engineer the future
هندسة المستقبل

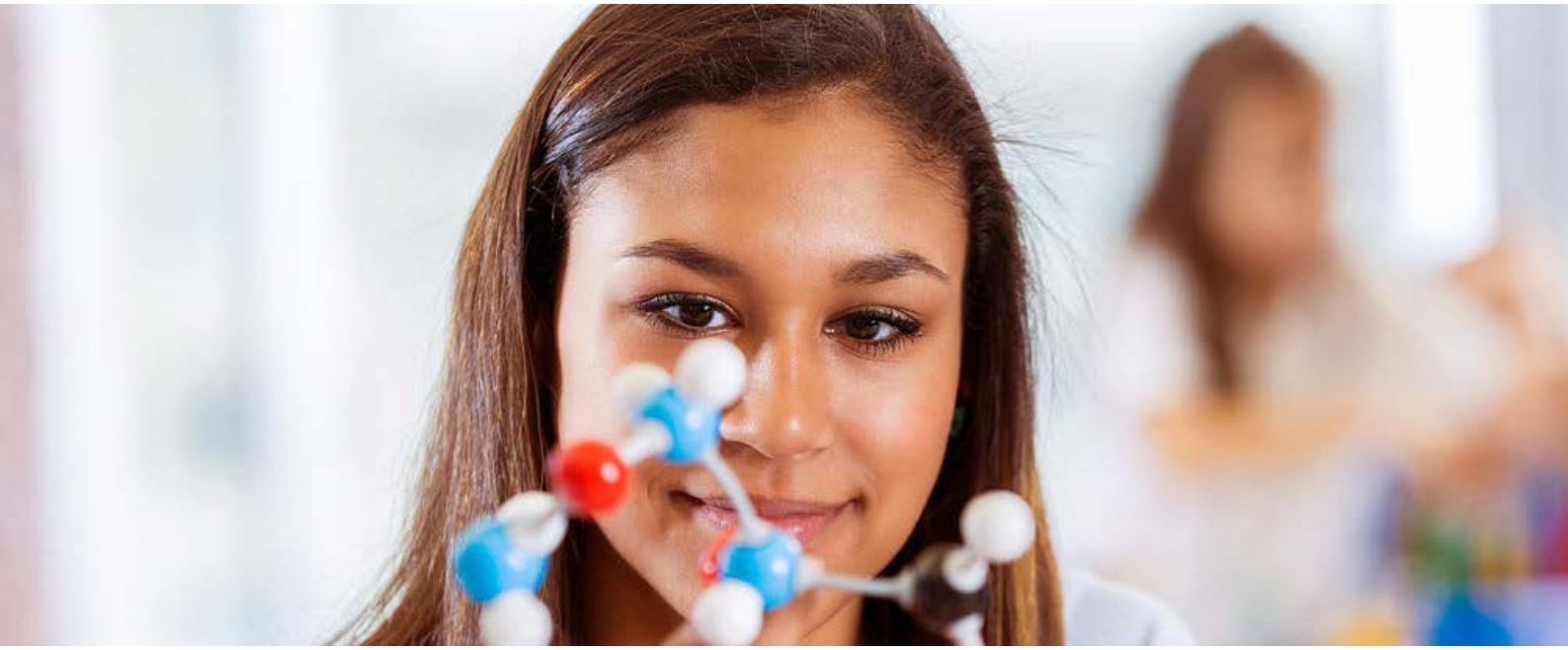
A programme by:
EGA
الإمارات العالمية للألمنيوم
EMIRATES GLOBAL ALUMINIUM

Challenge manual for The EGA Aluminium Design Challenge

2018-2019

Challenge Manual Index

01
Introduction



About The EGA Aluminium Design Challenge, 2018-2019

EGA is looking for teams who can engineer the future! Through the UAE's very first aluminium design challenge, EGA aims to help young UAE Nationals and resident develop the skills they need to pursue STEM subjects and share their ideas with the nation.

Through this challenge, students will apply the knowledge they have gained in the classroom, and design their own solutions for aluminium-intensive sectors.

Themed challenges

The design challenge consists of four main themes that form its competitive categories. Each participating team that registers for The EGA Aluminium Design Challenge needs to submit a project portfolio, using the template provided at https://www.ega.ae/en/ega-aluminium-design-challenge/required-forms/, on or before 15 November 2018.

Each submission must address one of the four challenge themes. The four themes are:

Futuristic transportation

Aluminium is light, strong and flexible, which allows people to design transportation vehicles that move at breakneck speeds, cross oceans, fly in the sky and even leave our planet. Design and create a futuristic transportation solution that can be based on air, water or roadways, and requires aluminium as a core component.

(Image Source:
The Initial Design of the Dubai Hyper loop Pod exhibited at City Walk as part of UAE Innovation Month
https://hyperloop-one.com/blog/first-look-our-dubai-hyperloop-pod)

Architectural marvel

Aluminum is recognized as one of the most energy efficient and sustainable construction materials in the world. As a result, it has been used extensively in building structures around the world. In this theme, students need to create structurally stable designs of superstructures.

(Image Source:
Burj Khalifa, as the tallest structure in the world, has a total weight of aluminium equivalent to that of five A380 aircraft.
http://www.burjkhalifa.ae)

Kinetic art

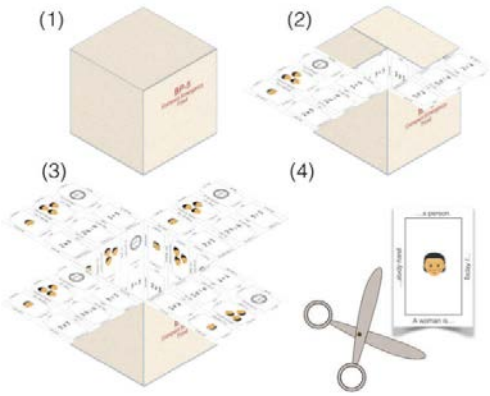
Using aluminium as a core component, design a kinetic art form, sculpture or a product that uses natural elements, such as wind, water or sunlight for the movements. The product should be based on the concepts of science, technology, engineering and math, as well as art.

