implementing the third and fourth themes. Visitors to the exhibit will participate in highly interactive activities in which they create and invent things of their own, gaining first-hand experience with the engineering design process and creative problem solving. Rather than seeing technology and engineering as difficult to understand and separate from what they already know and do, visitors will have an opportunity to learn how some technologies work. Interactions with high-tech art will invite visitors to broaden their views of technology and the people who create it. Creativity Workshop will also provide a permanent home for the successful Design Challenges program, which focuses on the third theme: how technologies are created.

# Findings from the Literature

Findings from published literature and from unpublished front-end studies conducted at the Museum have informed the goals and methods chosen for the project.

## Technological Literacy

According to the National Academy of Engineering, "Most experts who have thought about the issue [technological literacy] in depth agree that people in this country are not as technologically literate as they should be." Some examples of this lack of understanding include the following:

- **Most people don't understand the difference between science and technology:** In a 2004 survey commissioned by the International Technology Education Association (ITEA), 63% of respondents agreed that engineering and technology are "basically one and the same thing," while 62% said the same about science and technology. "Given that experts in the field link engineering and technology but are not inclined to link science and technology, the lack of discrimination on the part of the public…is another example of the need to build technological literacy" (Rose, Gallup, Dugger, & Starkweather, 2004).
- **Many people don't understand how common technologies work, even when relevant to their personal health and safety:** In the 2004 ITEA survey, nearly half of respondents believed, incorrectly, that using a cordless phone in the bathtub creates the possibility of being electrocuted; and nearly half believed, also incorrectly, that antibiotics kill viruses as well as bacteria. These findings are echoed by the 2006 Science and Engineering Indicators, which found that most Americans express support for science and technology, but are not well informed about these subjects (National Science Board, 2006).
- **Most people don't know what engineers do:** Sixty-one percent of Americans feel that they are "not very well informed" or "not at all well informed" about engineers and engineering (American Association of Engineering Societies, 1998). Many children believe that engineers work in construction or fix cars (Cunningham, Lachapelle, & Lindgren-Streicher, 2005).

## Creativity and Technology

The development of technology depends on the human ability to be creative (ITEA, 2002). Thus, any exhibit about the development of technology must look at creativity, particularly at inventiveness—the form of creativity that leads to the design and fabrication of new and useful products (Committee for Study of Invention, 2004).

- **Who is creative/inventive?** Visitors to the Museum of Science see inventors as creative, but see engineers as less creative than both inventors and scientists. They

see themselves as creative, and as more creative than other people in general (Chin, 2006). However, a survey from another museum indicates their visitors don't see themselves as inventors (Pekarik & Dreibelbis, 2000). Young people are increasingly attracted to careers they see as "creative" (Florida, 2002). Helping visitors see engineers as creative and themselves as "inventive thinkers" therefore may be a way to encourage more children to consider engineering and other technology careers.

- **Creative thinking tools and cognitive strategies of inventors:** Research by historians of science and technology, cognitive scientists, and educators have identified a number of tools and strategies used by inventive minds (Root-Bernstein, 1999; Committee for Study of Invention, 2004; Friedel, R.).

## Technology/ Engineering Education

A variety of sources provide evidence about engaging experiences that promote technological literacy and/or technological creativity.

- **Interactive exhibits can be an effective way to interest people in engineering:** An evaluation of *Innovation Station*, at the Oregon Museum of Science and Industry, found that hands-on interactives had a higher attracting power with visitors than graphic panels or video kiosks (People Places & Design Research, 2005). An evaluation of the *Tech City* exhibition, from the Ithaca Sciencenter, found that while visitors did notice other types of exhibit components, hands-on engineering design components were the most successful at attracting visitors and holding their attention (Spencer, Carroll, Huntwork, & John, 2003).

- **Early hands-on experiences with technology can contribute to subsequent pursuit of careers in engineering and inventing:** Many inventors and engineers identify early experiences tinkering with technology as influential to their becoming interested in the field (Henderson, 2004). Positive, hands-on experiences with engineering can influence children, especially girls, to pursue engineering as a career (Bennett, 1996).

- **Additional museum research about, and evaluation of, exhibit methods will inform the development of Creativity Workshop's interactives.** The exhibit team will make use of the findings from the PISEC Family Learning Study (Borun, et al., 1998), the Exploratorium's APE (Active, Prolonged Engagement) Project (Humphrey & Gutwill, 2005), and the evaluation from the exhibition *Star Wars: Where Science Meets Imagination* (Tisdale, 2006) to create exhibits that are family-friendly, open-ended, and compelling.

