Science, Technology, Engineering, and Math

STEM Expo an innovative alternative to the typical science fair

STEM Expo 2018-2019

Category Descriptions, Concepts, and Recommendations

1. CATEGORY OVERVIEW AND GENERAL NOTES

1.1. BRIEF CATEGORY DESCRIPTIONS

- **Infernal Contraptions** - An Infernal Contraption is a deliberately overdone machine that performs a simple task in a very complex fashion.
- **Intelligence and Behavior** - covers the study of the mind and its processes.
- **The Living World** - includes anything to do with biological organisms.
- **Science Fiction** – provides a category where currently impossible scientific ideas and unknown concepts can be examined and presented.
- **Reverse Engineering and Invention** - involves the understanding of how things work together in either a creative or evaluative manner.
- **The Physical Universe** – covers anything non-biological, from chemistry to astronomy, from earth sciences to quantum mechanics.
- **Robotics and Computation** – includes robotics, computer science and mathematical analysis or ideas
- **Things** – physical items or designs are featured, from architectural design, through welding, to 3D printing.
- **Non-Category Awards** may be presented at the discretion of the Event Organizer and Event judging director.

1.2. REVISIONS

These categories have been again revised from the previous years, this time adding a new category (Things) aimed at providing an appropriate place for created objects or makers.

The singular concept of Scientific Method has been replaced with the concepts of Science and Engineering Practices to reflect modern processes and the Next Generation Science Standards.

The Living Things category has been renamed to The Living World so as not to conflict with the new Things category.

The Infernal Contraptions category has been modified to increase the significance of the working model.

Originality has been added to The Living World, Intelligence and Behavior, and The Physical Universe categories as a significant factor in judging.

Science Fiction submittal dates are changed

Minor textual revisions were made to the existing categories for clarification purposes.

Revision December 01, 2018 – Initial release

1.3. GENERAL

Students entries at STEM Expo will be submitted in one or more of the eight established categories (listed above).

If there are any questions about where a specific project belongs, please contact the STEM Expo Judging Advisor for assistance.

1.4. GLOBAL CONCEPTS

There are certain concepts and ideas that are used throughout the category descriptions. Rather than re-enter them multiple times, they are presented here.

SCIENCE AND ENGINEERING PRACTICES

The traditional model of the Scientific Method is outdated in that it depicts a linear process, while actual scientific advances happen through significantly more non-linear ones. Although the concepts are the same, they have been re-arranged and re-thought out to create the next generation in science standards.

These eight practices are parts of any good scientific or engineering project:

1. Asking questions (science) and defining problems (engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (science) and designing solutions (engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

But rather than thinking of them numerically, it is better to think of them interdependently as shown in the image. Each connects to and leads to and from every other one, there is no specific sequence that needs to be followed, and steps can be visited more than once.

Note that these concepts can be applied in one form or another to all of the categories in STEM Expo.

For more information, see https://www.nextgenscience.org/ and https://ngss.nsta.org/
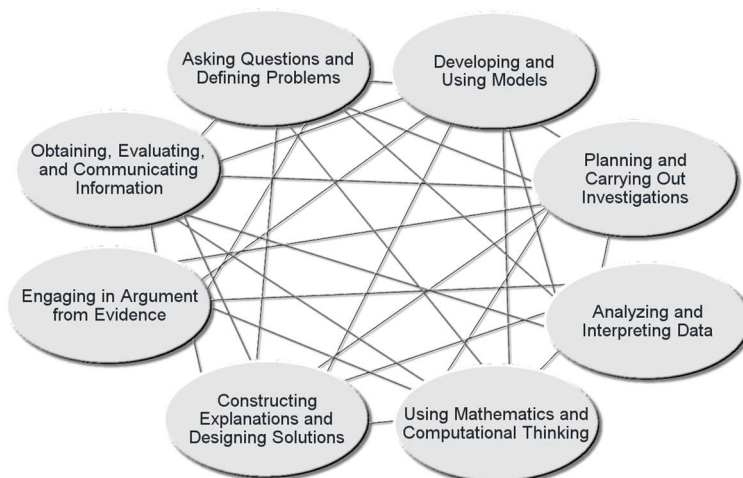
PROJECT JOURNAL/LOG BOOK

Keeping a journal of progress is an important part in several kinds of project. Journals or log books should include all aspects of the project. From daily notes of occurrences and ideas, to hand-drawn sketches, to photos of anything that is occurring (including white-board sketches, or discussion points, for instance.)