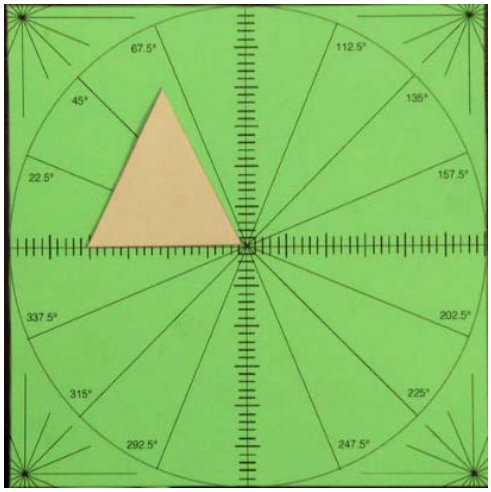
(Image Source:
Octo 2&3 Kinetic Sculptures - “Wind energy is used to propel this kinetic sculpture”
https://gulfnews.com/news/uae/leisure/famous-american-artist-brings-kinetic-sculptures-to-dubai-1.1835247)

Humanitarian relief packaging

Well-designed packaging saves ten times more waste than it creates. The right packaging saves space, reduces, preparation, travel, and energy consumption cost.

Design innovative and efficient packaging for foods, liquids or other kinds of goods that can be delivered to address humanitarian needs.



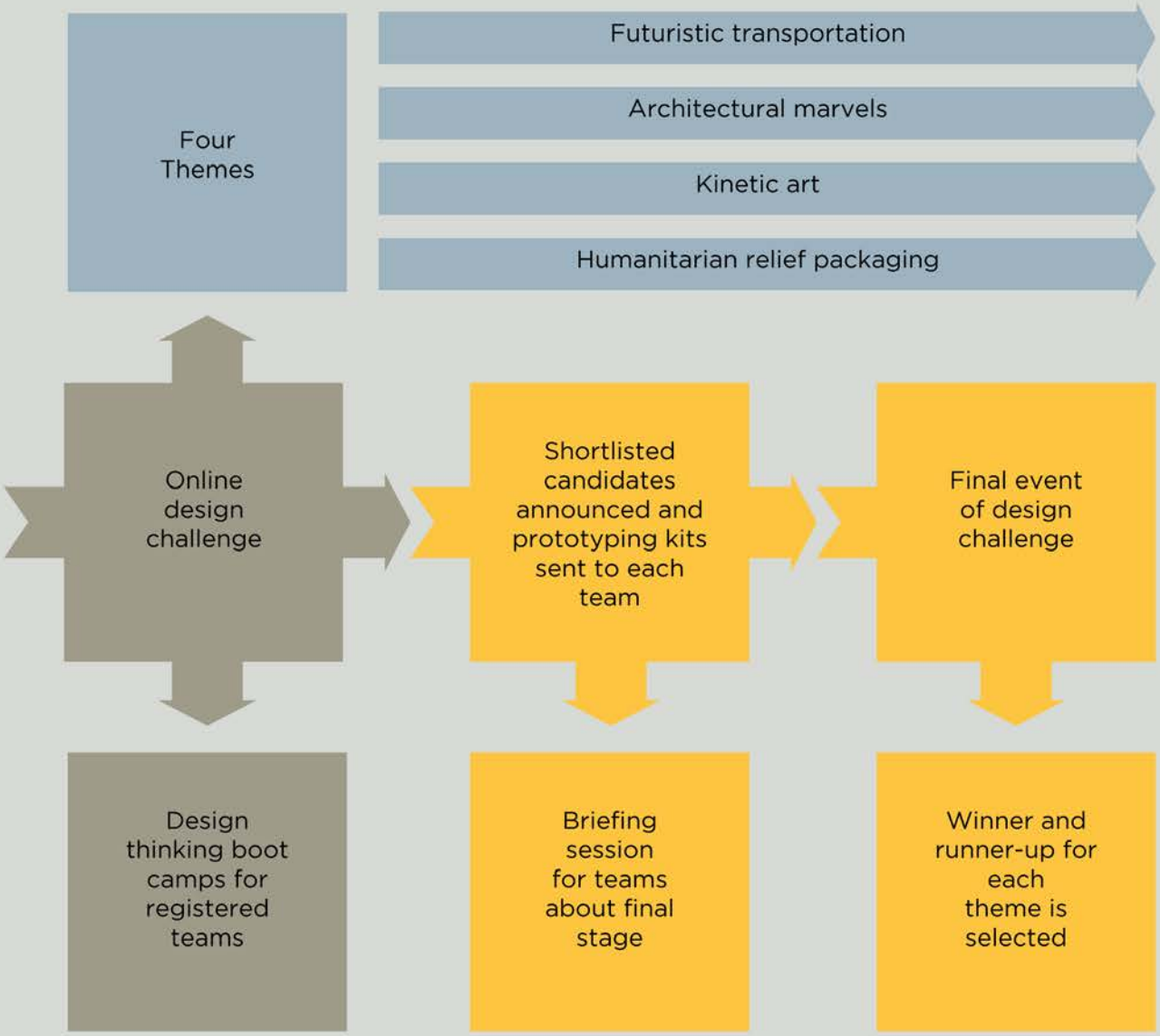


(Image Source:
Adding educational card games into food packaging cartons is a way to expand learning opportunities for refugees
https://challenges.openideo.com/challenge/refugee-education/ideas/educational-card-games-on-food-packaging)

Who is eligible to participate?

High school students of grades 9 to 11 from schools in the United Arab Emirates can participate in the Aluminium Design Challenge.

ADC process from beginning to finals:



Stage 1	Online design challenge ˝Online submission of project based on the themes˝
Stage 2	Final event of design challenge ˝Model of the submitted project made with the prototyping kits are displayed in the final event˝

The EGA Aluminium Design Challenge
Key dates and timeline:

23 Sep, 2018

Stage one: online challenge
Registration opens

To be announced

Design thinking bootcamps
*Team members should be present at the camp

15 Nov, 2018

Online submission closes
* Deadline for project portfolio submission

20 Dec 2018

5 shortlisted teams in each category announced
Prototyping kit sent

To be announced

Briefing session for shortlisted teams
on the final stage of the competition

Feb 2019

Date and venue to be announced
Final event

Prizes

The winning team from each theme will receive a cash prize of AED15, 000.