# Exhibit Messages

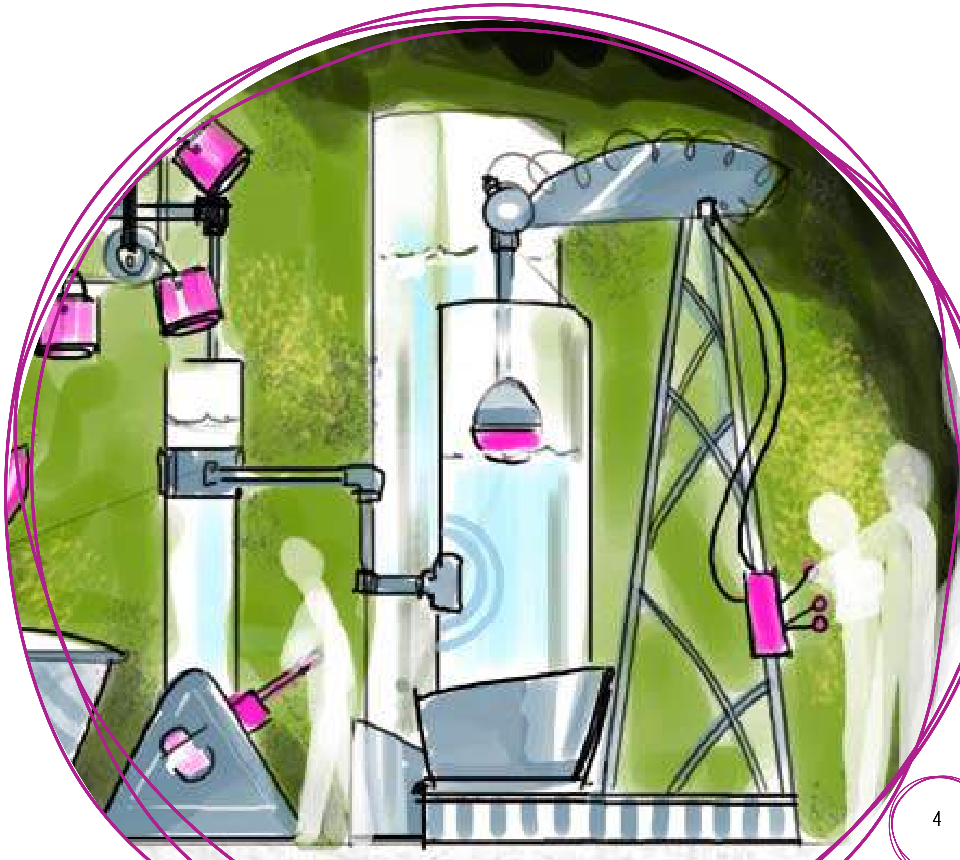
Exhibit messages are the ideas the exhibit will communicate, expressed using the type of language that might be used by museum visitors. These messages are based on the educational goals, listed in the next section.

Main Message:

I can have fun playing with, understanding, and creating technologies.

Supporting Messages:

1) I can design technologies using the same processes engineers and inventors use.
2) Designing art and designing technology both require creativity.
3) Everyone, including me, can be creative.
4) There can be many different solutions to the same problem.
5) I can understand how technologies work.



# Educational Goals

## In Creativity Workshop, visitors will

1) have fun playing and creating with technologies. *(behavioral/affective)*
   - feel that they can create using technology. *(affective)*
   - be inspired by what others have created. *(affective)*
   - use technology to express themselves. *(behavioral)*

2) learn about and experience the processes by which new technologies arise. *(cognitive)*
   - create an object or system using the engineering design process. *(behavioral)*
   - learn about and/or experience other creative thinking tools and inventive processes. *(cognitive/behavioral)*

3) perceive themselves as capable of understanding technologies. *(affective)*
   - see technology as marvelous but also comprehensible. *(affective)*
   - discover how things work by reading instructions, taking apart, putting back together, making observations, and asking questions. *(behavioral/cognitive)*

4) learn that technology is a human activity. *(cognitive)*
   - learn that inventing may be driven by the demands of the marketplace or by the inventor's awareness of possibilities for which no demand yet exists. *(cognitive)*
   - learn that technology is the result of the human ability to be creative. *(cognitive)*
   - learn that different cultures may have different needs or different responses to the same needs. *(cognitive)*
   - understand that there is no perfect design; all design involves trade-offs based on human preferences. *(cognitive)*

5) see that art and technology are related. *(cognitive)*
   - learn that design, whether of a piece of artwork or a new technology, is a creative process. *(cognitive)*
   - learn that art is created using technologies, and will consider whether the resulting creations are also technology. *(cognitive)*

Educational goals for this exhibition were developed with reference to the ITEA's *Standards for Technological Literacy* (ITEA, 2002), the *Massachusetts Science and Technology/Engineering Curriculum Frameworks* (Massachusetts Department of Education, 2006), *Benchmarks for Science Literacy* (Project 2061, 2003), and other sources, and choosing/adapting goals appropriate to an informal education environment. See Appendix A: Educational Goals: Connections to Standards, for detailed information on the sources of these goals.

*Behavioral* goals are those activities that we hope visitors will undertake during their visit to the exhibit.

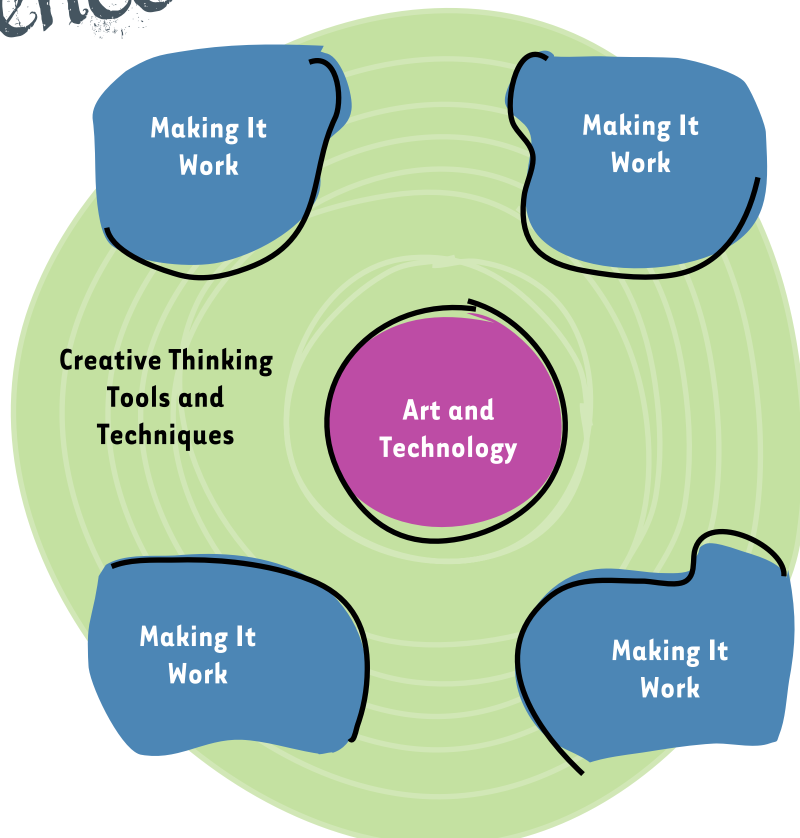
*Affective* goals represent hoped for changes in attitudes or beliefs.