Electronic logs are allowed. While, in some venues, it is common to require that the log be handwritten, at STEM Expo it is not required. However, to retain the verification of procedure, it is recommended that non-hand-written logs be printed when each day's work is completed, set into a binder, and signed and dated. Another common method of recording data is to store the log online, in a public or private blog server, with automatic dating that records when the log was entered, and any changes that are made. – Even in the case of automatic recording, we still recommend that the log be printed and signed at the conclusion of the day's work.

1.5. ENTERING THE SAME PROJECT IN MULTIPLE CATEGORIES

Students are reminded that it is permissible (and expected) that entries be placed in multiple categories if appropriate.

2. CATEGORY: INFERNAL CONTRAPTIONS

2.1. CATEGORY DESCRIPTION

AN INFERNAL CONTRAPTION IS A DELIBERATELY OVER-ENGINEERED OR OVERDONE MACHINE THAT PERFORMS A SIMPLE TASK IN A VERY COMPLEX FASHION, USUALLY IN A CHAIN REACTION. THE CATEGORY IS FASHIONED AFTER THE AMERICAN CARTOONIST AND INVENTOR RUBE GOLDBERG (1883-1970).

2.2. PERTINENT INFORMATION AND DEFINITIONS

Entrants in this category are exploring imaginative, non-linear, methods to solve a problem or do a mundane task.

PROJECT SCOPE

Infernal Contraptions use a sequential progression of events, which starts with a simple initialization, from then on, each action triggers one or more following actions. Finally, a clearly defined and (usually) simple task is accomplished.

Entries in this category will make use of several types of simple machines and physical forces during their sequence of operation. Simple machines include lever, wheel, pulley, incline plane, screw, and wedge. Physical forces include inertia, gravity, friction, stored energy, combustion, etc. (note that no flames are allowed on site, combustion should only be used diagrammatically).

Advanced projects will have simultaneous actions in two or more action paths, and/or the same path will be used with different materials or different results more than one time. In addition to strictly mechanical operation, time is considered. A slow moving part or something that delays operation, while still proceeding, can add complexity.

PROJECT DISPLAY AND DESCRIPTION

While it is very appreciated, entries do not have to have the entire sequence operate at the event. But, since this is primarily an audience appreciation based category, it is strongly recommended that an operational portion of the sequence is presented to show the viewers a significant or important part of the contraption.

The entry should have a diagram (illustration) of the sequence from initial step to conclusion. These illustrations should clearly define the sequence of operation, including direction of force. Entries should be documented with a written sequential procession from beginning to final step.

If the entire sequence is built, please video the sequence of operation and post it to an internet video site (such as YouTube) and provide the link to the video as part of your display. Free WiFi is available at the venue to allow entrants to play the videos during judging, and so judges (and the public) can review them later.

2.3. ENTRY, REVIEW, AND JUDGING

Judging will include an interview period and potential additional views of the project display. Judges will use an understanding of the category, this document, the rubric, and the general rules in their evaluations. Please review these documents for other items that may be considered.

WHAT WILL BE JUDGED

- General display rules and judging criteria
- Sequential progression is clearly labeled with indications of simple machines and physical forces
- Diagram of operation is complete and understandable
- If constructed and/or video recorded, the sequence fully runs with little to no outside intervention
- If an operational portion of sequence is displayed, it should be an important, understandable piece of the whole sequence
- The presented portion of the sequence is understandable and represents a critical part of the whole

ADDITIONAL ITEMS THAT WILL AFFECT THE REVIEW AND JUDGING CONCLUSIONS

- Thematic construction, grouping of materials
- Complexity of device, including advanced concepts above
- Duration of progression – use of timing of operation as a consideration
- Originality of tasks, initialization, or specific steps

3. CATEGORY: INTELLIGENCE AND BEHAVIOR
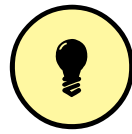
3.1. DESCRIPTION

THE INTELLIGENCE & BEHAVIOR CATEGORY COVERS THE STUDY OF THE MIND AND ITS PROCESSES. THE FOCUS OF THIS CATEGORY IS THE UNDERSTANDING OF HOW BEINGS (HUMAN OR OTHERWISE) REPRESENT, PROCESS, AND TRANSFORM INFORMATION. SCIENCES IN THIS CATEGORY INCLUDE PSYCHOLOGY, PHILOSOPHY, LINGUISTICS, ANTHROPOLOGY AND NEUROSCIENCE.