The runners-up from each theme will receive a cash prize of AED 10,000.

How to enter?

You can enter the design challenge on or before 15 November by making submissions in the Engineer the Future Award Force online portal, https://engineerthefuture.awardsplatform.com/

Link to important documents:

Read through the important documents such as rules and regulations, submission criteria and general terms at:
https://www.ega.ae/en/ega-aluminium-design-challenge/

The winning design team must have the following criteria:

Futuristic transportation

If the transportation is driverless, make sure that the correct innovation has been used. Also, the winning submissions will excellently detail the following:

1. Vehicle shape plan, exhibiting the vehicle's exterior
2. Ergonomics of seating and control
3. Chassis design
4. Vehicle component and space for seats
5. Safety considerations

Architectural marvel

The architectural marvel can be buildings, bridges, superstructures, or monument. It must aesthetic as well as serves the purpose.

1. Architectural sketches

2. Structural function
3. Structural stability
4. Accessibility
5. Aesthetics

Kinetic art

The use of energy from natural elements is of importance. Also, the design should be aligned with STEAM conceptual.

1. Performance requirements and functionality of the Kinetic art has been mentioned
2. Physical requirements of the product are well defined.
3. Aesthetics
4. Alignment with STEM conceptual
5. What natural element is used to power the art?

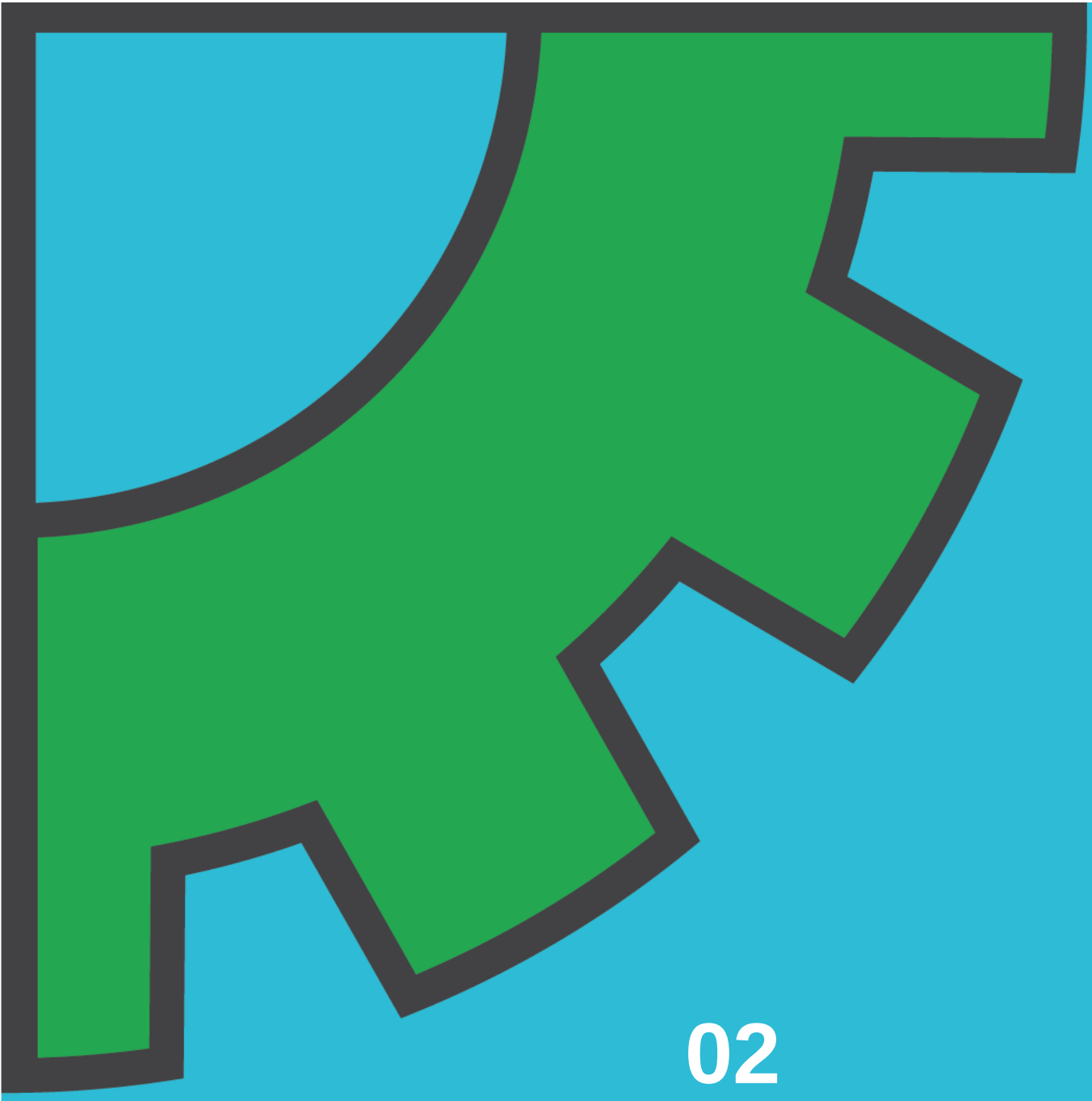
Human relief packaging

1. The practicality of the packaging
2. Shelf life of the product is improved with the packaging
3. The packaging addresses the needs of the user
4. Packaging highlights the overall theme of the category by using the right colours, visual metaphors, textures, materials and word choice

Guide for teachers

Use the Teacher Support Guide as a reference. The guide can be integrated into any design and technology curriculum, STEM clubs, after-school programs or innovation programs. Additionally, the teacher can mentor the team using the Teacher Support Guide. Interested students may also make use of the guide in order to complete the

design portfolio. The design template portfolio can be found among resources at this link: https://www.ega.ae/en/ega-aluminium-design-challenge/required-forms/.