*Cognitive* goals indicate understanding of specific facts or concepts that will be presented in the exhibit.

# The Visitor Experience

Creativity Workshop will be organized into three main areas:

**Art and Technology** will feature a large multimedia kinetic sculpture, with related exhibits that document the artist's process and provide an opportunity for visitors to make a small kinetic sculpture of their own. Other works of technological art will be incorporated through the exhibition.




**Creative Thinking Tools and Techniques** will introduce visitors to, and give them practice with, a series of creative thinking tools and techniques that are useful in designing new technologies and in other forms of technological problem-solving. Each tool or technique will pair a hands-on activity with an inventor/engineer story, told through text, artifacts, and media.

**Making It Work** will include Engineering Design Labs; the Open-Ended Workshop; Tech Junior, a space for young learners; and flexible program space for the Museum's Design Challenges Program.

(See Appendix B: Other Organizational Schemes for descriptions of additional organization schemes that were considered.)

# The Visitor Experience:

## Art and Technology

*The George Rhoads sculpture* in the Lower Lobby of the Museum of Science and similar sculptures at other science centers have demonstrated that large, dynamic artworks have the power to entice, to absorb, and to inspire conversation. They are fascinating even if they provide no means for visitors to interact with them.

Picture the effect on visitors of a sculpture that not only makes use of electronics and multimedia, but also incorporates sensors that make it possible for the sculpture to respond to its surroundings—especially the visitors. We propose to commission such a sculpture to serve as an icon and an introductory experience for Creativity Workshop. It will provide a playful and fun way for visitors to encounter technology and start to examine how it works.

Accompanying the sculpture will be sketches, models, and videos that document the artist's process of creating it, thereby beginning to introduce visitors to some of the key themes of the exhibit—the relationships among creativity, art, and technology and the nature of the creative process.

A nearby interactive will encourage visitors to broaden their definition of technology by classifying various artifacts/objects as art or technology; an augmented reality interface might provide additional information and provocative questions based on their choices.

In the *kinetic sculpture design studio*, visitors will have the opportunity to design, build, test, and refine their own artistic creation. Each station will feature a built-in motor/sensor combination: visitors build sculptures, using Lego, K'Nex, and Atollo (which enable interconnecting Lego and K'Nex) around the motor; and then they program the sensor/motor interaction by choosing from among a few simple options.

Technological art and immersive/reactive environments will be incorporated throughout the exhibit. The following are examples of the types of art and artists who might be included:

### *Scott Snibbe/Sona Research*

"Scott Snibbe is best known for creating interactive artwork that reveals people's interdependence. Most of his works do not function unless the viewer actively engages with them—by touching, breathing, moving, etc. The works present systems in which the viewer is an essential component. Although his works involve significant technological infrastructure, visitors' experiences predominantly involve human-to-human interaction. The pieces provoke communication among the viewers, which, more than a mere reaction to the work, becomes its very essence."[1]

### *Patti Maes/MIT Media Lab Ambient Intelligence Group*

"The goal of the Ambient Intelligence research group is to radically rethink the human-machine interactive experience. By designing interfaces that are more immersive, more intelligent, and more interactive we are changing the human-machine relationship and creating systems that are more responsive to people's needs and actions, and that become true 'accessories' for expanding our minds."[2]

### *Sergi Jordá/Music Technology Group, Pompeu Fabra University*

"The *reactable* is a multi-user electro-acoustic music instrument with a tabletop tangible user interface. Several simultaneous performers share complete control over the instrument by moving physical artifacts on the table surface and constructing different audio topologies in a kind of tangible modular synthesizer or graspable flow-controlled programming language." [3]

1. http://sonaresearch.com/about.htm
2. http://ambient.media.mit.edu/vision.html
3. http://www.iua.upf.es/mtg/reacTable/

# The Visitor Experience:

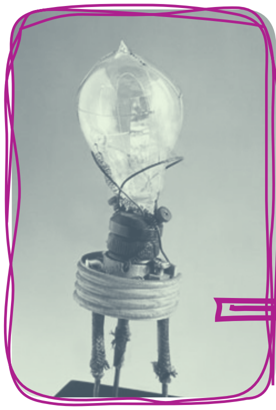
## Creative Thinking Tools and Techniques

Creativity is often viewed as a mysterious or even mystical process, but researchers in cognitive science and the history of technology have identified numerous tools and techniques that inventors, engineers, and other creative thinkers use in coming up with new ideas. By practicing these skills, people can enhance their ability to be creative.

The exhibit will feature some of the creative thinking tools and techniques described on the following pages. For each tool or technique, the exhibit will include a story of an inventor or engineer who successfully used the tool or technique in creating a new technology or solving a technological problem in a creative way.