3.2. PERTINENT INFORMATION AND DEFINITIONS

This category provides the opportunity to explore the way people think, feel, act, and react. A successful project in this category will present an idea or concept about a specific intelligence and/or behavioral aspect, and then will attempt to prove that idea, and finally will present a conclusion.

PROJECT SCOPE

This is one of the basic experimentation (scientific inquiry) categories. Most commonly a question is asked, a hypothesis is created, research is done, an investigation is performed, and a conclusion is reached. The Science and Engineering Practices described earlier in this document are very apparent in any entry in this category.

Projects in this category should have some form of log of the progress through the entire sequence. This log could be written in a log-book, or in electronic form (see Section 1 of this document).

Projects should have an original or innovative aspect to the work at least in either concept or approach. If an existing project is modified or continued from a previous year, such work should be noted and credited, and the expanded and/or innovative portions clarified or explained and documented.

PROJECT DISPLAY AND DESCRIPTION

The project display is a summary of all the work done on your project. It should include an understandable description of the idea or concept being explored, the methods used in that exploration, and the conclusions generated.

Information that should be part of the display include:

- Graphical information that will clarify the project's scope or details
- A list of materials used, and any construction methods used to build any custom apparatus
- A bibliography that shows any research sources.

3.3. ENTRY, REVIEW, AND JUDGING

Judging will include an interview period and potential additional views of the project display. Judges will use an understanding of the category, this document, the rubric, and the general rules in their evaluations. Please review these documents for other items that may be considered.

WHAT WILL BE JUDGED

- General rules and judging criteria
- The scientific method (including completeness of thought processes and presentation of cause and effect)
- Preparation and display of information about the entry
- Comprehension, Completeness, Effort and Motivation of and by the entrant(s)
- Originality and/or innovative approaches or concepts

ADDITIONAL ITEMS THAT WILL AFFECT THE REVIEW AND JUDGING CONCLUSIONS

- Presentation of the inquiry findings for peer or scientific review
- Understanding of how the inquiry relates to broader scientific principles and real world applications

4. CATEGORY: THE LIVING WORLD

4.1. DESCRIPTION

THE LIVING WORLD CATEGORY INCLUDES ANYTHING TO DO WITH LIVING ORGANISMS. THIS INCLUDES MICROORGANISMS, PLANTS, ANIMALS, AND HUMAN BEINGS AS WELL AS BIOETHICS, MEDICINE, MOLECULAR BIOLOGY AND BIOTECHNOLOGY, ETC. AGRICULTURAL STUDIES FIT INTO THIS CATEGORY AS WELL.

4.2. PERTINENT INFORMATION AND DEFINITIONS

This category is for exploring all aspects of life and living things. A successful project in this category will usually be based on a question about a living thing (or about something that affects living things), it will attempt to answer the question and, finally, will present a conclusion.

PROJECT SCOPE

This is one of the basic experimentation (scientific inquiry) categories. Most commonly a question is asked, a hypothesis is created, research is done, an investigation is performed, and a conclusion is reached. The Science and Engineering Practices described earlier in this document are very apparent in any entry in this category.

Projects in this category should have some form of log of the progress through the entire sequence. This log could be written in a log-book, or in electronic form (see Section 1 of this document).

Projects should have an original or innovative aspect to the work at least in either concept or approach. If an existing project is modified or continued from a previous year, such work should be noted and credited, and the expanded and/or innovative portions clarified or explained and documented.

PROJECT DISPLAY AND DESCRIPTION

The project display is a summary of all the work done on your project. It should include an understandable description of the idea or concept being explored, the methods used in that exploration, and the conclusions generated.

Information that should be part of the display include:

- Graphical information that will clarify the project's scope or details
- A list of materials used, and any construction methods used to build any custom apparatus
- A bibliography that shows any research sources.

4.3. ENTRY, REVIEW, AND JUDGING

Judging will include an interview period and potential additional views of the project display. Judges will use an understanding of the category, this document, the rubric, and the general rules in their evaluations. Please review these documents for other items that may be considered.