02

Introducing aluminium

Introducing aluminium

Aluminium (Al), or aluminium, is a silver, soft metal with an atomic number of thirteen and thirteen protons in the nucleus. It constitutes about eight percent of the Earth's land mass. It is the most abundant mineral on Earth after oxygen and silicon.

How al was first discovered?

Since pure aluminium is very rare to find in nature, the first nodules of aluminium were produced in the year 1825. In 1807, the English chemist Sir Humphrey Davy underlined the existence of the element arguing that "alum" was the salt of an unknown metal which he said should be called ‘alumium’. Davy tried but was unsuccessful in producing aluminium by electrolyzing a fused mixture of aluminium oxide and potash.

Following Davy’s work, the Danish physicist H.C. Oersted managed to produce the first nodules of aluminium by heating potassium amalgam with aluminium.

It hasn’t even been up to 200 years since the element aluminium was discovered and only 100 years since a viable production process of this metal was established.

Where does aluminium come from?

To make aluminium, the ore (bauxite) must first be mined. The main sources of bauxite are in Australia, South America, and Africa, but other countries including China, Jamaica, India, and the USA also have large amounts of the ore.
Once it has been mined and cleaned, the bauxite is transported to a factory where it undergoes many processes to produce aluminium metal.

Mining and refining aluminium

Deposits of bauxite occur as flat layers lying near the Earth's surface covering many miles. Geologists locate these deposits by a method called prospecting. This is simply taking the core samples or drilling in soils suspected of containing the ore. By analysing the cores, scientists are able to determine the quantity and quality of the bauxite.

After the ore is discovered, open-pit mines typically provide the bauxite that will eventually become aluminium. First bulldozers clear land above a deposit. Then workers loosen the soil with explosives, which bring the ore to the surface. Giant shovels then scoop up the bauxite-rich soil and dump it into trucks, which carry the ore to a processing plant.

The first step in the commercial production of aluminium is the separation of aluminium oxide from the iron oxide in bauxite. This is accomplished using a technique developed by Karl Joseph Bayer, an Austrian chemist, in 1888. In the Bayer process, bauxite is mixed with caustic soda, or sodium hydroxide, and heated under pressure. The sodium hydroxide dissolves the aluminium oxide, forming sodium aluminate. The iron oxide

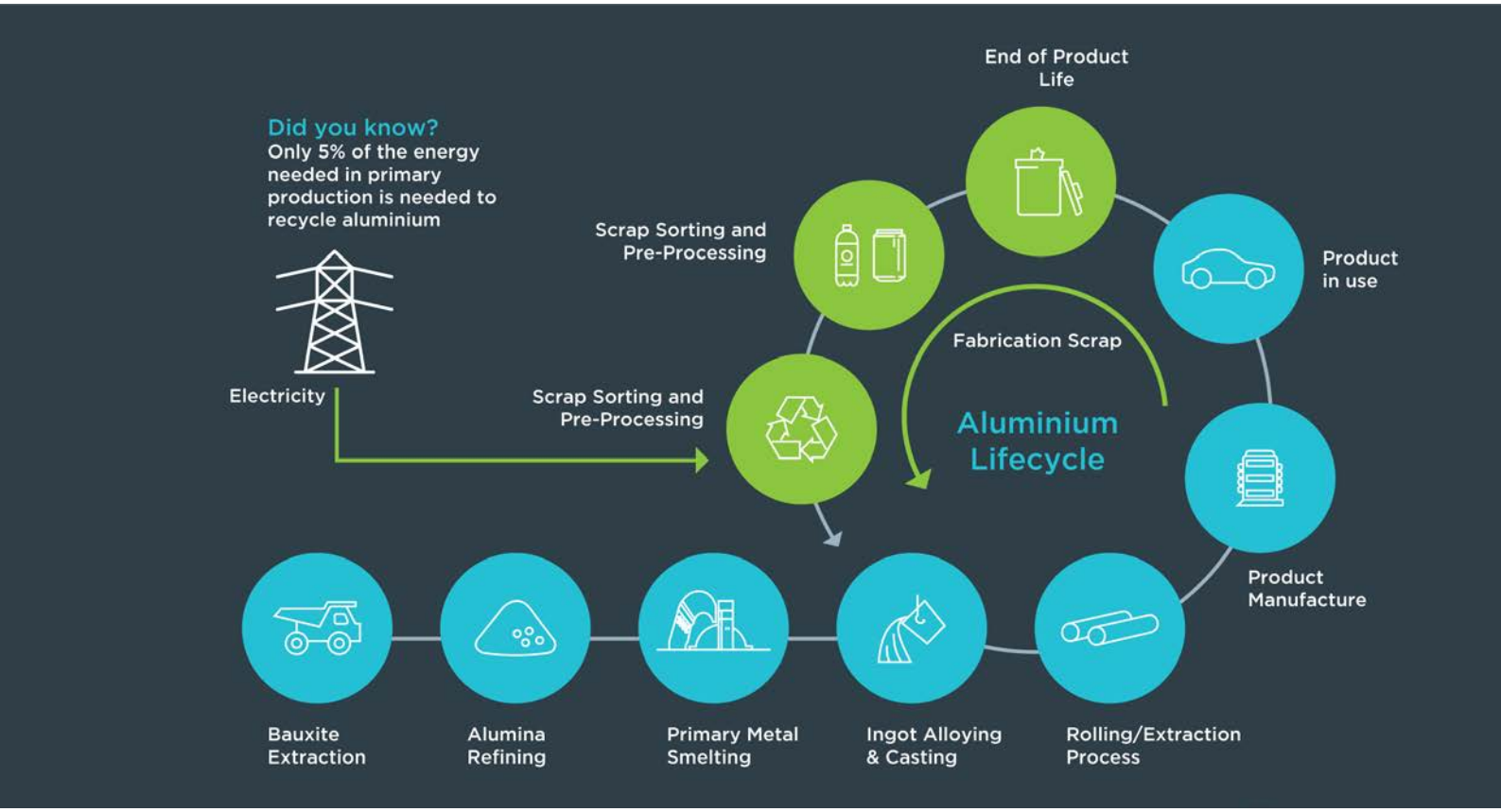
remains solid and is separated by filtration. Finally, aluminium hydroxide introduced to the liquid sodium aluminate causes aluminium oxide to precipitate, or come out of solution as a solid. These crystals are washed and heated to get rid of the water. The result is a pure aluminium oxide, a fine white powder also known as alumina.
Recycling aluminium requires only five percent of the energy that extracting it from ore requires.