Some examples are included below, both to clarify the tool or technique and to illustrate the types of stories that might be included. The examples here are primarily older, historical examples. The exhibit will also include examples of newer technologies, including some that are still under development. The project team will solicit examples from the exhibit's Advisory Committee (see p. 21) and possibly from the engineering community through professional societies. Additional examples may be solicited from student inventors through a contest. By requiring entrants to write an explanation of how they applied a particular creative thinking tool or technique, provide documentation of their process through sketches or prototypes, and be available for interview, the contest would not only provide us with inventors' stories, but also with artifacts and media to authentically illustrate the stories.

When possible, each interactive activity will provide visitors an opportunity to practice a tool or technique. Preliminary activity ideas for some of the tools and techniques are described on the following pages.



## A. Combining

It may be hard to imagine a hammer without a head on one end and a claw on the other, but originally these were two separate tools that someone thought to put together. Many other inventions are clever ways of combining two or more items into something new. The Swiss Army knife is a classic example: a blade, can opener, two sizes of screw drivers, a wire stripper, and a reamer, all safely folded up in your pocket.

### *Inventor Story*

In 1904, John Ambrose Fleming combined the existing mechanisms in the Edison light bulb, radio, and water supply systems to create an "electric valve," known as a vacuum tube or diode, that restricts alternating electric current to flow in only one direction.

### *Activity*

Visitors will be posed a challenge like this one: you need to get across the room with your cell phone, a glass of water and... but you only have one hand free. (The other could be holding a baby, in a cast, or missing).

## B. Repurposing

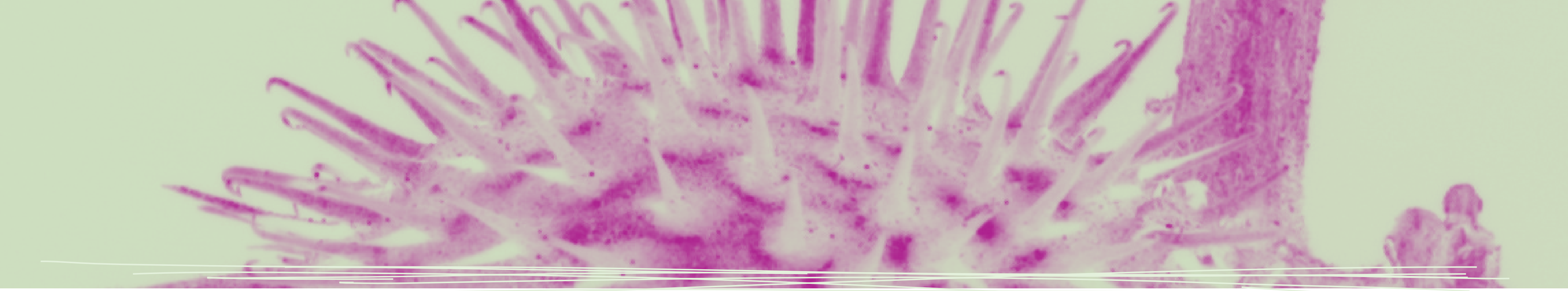
People use things for other than their intended purposes all the time. While some of this repurposing, like using the flat side of a tape measure to pound in a picture hanger or using a scissors to remove a staple is not an improvement over available technologies, other repurposing may result in a useful invention or the solution to a technological problem.

### *Inventor Story*

In the 1920s, Marjorie Joyner developed a new way to curl hair more permanently. She hooked up the thin metal rods that she used to help cook her pot roasts to a hood-style hair dryer and was able to use the heat to produce lasting curls one head at a time, instead of one curl at a time. "If I can take pot roast rods and have a one-of-a-kind invention, believe me, people can do what they set their minds to," Joyner said.

### *Media/Artifacts*

- Video clip from the film *Apollo 13*, in which engineers and technicians figure out a way to use available materials to make an air filter for the rescue vehicle.



## C. Reorienting/Challenging Assumptions

Sometimes, in order to find a solution, it is necessary to redefine the problem. Maybe the problem is not trying to figure out how to make a water current flow around a sea anemone, but rather how to make the sea anemone move through a tank of water. You have to understand a lot about a problem in order to know that, for the purposes of your experiment, moving water with a stationary object produces the same effect, as a moving object with stationary water. And you need to be able to see the problem with fresh eyes.

### *Inventor Story*

Researchers at Sony were trying to develop a portable tape player, but they were having trouble getting everything to fit it the small package they were hoping for. Company founder Masaru Ibuka suggested that they remove the "record" feature and use headphones rather than speakers. This challenged the conventional thinking of the time, but it addressed a number of the problems they were hoping to solve. The result was the Sony Walkman®.

### *Media/Artifacts*

- Optical illusions, which provide a classic example of seeing things in two ways.
- Logic puzzles that require the solver to challenge assumptions: "A boy and his father are injured in a car accident. Both are taken to a hospital. The father dies at arrival, but the boy lives and is taken to surgery. A grey-haired, bespectacled surgeon looks at the boy and says, 'I cannot operate on this boy—he's my son.'" How can that be?

## D. Making Connections/Analogizing

Word analogies are a common feature of standardized tests. "Hand is to glove" as "foot is to…"? Similarly, this creative tool looks at the relationship between an object or process and a desired outcome. Why is a burr so good at sticking to my sock? It has little hooks at the end of each bristle. How can I make use this feature to make something I want to adhere? Velcro® uses just those same hooks.

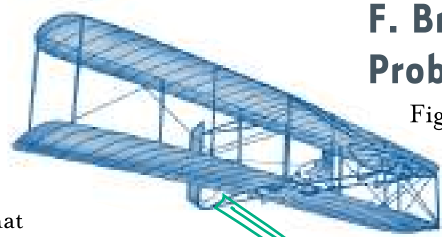
The burr that inspired Velcro

A close-up of Velcro

### *Interactive*

Visitors match inventions (represented by images or artifacts) with the objects (also represented by images or artifacts) that inspired them.