WHAT WILL BE JUDGED

- General rules and judging criteria
- The scientific method (including completeness of thought processes and presentation of cause and effect)
- Preparation and display of information about the entry
- Comprehension, Completeness, Effort and Motivation of and by the entrant(s)
- Originality and/or innovative approaches or concepts

ADDITIONAL ITEMS THAT WILL AFFECT THE REVIEW AND JUDGING CONCLUSIONS

- Presentation of the inquiry findings for peer or scientific review
- Understanding of how the inquiry relates to broader scientific principles and real world applications

5. CATEGORY: SCIENCE FICTION
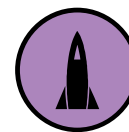
5.1. CATEGORY DESCRIPTION

SCIENCE FICTION IS A GENRE OF FICTION DEALING WITH IMAGINARY, BUT MORE-OR-LESS PLAUSIBLE CONTENT SUCH AS FUTURE SETTINGS, FUTURISTIC TECHNOLOGY, SPACE TRAVEL, ALIENS, ETC. EXPLORING THE CONSEQUENCES OF SCIENTIFIC INNOVATIONS IS ONE PURPOSE OF SCIENCE FICTION, MAKING IT THE TRUE FUTURE OF STEM.

5.2. PERTINENT INFORMATION AND DEFINITIONS

Science fiction includes an imaginative vision of the possible future of science and technology. Good science fiction tells a good story or raises questions to show the concept of where we have expanded beyond our current understanding.

PROJECT SCOPE AND DEFINITIONS

This category includes presentations in the form of stories, graphic novels, comic books, plays, videos, etc. These presentations are expected to include imaginary or futuristic scientific concepts and/or focus.

There is no length limit for any written story, but the quality should be "grade level appropriate". Illustrations for written stories, and storylines for non-written entries are appreciated, and collaborative efforts to provide those (and other) combinations are welcomed.

Science Fiction relies on the concept of "Willful Suspension of Disbelief". This concept is a viewer's ability to accept what they know to be untrue (or not yet proven) to be real for the duration of the story or viewing. The best Science Fiction establishes this adjusted reality early on, and doesn't introduce changes or violate the principles that are set.

Science Fiction is not the only type of speculative fiction. Although fantasy (for instance) is a similar genre, it is not the same – pieces that rely on magic, or phenomena that cannot be explained by the scientific reality as described, will not be rated at the same level as those that follow the principles that are established.

PROJECT DISPLAY AND DESCRIPTION

An electronic version of the primary entry (not the display) must be submitted no later than <u>five days prior</u> to the STEM Expo event (the Monday before the Saturday event). If an entry is over 10 pages (10 minutes if in Audio or Video format) then this deadline is one-week prior (the Saturday before). If this is an art piece, a photograph with the explanatory text of the presentation display is acceptable. *See notes on website for entry procedure.*

As in all categories, the general requirements must be followed for this category, including some form of display for the day of the event. This display may be simple or complex, it may include:

- Description of the entry (an outline, a storyboard, etc. as appropriate)
- References to supporting or similar works
- A copy of the actual story/entry
- Any illustrations or images that represent the story

5.3. ENTRY, REVIEW, AND JUDGING

Judging will include an interview period and potential additional views of the project display. Judges will use an understanding of the category, this document, the rubric, and the general rules in their evaluations. Please review these documents for other items that may be considered.

WHAT WILL BE JUDGED

- General rules and judging criteria
- Science fiction vs. other speculative fiction (e.g. fantasy)
- General standards for the media chosen (e.g. well written for stories, good production values for A/V items)
- Use of creative ideas and imagination is important to the entry

ADDITIONAL ITEMS THAT WILL AFFECT THE REVIEW AND JUDGING CONCLUSIONS

- Alternative thought process or physical rules are clearly expressed (but not necessarily described in detail)
- Alternative rules are consistent
- Willful suspension of disbelief effort is almost negligible

6. CATEGORY: REVERSE ENGINEERING AND INVENTION
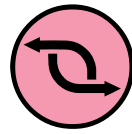
6.1. CATEGORY DESCRIPTION

THE REVERSE ENGINEERING AND INVENTION CATEGORY INVOLVES THE UNDERSTANDING OF HOW THINGS WORK TOGETHER IN EITHER A CREATIVE OR EVALUATIVE MANNER. REVERSE ENGINEERING IS TO TAKE SOMETHING APART AND ANALYZE ITS WORKINGS, WHILE INVENTION INVOLVES CREATING SOMETHING NEW. BOTH ASPECTS FOCUS ON A PRODUCT OR DEVICE THAT SOLVES A SPECIFIC PROBLEM OR NEED.