Transforming alumina to aluminium oxide and then into aluminium is done by aluminium smelting which is a process based on electrolysis.

The steps in aluminium smelting are described below:

1. The Alumina is dissolved in molten cryolite at 1,000 degrees C (1,832 degrees F). The melting point of pure alumina is 2,054 degrees C (3,729 degrees F). Adding cryolite allows the electrolysis to occur at a much lower temperature.
2. The electrolyte is placed in an iron vat lined with graphite. The vat serves as the cathode.
3. Carbon anodes are immersed in the electrolyte.
4. Electrical current is passed through the molten material.
5. At the cathode, electrolysis reduces aluminium ions to aluminium metal. At the anode, carbon is oxidized to form carbon dioxide gas. The overall reaction is: 2Al2-O3 + 3C -> 4Al + 3CO2-
6. Molten aluminium metal sinks to the bottom of the vat and is drained periodically through a plug.

Life cycle of aluminium



Advantages of aluminium

Lightweight

Aluminium is a very light metal with a specific weight of 2.7 g/cm3, about a third that of steel. (Example: Aero plane)

Corrosion Resistance

Aluminium naturally generates a protective oxide coating and is highly corrosion resistant. (Example: Structure)

Electrical and thermal conductivity

Aluminium is an excellent heat and electricity conductor and in relation to its weight is almost twice as good a conductor as copper.
(Example: Power Line, Cookware)

Reflectivity

Aluminium is a good reflector of visible light as well as heat, and that together with its low weight makes it an ideal material for reflectors.
(Example: Mirror)

Ductility

Aluminium is ductile and has a low melting point and density.

Impermeable and odourless

Aluminium foil, even when it is rolled to only 0.007 mm thickness, is still completely impermeable and let neither light aroma nor taste substances out.
(Example: Tetra Pak, Aluminium Foil)

Recyclability

Aluminium is 100 percent recyclable with no downgrading of its qualities.

03

Prototyping your idea with aluminium

Prototyping your idea with aluminium

The shortlisted teams will be provided with a prototyping kit to prototype their ideas. This prototype needs to be displayed at the final stage along with posters and supporting project portfolio. Judges will select the winners and the runners-up from each theme based on the following model criteria.

The dimension of the models should not be more than 1sqm x 1sqm x 1 sqm.
Sensors and electronics, such as a DC motor, battery and servos, cannot be included.

Kinetic Art should utilize natural elements, such as light, water, wind, to show movement. In addition, teams must simulate movement to show the kinetic nature of the prototype. For imitating natural elements such as wind, water movement, sunlight, etc, you can use the materials provided in the prototyping kit.

The prototype may not be a viable product, but a prototype may or may not be a working model.

What is a prototype?

A prototype is an early version of a model, or of a product to be released in the market. It is built to test an idea, a concept or a process. A prototype needs to be tested and re-tested before the product can be said to be viable.

Steps to build your prototype:

1. Create a concept sketch

   The first step to turning your idea into reality is paper prototyping. With paper prototyping, you simply sketch your idea on paper. This helps you to visualize your idea in a greater detail. Drawing a concept sketch is important because it also conveys your ideas to designers, team members, users and other stakeholders in the first stages of the user-centered design process. Within the prototyping kit, you are provided with a prototyping notebook. Use this notebook, to make an entry of your team's journey of creating the prototype.

2. Develop a virtual prototype

   Eventually, you might need to work on creating a digital sketch of your idea to get a better clarity. For this, you can use simpler computer-aided design tools such as Tinker Cad or Google Sketch Up. In case you require standard designs, use tools employed by engineers, such as AutoCAD or Fusion 360 for the same. In case your virtual prototype includes a lot of 2D design and drafting, AutoCAD is the ideal

software. Fusion 360 is similar, but it is ideally used for engineering-based 3D models.

Once you have a concept sketched, you can take a print out of your digital design and attach it in the prototyping notebook to mark your progress.

3. Build a physical prototype

   Once you have designed a virtual prototype, you are ready to build a physical prototype. Make the prototype by using the materials provided in the prototyping kit, stressing a high use of aluminium. Once your first prototype is built, you may find flaws before you finalize your product or idea design. Creating a prototype helps you to realize your concept beyond virtualization. The prototype that we provide also makes it easy to incorporate changes almost instantly. This helps to cut down cost and time. Imagine finding a design flaw once an architectural structure is already built!

4. Test, re-iterate and build

   In case your physical prototype requires further changes, these can easily be incorporated and tested. Submissions will be evaluated based on the design thinking process of Empathize, Define, Ideate, Prototype, and Test.

Contents in the prototyping kit:

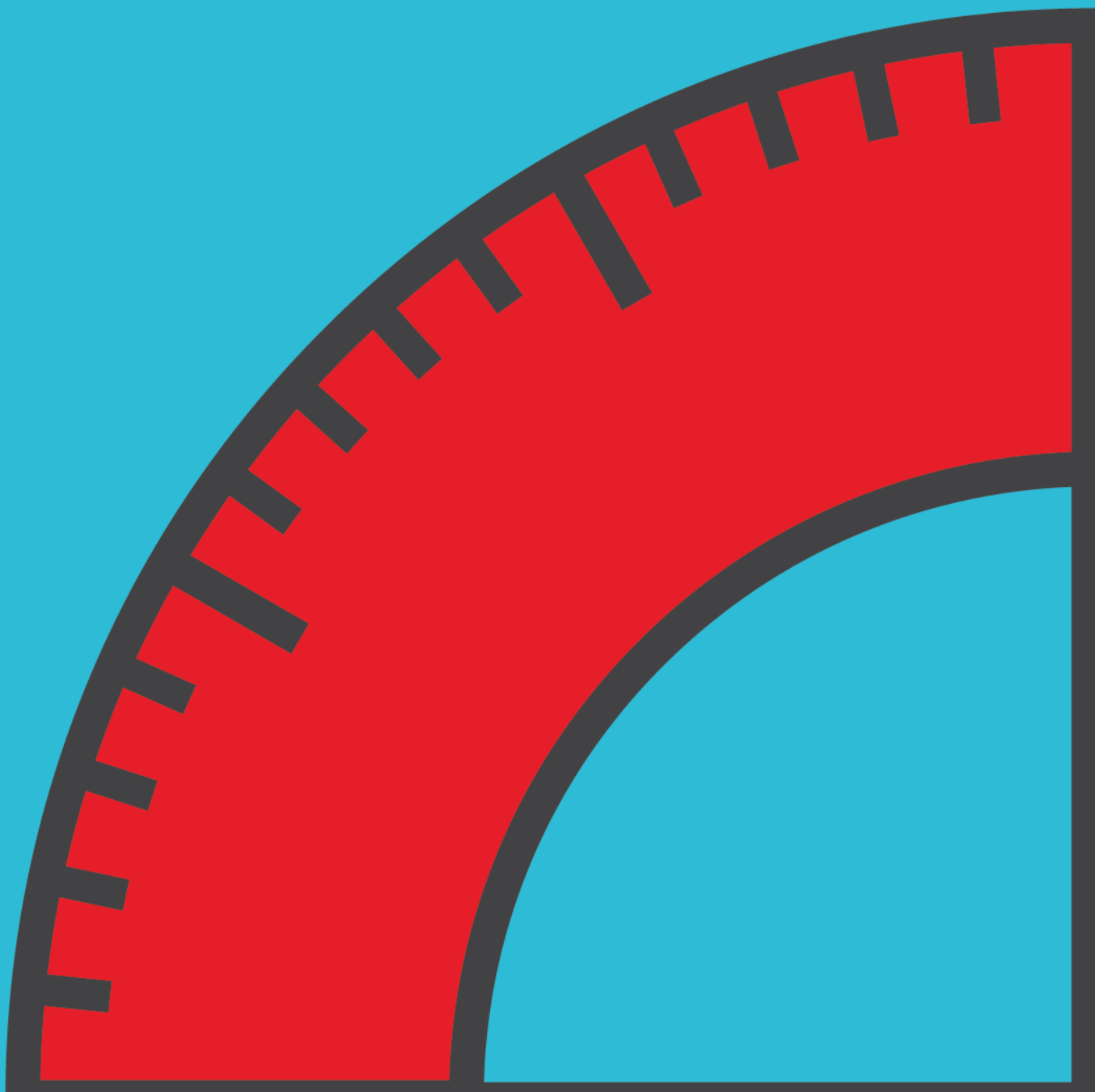
We provide the prototyping kit with the following materials to spark your creativity. A few materials within the kit are:

Aluminium based materials such as	Other Materials such as	Hardwares such as
Aluminium sheet	MDF sheet	Tin snip
Aluminium foil paper	Foam board	Hand drill (5V or 12V)
Aluminium tape	PVC foam sheet	Hardware set (Including pliers,
Aluminium mesh	Magnetic vinyl	Screw driver & mallet)
Soft aluminium wire	Gloss fInish vinyl	Glue gun
Promolyte aluminium sheet	Clear PVC sheet	Craft knife

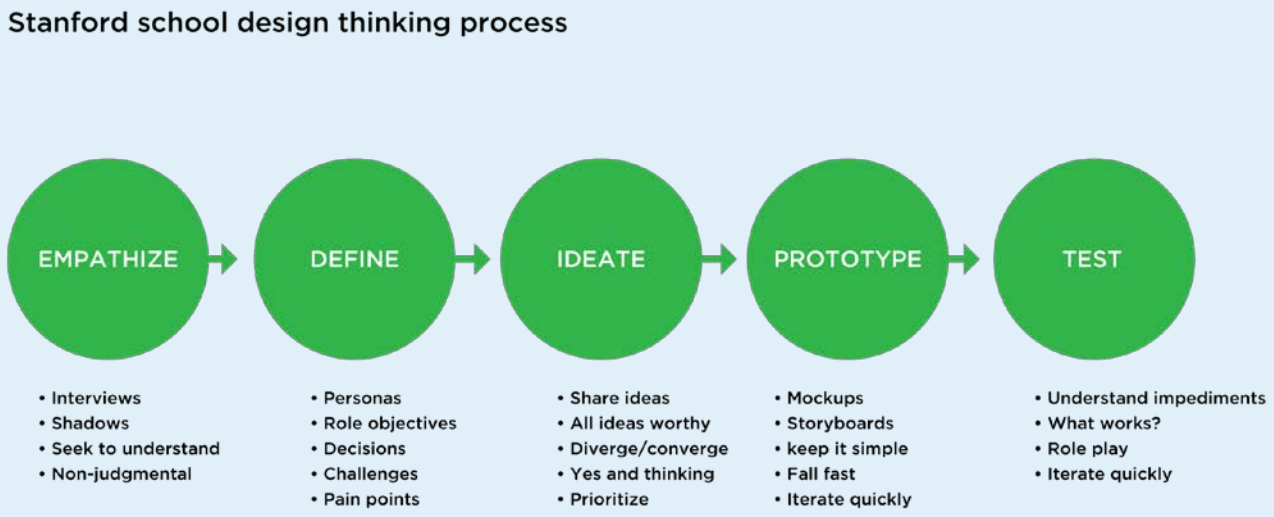
Fasteners, safety and measuring equipment, and a few theme-based materials are also included.