## E. Exhaustive Search



A technique for finding the solution to a problem is to eliminate everything that is not a solution, one by one, until something is found that is. Dealing with failure and then learning from mistakes is a crucial part of finding a solution. This was Thomas Edison's technique for finding the right material for the filament of his light bulb. This technique is also an important part of modern drug development: in high-throughput screening (HTS), tens of thousands of molecules may be tested to see if they have the potential to be further developed into a drug.

### *Activity*

From a pile of identical-looking blocks, visitors try to find the one that will make a toy work when inserted in the slot.

### *Media/Artifacts*

- Early light bulbs, samples of materials that were tested by Edison for use in light bulb filaments, and photographs of Menlo Park laboratory.
- Equipment used in HTS, such as multi-well plates, micropipettes, and a robotic arm; video footage of HTS at a local drug company.

## F. Breaking Down the Problem

Figuring out how to break a problem down into somewhat independent sub-problems can be a crucial first step. Many inventors and scientists struggled with the problem of heavier-than-air powered flight, but the Wright brothers succeeded where others had failed in large part because they broke the problem down into three parts: lift, propulsion, and steering.


## G. Taking Advantage of Chance

Some inventions are happy accidents. The inventor of Post-it® Notes was actually looking for a strong glue when he happened upon a weak glue that was easily removed. Chance occurrences are not things you can count on, but being able to spot your big break and capitalize on it are skills you can develop. As Louis Pasteur remarked, "Chance favors the prepared mind."

## H. Body Thinking

Sometimes reading or talking to someone is not enough to fully understand a situation. In body thinking, one's own body is used to help understand a problem. Insight can be gained by physically acting out a scenario or by being present in a workplace.

### *Activity*

Visitors engage in an activity like this one from researcher Brenda Laurel's course on Design Improvisation. Students videotape people "'having trouble' with technology in public places." Each student studied the video until they could pantomime the interaction from memory. They then performed the motion for others and used that experience to improvise a solution to the problem. For example, a student watched an ice cream store worker turn his back to the customer and hunch down for several moments to swirl the soft-serve into the cone. The student redesigned the ice cream dispenser to hang from the ceiling between the server and the customer at shoulder height, so the server could stand up straight, face the customer, and even add a performance element to the swirling of the ice cream.

Each of the tools and techniques listed above requires further research and development before a decision is made about which to include in the exhibit. During this process, the exhibit team will also consider a number of other tools and techniques, such as recognizing patterns, abstracting, and spacial reasoning.

# The Visitor Experience:

## Making it Work

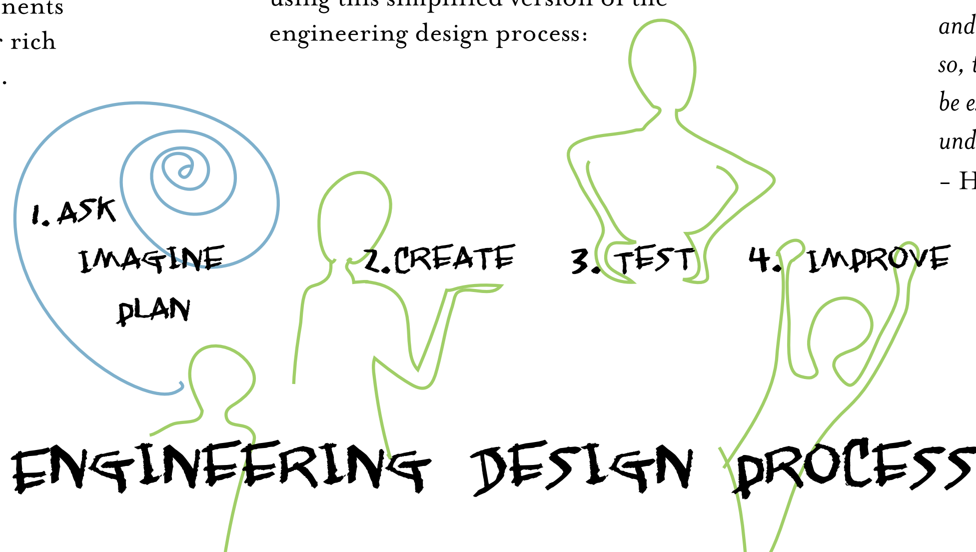
Tinkering, experimenting, troubleshooting and, above all, making choices are all skills needed to turn the spark of an idea into a new or improved device or process.

### A. Engineering Design Labs (EDLs)

The core of Making It Work is the Engineering Design Labs (EDLs). Here the exhibit team will continue the groundbreaking work of the Museum's *Star Wars: Where Science Meets Imagination* exhibit, creating exhibit components that provide an opportunity for rich engineering design experiences.