6.2. PERTINENT INFORMATION AND DEFINITIONS

This category focuses on the exploration of problem solving in the physical world. Invention and Reverse Engineering are two faces of the same subject. In both cases the project creator must learn or define how something works. The category is specifically focused on physical devices and products.

PROJECT SCOPE

The projects in this category must describe what problem is being solved. They must also show how the project's device solves the problem, and try to identify ways to improve the solution.

A Reverse Engineering project will have enough complexity to allow the student to gain an understanding of how something works, in detail, without being overwhelming.

An Invention project may be simpler than an equivalent Reverse Engineering project because the invention itself may be something simple that no one else has yet created.

PROJECT DISPLAY AND DESCRIPTION

A successful project display will include the following:

- A description of the use of the device, and the benefits associated.
- A complete 'mock-up', prototype, or construction of all or part of the device. If this is an invention this is the key physical portion of the project
- A disassembly of the completed device showing the components and/or subcomponents with a description of their purpose and how they work. If this is a reverse engineering project, this is the key physical portion, and these pieces are expected to be the centerpiece of the display. If an invention, this portion may consist of photographs, drawings, or textual descriptions of the components (and sub-components, if any) of the device.
- A description of the tools, methods, and sequences required in the construction or deconstruction.
- A definition of how to solve (or improve existing solutions to) the problem

Marketing material is often key in describing a product or device and its inclusion is appreciated and recognized.

6.3. ENTRY, REVIEW, AND JUDGING

Judging will include an interview period and potential additional views of the project display. Judges will use an understanding of the category, this document, the rubric, and the general rules in their evaluations. Please review these documents for other items that may be considered.

WHAT WILL BE JUDGED

- General rules and judging criteria
- Overall device clearly described including what it is, how it would be used, and its benefits
- Preparation and display of the components or subcomponents of the original object
- The accuracy of explanation of components and overall operation
- The understanding of the device, how it works, and how it was built

ADDITIONAL ITEMS THAT WILL AFFECT THE REVIEW AND JUDGING CONCLUSIONS

- Research on similar products or processes
- If an invention, how well it addresses a real-world need, and its practicality in size, cost, materials, etc.
- Any unique or innovative methodologies or concepts that were used or understood

7. CATEGORY: THE PHYSICAL UNIVERSE
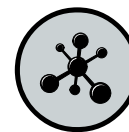
7.1. CATEGORY DESCRIPTION

THE PHYSICAL UNIVERSE CATEGORY COVERS EXPERIMENTATION IN THE NON-BIOLOGICAL, NON-BEHAVIORAL AREA.

CHEMISTRY, PHYSICS, EARTH SCIENCE, AND SPACE SCIENCE ALL FIT INTO THIS GROUPING.

7.2. PERTINENT INFORMATION AND DEFINITIONS

This category is for explorations of the physical aspect of the world around us. A successful project in this category will commonly ask a question of a non-biological nature, then using research and experimentation it will attempt to answer the question and, finally, will present a conclusion.

PROJECT SCOPE

This is one of the basic experimentation (scientific inquiry) categories. Most commonly a question is asked, a hypothesis is created, research is done, an investigation is performed, and a conclusion is reached. The Science and Engineering Practices described earlier in this document are very apparent in any entry in this category.

Projects in this category should have some form of log of the progress through the entire sequence. This log could be written in a log-book, or in electronic form (see Section 1 of this document).

Projects should have an original or innovative aspect to the work at least in either concept or approach. If an existing project is modified or continued from a previous year, such work should be noted and credited, and the expanded and/or innovative portions clarified or explained and documented.

PROJECT DISPLAY AND DESCRIPTION

The project display is a summary of all the work done on your project. It should include an understandable description of the idea or concept being explored, the methods used in that exploration, and the conclusions generated.

Information that should be part of the display include:

- Graphical information that will clarify the project's scope or details
- A list of materials used, and any construction methods used to build any custom apparatus
- A bibliography that shows any research sources.

7.3. ENTRY, REVIEW, AND JUDGING

Judging will include an interview period and potential additional views of the project display. Judges will use an understanding of the category, this document, the rubric, and the general rules in their evaluations. Please review these documents for other items that may be considered.