04

Design thinking with aluminium



Design thinking with aluminium:



Design thinking is a design methodology that provides a solution-based approach to solving problems. The project presented should be aligned with design thinking ideology

1. Empathize

The first stage of the design thinking process is to gain a genuine understanding of the problem you are trying to solve. This may involve consulting experts to find out more about your area of concern through observation, engagement and conversation with people who know it well. Doing this will help you to understand their experiences and motivations, as well as immerse you in the physical environment to have a deeper personal understanding of the issues involved. Empathy is crucial to a human-centred design.

2. Define (the problem)

During the define stage, you will put together the information you have gathered during the empathize stage. Here, you will analyze your observations and synthesize them in order to define the core problems that you and your team have identified up to this point. You should seek to define the problem as a problem statement in a human-centred manner.

3. Ideate

During the third stage of the design thinking process, designers are ready to start generating ideas. The final idea needs to be submitted through the online challenge.

Once you have grown to understand your users and their needs in the empathize stage, and you have analysed and synthesized your observations in the define stage, and ended up with a human-centred problem statement, it is time to put your findings together. With this solid background, you can start to 'think outside the box', and identify new solutions to the problem statement you've created. At this stage, you can begin looking for alternative ways of viewing the problem.

4. Prototype

Using the prototype, the shortlisted teams will produce a number of inexpensive, scaled down versions of their ideas, including the specific features found within the submitted idea. The teams can now investigate the problem solutions generated in the previous stage.

These prototypes will be exhibited and demonstrated during the final stage and the judges will evaluate these prototypes. At the ending of the judging period, one winning team per category and one runner-up per category will be selected.

5. Test

The winning and runner-up teams can further test their prototypes using the cash prize.

05

Application

Automotives:

For many years the biggest end-use market for aluminium has been the transportation sector. More than a quarter of all aluminium is used in the transport sector. Originally indispensable for its lightweight for the aerospace industry, aluminium is now widely used in cars, buses, coaches, lorries, trains, ships, ferries, aircraft, and bicycles.

Dubai metro

Dubai Metro extensively uses aluminium in its driverless coaches, depot, and underground stations as roofing solutions.

Shinkansen japan

Steel and aluminium are the dominant materials used in the construction of train bodies, including the train sideboards, roof, floor panels and cant rails, which connect the floor of the train to the sidewall. Aluminium provides a number of benefits to high-speed trains: its relative lightness compared to steel, easier assembly due to parts reduction, and high corrosion resistance. Though aluminium is about 1/3 the weight of steel, most aluminium parts used in the transport industry are about half the weight of corresponding steel parts due to strength requirements.

Architectural structures:

At the beginning of the last century, Aluminium was virtually unused in civil engineering, as the metal was too expensive and not produced in sufficient volumes. Everything changed in the 1920s when the electrolysis process reduced the cost of Aluminium by 80%. The metal became extremely popular for finishing roofs and domes and for use in drains and wall panels, as well as for decorative purposes. The first building in which Aluminium was widely used in construction was the Empire State Building, the famous New York skyscraper built in 1931 – and the tallest building in the world until 1970.

Burj Khalifa

The total weight of aluminium used on Burj Khalifa is equivalent to that of five A380 aircraft

Gulf Extrusions Co., one of the largest aluminium extrusion plants in the Gulf, has announced that it has supplied 170 tons of aluminium till date for the Burj Khalifa project, proposed to be the world's tallest building. Gulf Extrusions is the sole supplier of aluminium for the construction of Burj Khalifa and had signed an AED 130 million contract to supply 1,400 metric tons of alloy 6061 and 6063 for the project which is scheduled for completion by 2008.

Esplanade Singapore
The Esplanade is one of the eye-catching buildings in Singapore and a world-class performing arts center. It is made up of two rounded glass domes fitted with over 7,000 triangular aluminium sunshades.

Ferrari World

The largest Aluminium roof in the world is the roof of the Ferrari World giant entertainment park in Abu Dhabi. It has an area of 200,000 square meters, it is over 700 meters in diameter; the Ferrari logo that you can see in the photo measures an incredible 65 meters in length and covers an area of 3,000 square meters, it is the biggest Ferrari logo ever created.

Humanitarian packaging:

Aluminium's ability to form any shape and its protective qualities have made it the most versatile packaging material in the world. Aluminium foil is used in the packaging of all types of medications such as pills, capsules, creams, lotions, liquid and powder medications. Aluminium foil offers 100% protection against light, moisture, oxygen and other gases as well as against microorganisms and bacteria. Examples:

Thermal blankets

Space blankets are made by vacuum-depositing a very precise amount of pure aluminium vapour onto a very thin, durable film substrate.

Food and medicine packaging:

The use of aluminium foil laminated paper in a rigid, semi-rigid, and flexible package for in-pack thermal processing permits the selection of package geometries that ensure rapid heating and minimum heat damage during processing. Aluminium foil's unrivalled barrier properties, which can totally exclude moisture, microorganisms, light, oxygen and other gases make it a primary material in the protective packaging of pharmaceuticals.

Kinetic art:

Designers use aluminium to create kinetic art-based products or sculptures because it gives them a lot of freedom in choosing the shape for their creations, as well as being easy to process and aesthetically pleasing. Being lightweight, it makes products light yet durable. Make sure the kinetic arts make use of natural elements for it to be propelled.

Arc of petals (1941)

https://www.guggenheim.org/artwork/745

Octo 2 and 3

https://nerdist.com/giant-kinetic-sculptures-beautiful-and-hypnotizing/

Kinetic Art Table

https://www.kickstarter.com/projects/1199521315/sisyphus-the-kinetic-art-table

06

Judging criteria

Judging criteria in detail

The work that each team submits will be judged using a set of rubrics available at the end of the Teacher Support Guide, or separately in the challenge rubric section. The final score for the initial stage of the challenge is out of 50 with the top-five teams in each design theme moving onto the finals stage. All work needs to be entered onto the corresponding portfolio for the chosen theme.

For futuristic transportation:

Vehicle shape plan, chassis design, vehicle packaging, ergonomics of seating and control panels must be illustrated. If the transportation is driverless, make sure the right innovation is been used.

For architectural marvel:

Supporting architectural sketches and site plan must be present. The structural function, accessibility, and stability must be specified. The architecture must be a superstructure and aesthetically pleasing exteriors.