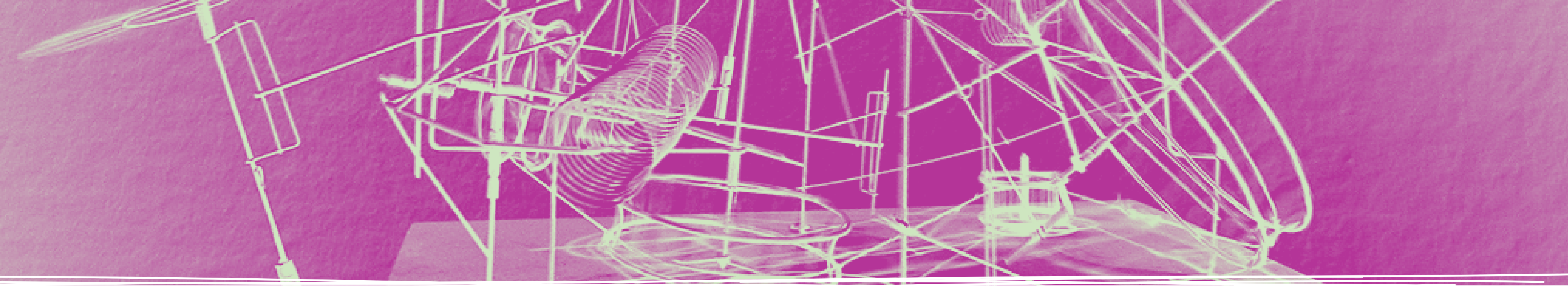
#### Engineering Design Process

Though there are a vast number of versions of the engineering design process, and most contain too many steps to be feasible for a museum exhibit, they all share an emphasis on the iterative nature of the process and the importance of testing possible solutions. Based on an analysis of design processes used in other museum exhibits and programs (see Appendix C: Engineering Design Processes), the exhibit team proposes using this simplified version of the engineering design process:




The best word choice(s) for each step—those that appeal to visitors and elicit the appropriate visitor behaviors—will be explored through prototyping. Instructions for each of the EDLs will be provided in the context of these four steps.

> *As important and serious as are the things that engineers learn in college and the things they do in practice, they are still not essential to comprehending the profession's fundamental activity, which is design. Design is rooted in imagination and choice—and play. Because this is so, the essential idea of engineering can be explained to children and can be understood by them.*
> – Henry Petroski (2003)



## Criteria for Developing EDLs

Based on the Museum's experiences developing the Star Wars exhibit, studies of other exhibitions that provide design challenges, and an analysis of the research literature on the use of engineering design challenges in formal education, the exhibit team has identified a number of selection and design criteria for Creativity Workshop's EDLs.

### Multiple Solutions

There are several (or more!) different designs that satisfy the goals of the challenge. The number and variety of parts visitors can use are wide enough to allow multiple solutions, but not so wide as to be overwhelming.

### Multiple Goals

The challenge offers visitors the option of choosing their goal (e.g., make the fastest bobsled or the slowest bobsled) or asks visitors to balance competing goals (e.g., cheap vs. fast, or strong vs. light). This contributes to the challenge having multiple solutions and illustrates an important attribute of design.

### Testable

The success of the design can be measured using reliable, non-subjective tests. Repeated testing yields consistent results.

### Real Context

The challenge harkens to a real world problem without being too vague or too forced. Some storyline is desirable. Any real-world phenomena represented in the challenge are modeled accurately.

### Short Iteration Time

Each possible solution is relatively quick to build and test. Though a single design can be completed in a few minutes, the overall challenge is interesting enough for some visitors to spend a longer time revising and refining.

### Noticeable Improvement

It is possible to achieve noticeable, measurable improvement by improving the design. For example,

- Improving the design of your car causes it to go 10 seconds faster, not merely 0.01 seconds faster.
- With improvements to your design, your catapult gets the ball closer and closer to the target, until the ball finally lands in the basket.

### Sample Design

The activity provides a sample solution (or instructions for creating one) that barely meets the challenge. Visitors who need a starting point can begin by improving upon the sample.

### Museum-Specific

The experience does not replicate something that a typical visitor can do at home or at school. It includes features, such as the building materials or the testing environment, that are unique to the museum setting.

### Take-Home Component

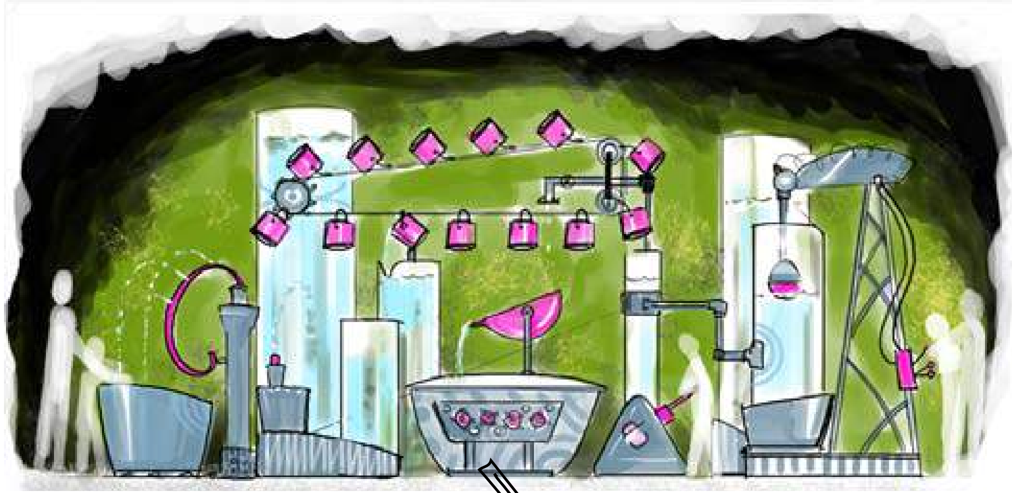
There is some aspect of the experience that visitors can take home, such as a photo or video of their design or a challenge extension to try at home. These would most likely be made available using the web, but other means will be considered.