WHAT WILL BE JUDGED

- General rules and judging criteria
- The scientific method (including completeness of thought processes and presentation of cause and effect)
- Preparation and display of information about the entry
- Comprehension, Completeness, Effort and Motivation of and by the entrant(s)
- Originality and/or innovative approaches or concepts

ADDITIONAL ITEMS THAT WILL AFFECT THE REVIEW AND JUDGING CONCLUSIONS

- Presentation of the inquiry findings for peer or scientific review
- Understanding of how the inquiry relates to broader scientific principles and real world applications

8. CATEGORY: ROBOTICS AND COMPUTATION
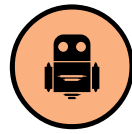
8.1. CATEGORY DESCRIPTION

THE ROBOTICS AND COMPUTATION CATEGORY INCLUDES ROBOTICS AND COMPUTER SCIENCE. THE FOCUS OF THIS GROUP INCLUDES SUCH APPLIED SCIENCES AS ENGINEERING, PROGRAMMING, AND MECHANICAL DESIGN AND SUCH FORMAL SCIENCES AS MATHEMATICS, LOGIC, AND STATISTICS.

8.2. PERTINENT INFORMATION AND DEFINITIONS

Computer science is the study of the principles and use of computers. Included in that is the design of software that performs tasks. Robotics often involves computer science but adds the design, and application of physical components that perform tasks. Entrants in this category design, build, and operate mechanical and/or software constructions.

PROJECT SCOPE

Entries in this category will create all or part of a functional program or automated device.

When considering design elements, the focus is on the physical design (user interface) of the entry. Sensors and/or operator input must be appropriate and understandable for the planned purpose(s). Manipulators and/or displays should be used as needed to accomplish the desired tasks. Physical or interface construction also should be appropriate and elegant.

Functionality is also a key part of this category. Operational methods of the software or robot should be complete and appropriate for the purpose. The design should allow for variables in the operating environment and error handling. Operation should be repeatable and consistent with the planned function.

Advanced entries will take alternate operation based on variations in operating parameters into consideration. They will also show an efficiency of design (whether software code or mechanical design). A formal test plan may be defined and implemented.

PROJECT DISPLAY AND DESCRIPTION

The project display should show the following:

- A working robot or sub-assembly or, if software, the working software should be presented
- The function or purpose of the robot or software should be described
- The description and clarification of any sub-components should be explained
- A description of the methodology used to operate the robot or software may be included

The following items are also often included in the display:

- A written document that defines the functional specification and testing plan for the entry
- Documented code listing

8.3. ENTRY, REVIEW, AND JUDGING

Judging will include an interview period and potential additional views of the project display. Judges will use an understanding of the category, this document, the rubric, and the general rules in their evaluations. Please review these documents for other items that may be considered.

WHAT WILL BE JUDGED

- General display rules and judging criteria
- Physical design and operational functionality
- Software source code evaluation (if applicable) (note: this can be confidential if desired)
- Display and documentation provided
- Comprehension, Completeness, Effort and Motivation of and by the entrant(s)

ADDITIONAL ITEMS THAT WILL AFFECT THE REVIEW AND JUDGING CONCLUSIONS

- The way the entry relates to real-world applications
- Original or innovative design and implementation of the robot or software and/or the associated purpose
- Illustrations, images, or other media that is presented as supporting information

9. CATEGORY: THINGS

9.1. CATEGORY DESCRIPTION

THE THINGS CATEGORY INVOLVES DRAFTING, RENDERING, MAKING, BUILDING, OR FORMING DESIGNS OR ITEMS UTILIZING STEM CONCEPTS. PRIMARILY FOCUSED ON ENGINEERING AND DESIGN PRINCIPLES, THIS CATEGORY PROVIDES A VENUE FOR EVERYTHING FROM 3-D PRINTING TO ARCHITECTURAL DESIGN, FROM WOODWORK TO WELDING.

9.2. PERTINENT INFORMATION AND DEFINITIONS

Entrants in this category design or build something tangible using STEM concepts and real-world tools.

PROJECT SCOPE AND DEFINITIONS

The entries in this category will present a real-world thing, either fully made or designed (or both). The presentation could include full design drawings, 3D graphical renderings, 3D printed models, machined parts, hand-constructed models, sub-pieces of the complete assembly, or other similar item(s).