For kinetic art:

The use of energy from natural elements is of importance. Also, the design should be aligned with science, technology, engineering, maths and art. The performance and physical requirements of the product design, as well as the key manufacturing technologies adopted, are accessed.

For humanitarian packaging design:

The submission will be judged against the practicality and functionality of the packaging design. The packaging should address the physical or psychological needs of people in need, and align with the longevity, storage and travel requirements of the product suggested.

How to enter the design challenge?

The first stage of the design challenge is online. Participating teams along with their mentor need to register for the challenge at the Engineer the Future Award Force online portal, https://engineerthefuture.awardsplatform.com/. Once registered for the challenge, the team should submit their project before the submission deadline.

Contact us

In case of any further clarifications, check out the Frequently Asked Questions section in the website at https://www.ega.ae/en/ega-aluminium-design-challenge/faqs/.

For further inquiries, you can mail at stem-ega@edutech.com.

07

Did you know?

Did you know?

Here are some key points about Aluminium

- A single Boeing-747 contains 147,000 pounds (more than 66,000 kilograms) of aluminium
- Some of parts of the airplane's engine used by the Wright Brothers were made of aluminium, making it light enough to fly
- The Empire State Building, constructed in 1930-1932, was the first building to make major use of aluminium components and fabricated structures
- The total weight of aluminium used on the Burj Khalifa is equivalent to that of five A380 aircraft
- Recycling aluminium takes only 5 percent of the energy needed to extract new aluminium from ore. About 55 percent of aluminium drink cans made it into the recycling bin
- Every minute of every day, an average of 113,200 aluminium cans are recycled.
- An aluminium can take as little as 60 days to return as a new can after recycling.
- Recycling one tonne of aluminium saves the carbon dioxide emissions of driving nearly 27,000 miles
- Rubies are simply aluminium oxide crystals with a few atoms of aluminium replaced by a few chromium atoms
- Aluminum was classified as a precious metal during the mid-19th century
- Napoleon III gave aluminium cutlery to his most distinguished guests; others used gold cutlery
- Aluminum has the amazing ability to reflect 98% of infrared rays and 92% or visible light, making it widely used for making reflective mirror surfaces

08

Terms and conditions

Terms and conditions

PLEASE REVIEW BELOW CAREFULLY.

We will consider your decision to enter the challenge as acceptance of the terms and conditions below, including any revisions posted here.

1. The EGA Aluminium Design Challenge is open to students in schools in the United Arab Emirates in Grades 9, 10 and 11 as of 23 September 2018.
2. Teams registering for The EGA Aluminium Design Challenge to include three to four students and one teacher/mentor.
3. The winners in the finals will be awarded prize money to be shared equally among team members.
4. Maximum of only one registration is allowed per team.
5. Registration can only be made online through the site, https://engineerthefuture.awardsplatform.com/https://engineerthefuture.awardsplatform.com/
   Registration must be done by the teacher/mentor using an official school e-mail ID.
6. Submission should be correctly labelled with the team ID.
7. Submissions must cover the three areas shown on each challenge guide: how students are using the Design Thinking process to solve a problem, how they are using aluminium, and the theme selected by the students.
8. Submissions must be a maximum of 10 pages of A4 Landscape and may also include up to 10 images/photos in addition.
9. The judging panel decision will be final, there will be no appeal system and no communication will be entertained on the announced results.
10. No attempt should be made to contact the judges or discussion entered into with the judges either personally or through any persons or medium during or after the challenge regarding the team participation, their submissions or the judging criteria.
11. The EGA Aluminium Design Challenge organizers will not be responsible for any inability of a prize winner to accept the specified prize.
12. The EGA Aluminium Design Challenge organizers will not be liable for any change of date or venue of the final event.
13. Travel costs to the boot camps, finalists briefing event or the final event will not be covered by the organizers.
14. The winners may be required to participate in publicity connected with The EGA Aluminium Design Challenge.
15. By entering The EGA Aluminium Design Challenge, students and mentors/teachers give agreement for the details of all submissions to be shared by EGA on its website and associated media channels.
16. This challenge is governed by UAE Law and is subject to the exclusive jurisdiction of the UAE courts.

17. Entries to The EGA Aluminium Design Challenge should not intentionally or unintentionally violate any applicable local, state, national or international law or regulation.

09

Appendix

Design thinking process

- Download DT toolkit from here for reference
  https://designthinkingforeducators.com/
- Foil challenge DT Standford
- https://dschool.stanford.edu/resources/getting-started-with-design-thinking
- Shapes - The Aluminium Design Knowledge Hub
  http://www.shapesbyhydro.com/

Curriculum links

- https://www.gov.uk/government/publications/national-curriculum-in-england-design-and-technology-programmes-of-study
- https://www.stem.org.uk/
- https://www.stem.org.uk/resources/elibrary/resource/28125/ideas-resources

Links to learning about aluminium

- Emirates Global Aluminium
  https://www.ega.ae/
- Gulf Aluminium Council
  http://www.gulfaluminiumdubai.com
- International Aluminium Institute
  http://www.world-aluminium.org
  http://www.thealuminiumstory.com
- Aluminum Transportation Group
  http://www.drivealuminium.org
- The Council for Aluminium in Building
  http://www.c-a-b.org.uk
- Aluminium Packing Recycling Organization
  www.alupro.org.uk
- The Aluminium Federation
  www.alfed.org.uk
- European Aluminium Foil Association
  https://www.alufoil.org/en/home.html

Recycling

- Novelis interactive tour of the recycling process for drink cans
  www.novelisrecycling.co.uk

- Think Cans
  http://thinkcans.net/think-cans-in-the-classroom

Recycle Now has information and resources for schools for recycling
www.recyclenow.com/schools/index.html

Manufacturing

- Can Manufacturers Institute (USA)
  www.cancentral.com

Links to learning about Innovation and creativity

- edX - Innovation Generation: How to Be Creative
  https://www.edx.org/course/innovation-generation-how-be-creative-uthealthsphx-inov101x