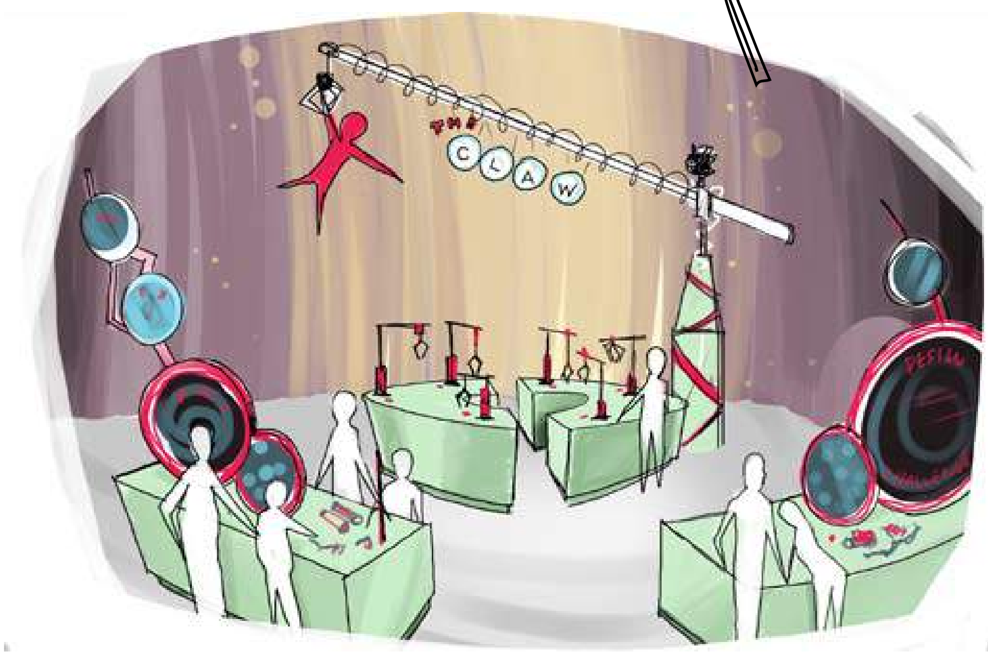
## EDLs to be Prototyped for Creativity Workshop

All interactive exhibits require extensive testing of prototypes with visitors to find out if they "work" and to make them work as well as possible; this is especially true of open-ended exhibit components like engineering design labs. Here are some of the EDLs the exhibit team plans to prototype:

### The Claw

Many people are familiar with the arcade game where you pay a quarter for a chance to grab a stuffed animal or other prize with a remote-controlled claw. This design lab will give visitors the opportunity to design their own claw to move objects. They will investigate question such as, How would you change the claw if the object were a smooth ball? What if you wanted to pick up as many objects as possible? What if the objects are very heavy? How would you design a claw if you *didn't* want users to pick up the objects?






### The Waterworks

Imagine a large, structure with water flowing into and out of containers, through tubes, and down waterfalls, and spurting up in fountains. These actions are orchestrated by visitors working at stations where they turn dials, open gates, close tubes, and set parameters. Each workstation has its own challenge: keep this bucket from overflowing, make a big waterfall, or stop the water from coming into this container. The system as a whole allows visitors working together to collaborate on a larger goal, like triggering a giant fountain.

A possible partner for the development of this component is Mitsubishi Electronic Research Laboratories, which developed the "Submerging Technologies" collection of interactive water displays featured at SIGGRAPH2006's Emerging Technologies venue.

### Programming Blocks

Computer programming is a core skill in engineering, but programming is not just for engineers and computer scientists. The logical thinking needed for programming is applicable to a wide range of problems, and understanding the basics of programming is necessary for beginning to understand a wide variety of modern technologies, since everything from coffee makers to children's toys may contain computer chips.

In this Engineering Design Lab, visitors will have an assortment of blocks, each of which performs a specific function: input (e.g., responding to a button press or a change in sound levels), processing (e.g., wait a certain length of time or add two inputs together), or output (e.g., a light, sound, or motor). By assembling them in a chain, visitors will create a computer program, while simultaneously creating a fun or interesting gadget such as an alarm system, a motion-sensitive holiday light display, or a reaction timer.

A wide variety of software tools and high-end educational toys have been developed that make it possible to create simple programs by assembling either virtual or physical blocks. The exhibit team will learn from these prior efforts, and create a set of blocks uniquely appropriate for a museum exhibit environment. The team may collaborate with the Lifelong Kindergarten Group at the MIT Media Lab in the development of this EDL.

## B. Open-Ended Workshop

Whether inspired by the kinetic art, the creative thinking tools, or by wanting to take an idea from the Engineering Design Labs in a new direction, visitors can use LEGOs, K'Nex, and Atollo to build their own kinetic art, invention prototypes, or something the exhibit team hasn't even imagined.

Including the Open-Ended Workshop as part of the exhibit would require staffing of the exhibit at a level similar to  Museum Discovery Spaces such as Cahners ComputerPlace.