The build and/or design should have enough detail to show the engineering involved. This may extend to include such things as bills of material, structural analysis, material selection, functional specifications, construction drawings, etc.

Entries in Things are commonly original creations. However, re-creation of existing items is allowed, as long as original work is done as part of the engineering and design process.

One of the considerations in the project is the make-up and granularity of the components used in the creation of the object. If, for instance, the object was a marble, the components involved might be basic glass rods, glass powder, or even sand; but if the object was a suspension bridge, the components might be beams, rivets, etc. (There would be no reason to describe the manufacturing of the bridge all the way from iron ingots.) Conversely, the specific details of components and manufacturing processes should be defined and documented. (For instance, if a 3D printer is used, the make, filament type and size, print temperature, nozzle diameter, print speed, etc. should all be noted.)

PROJECT DISPLAY AND DESCRIPTION

A successful project display will include the following:
- One or more of the following: the actual object, a critical component of the object, a mock-up of the final object, a live graphical rendering of the completed object, or a complete set of printed engineering drawings
- A description of the 'thing', and its purpose
- A bill of materials (BOM) and/or a description of the reasons why each component/material was used
- A list of the tool(s) and/or equipment used in design of the 'thing'
- A description of the engineering methodology and sequence(s) involved in design and/or build of the 'thing'
- Information on build failures (if any) regarding causes and any design/material changes made to solve the issue

9.3. ENTRY, REVIEW, AND JUDGING

Judging will include an interview period and potential additional views of the project display. Judges will use an understanding of the category, this document, the rubric, and the general rules in their evaluations. Please review these documents for other items that may be considered.

WHAT WILL BE JUDGED
- General rules and judging criteria
- Completeness and accuracy of the descriptive documents
- Quality of workmanship of the 'thing' and/or the projects modeling components
- The understanding of the design/build process

ADDITIONAL ITEMS THAT WILL AFFECT THE REVIEW AND JUDGING CONCLUSIONS
- Functionality/practicality of the 'thing'
- Complexity of the build process or engineering process

10. SPECIAL CATEGORIES

STEM Expo may offer awards in special or extra areas (categories) for entries that show a focus on these particular aspects in their project. Unless noted below, these awards are open to all entrants, and are awarded in addition to the normal awards for the category.

Entrants are automatically entered into the special categories when they enter the primary category: no separate entry for the special category is required.

There are no rubrics specific to these categories. During the course of judging, the judges may elect to nominate entries into these areas, then a special individual judge or panel of judges will determine the category award after reviewing the entries.

Note that projects that include some aspect of all of these categories are commonly among the most successful in their primary category.

STEM Expo may elect to include or exclude any or all of these award categories on the day of the event.

10.1. CREATIVE ARTS AWARDS

The Creative Arts award focuses on the presentation from an artistic and aesthetic standpoint. Engineers focus on how something works; artists focus on the user experience. The creative processes behind art can be used to drive innovation and find inventive solutions to problems. The intent of this award is to recognize the aesthetic entry(s) that use artistry in their presentation.

This artistry could be represented in one aspect (for instance a single drawing or graphical element) or as part of the project presentation as a whole.

10.2. RESEARCH AWARDS

The Research award focuses on the research that an individual entrant did in the preparation of the entry. The intent is to recognize the value of the research as a separate context and appreciate an entrant who has gone above and beyond the normal level of research for their category.

Research is applicable for all categories, and may be presented in any form as part of the entry.

10.3. IMAGINATION AWARDS

The Imagination award celebrates creativity and "thinking outside the box". This award is to recognize an entry that does things in a different manner. Whether it is the entrepreneurial spirit, the pioneer spirit, or just "it's the way I wanted to do it", these awards are presented to entries that the judges want to encourage because of the imagination involved in the project.

10.4. ADVANCEMENT TO THE NEXT LEVEL

Certain STEM Expo events are the local nominating affiliate for state and/or national STEM competitions. As such, all entries are considered for advancement to those events. STEM Expo is given a certain number of attendees that we may advance and they are expected to be the best representation of the standards at STEM Expo.

This advancement is applicable for all categories, depending on the requirements of the next level competition.

10.5. JUDGES AWARDS

Sometimes judges want to recognize outstanding work in an entry that doesn't quite fit into any other award category. Judges awards are presented at the request of the judging team, they are completely optional on the day of the event and can be presented to any entrant to encourage their continued work in the STEM fields.