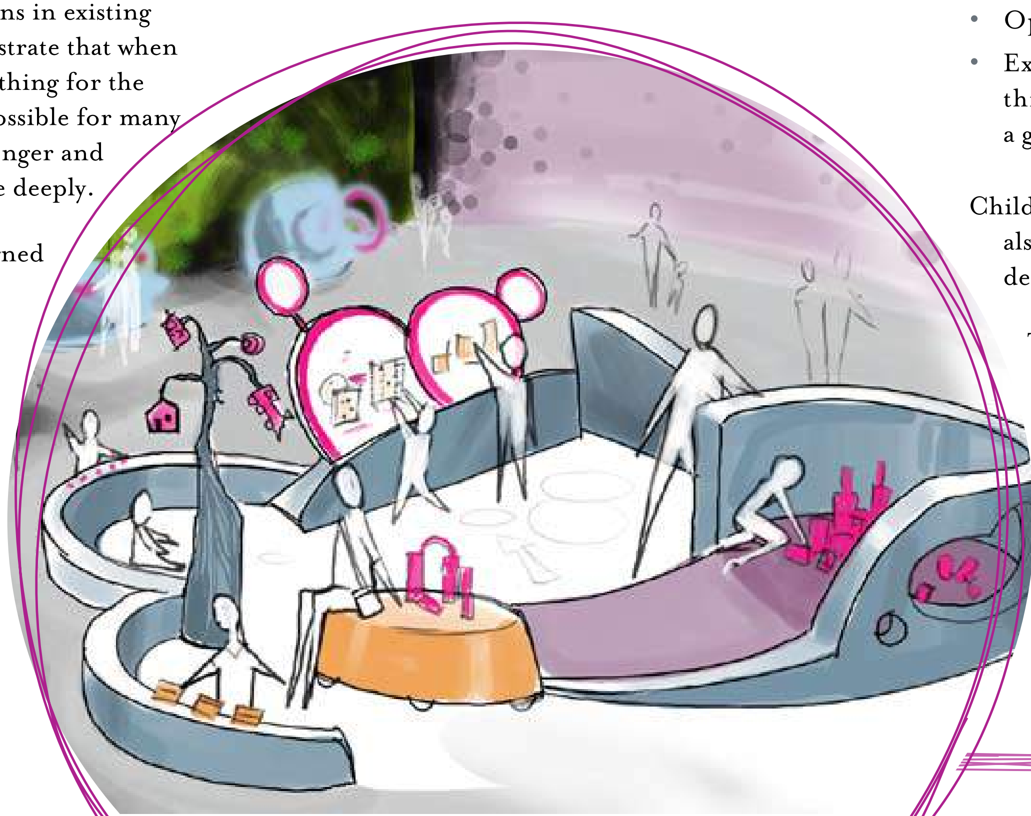
## C. Tech Junior

Even the youngest visitors can begin to learn about technology. Because many other exhibits and programs in the Museum's Technology Initiative are primarily geared toward adults, it is especially important that Creativity Workshop provides learning opportunities for young children. Furthermore, observations in existing Museum exhibits demonstrate that when an exhibit includes something for the younger children, it is possible for many visiting families to stay longer and enjoy an exhibition more deeply.

Tech Junior will be designed for children aged three to six. Appropriate technology education goals for these learners in this setting include

- using and understanding tools and materials
- exploring how things work
- recognizing that technologies are designed by people to solve problems and/or meet people's needs and wants

(ITEA, 2002; Massachusetts Department of Education, 2006).

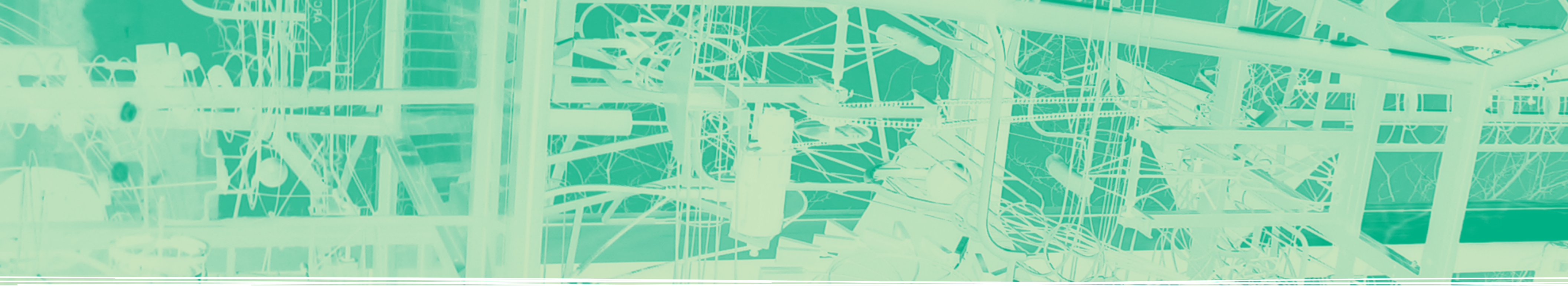


Activities in Tech Junior may include

- Simple sorting and matching activities: e.g., which objects and materials are natural and which are human-made? Which tool would you use to solve this problem?
- Block play with tips for parents on what behaviors to look for and encourage.
- Opportunities to use simple tools.
- Exploring cause and effect and how things work, through construction of a giant marble run or a chain of gears.

Children (and their adult caretakers) can also learn about ways that they already demonstrate creative thinking skills.

Tech Junior will be semi-enclosed by a low wall and centrally located, so parents can be watching a younger child learning there while an older child works and plays at one of the nearby Engineering Design Labs.



## D. Design Challenges Program Space

Design Challenges is a new Museum program offering that introduces students and other visitors to the engineering design cycle. By participating in a hands-on activity asking them to design, build, and test a prototype solution to a given problem, visitors have fun in an engaging experience with the engineering design process. Since its inception in 2003, the program has developed and implemented a dozen different challenges for Museum visitors.

Creativity Workshop will incorporate a flexible space for the Design Challenges program, with room for storage of materials and work space for visitors to build and test their designs. (Currently, the Design Challenges must set up temporary tables and wheel in carts of materials each time they offer a program.) Providing a permanent home for the Design Challenges Program within Creativity Workshop offer several advantages to the program and the exhibit:

- Design Challenges will have a physical context that matches its intellectual content.
- The increased convenience of setting up program materials and work areas will support the plan to increase the number of times per week the Design Challenges program is offered.
- The changing nature of the program will help reinforce an image of Creativity Workshop as a place where visitors can expect to see new and different things.
- The presence of staff in the exhibit will enhance the visitor experience.