The truss structure

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I’m Masako Nozaki and I’m a teacher of Art and Handicrafts at an elementary school in Tokyo, Japan.

I’m very happy to be here.

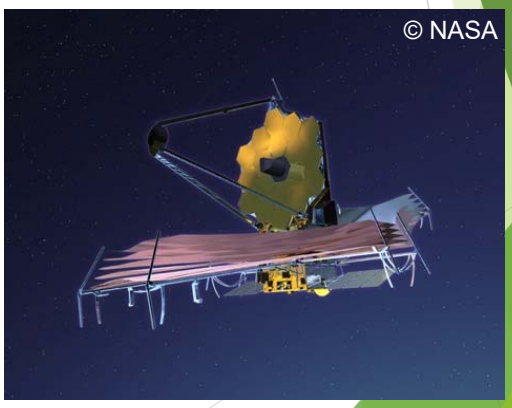
Today,I would like to talk about the utilization of the truss structure in primary education.

Larger spacecraft is more appropriate for highly precise performance.

Advanced space technology leads the development of large size spacecraft with high performance.

For larger spacecraft, the structure that maintains the shape is more important. Without a robust structure, spacecraft cannot withstand loads from various directions. And considering that spacecraft will be carried into outer space, they should be as light as possible.

So what makes a structure lighter and more robust?



Larger spacecraft is more appropriate for highly precise performance.

Advanced space technology leads the development of large size spacecraft with high performance.

One example is theJames Webb Space Telescope,which will launch next yearto succeed the mission of Hubble Space Telescope.

As the spacecraft becomes larger, the structure to support the size is more important.

A lighter, simpler, and more robust structurebecomesrequired.

Then how, can we makea structure lighter and more robust?

Let’s think aboutit.

What is a truss?

Which is the truss structure?

A

B

Well, today I will talk about the truss.

Here aretwo photosof famous towers

A is Tokyo Sky Tree. It is the tallest tower in Japan.

B is Burj Khalifa, in Dubai.It is a famous tower from the movie, Mission Impossible.

So, which tower do you think the truss structure is used?

TheAnswer is A. Do you know why?

But before that,do you knowwhat isthe truss?

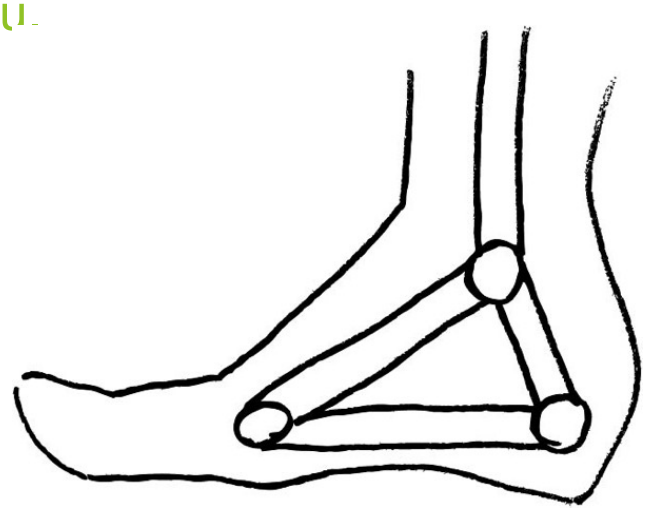
If you know, please raise your hand

So, what is a truss madefrom?

Thank you.That's right.

The structure based on triangle is called a truss.

The truss structure is everywhere all around you.



- Explanetory models of the foot function

You can see that the truss structure is used all around us.

The most familiar example is the structure of our feet.

Bicycles and soda car structure.

It is also used for bycicles, soda cans, ・・・

Other examples・・・

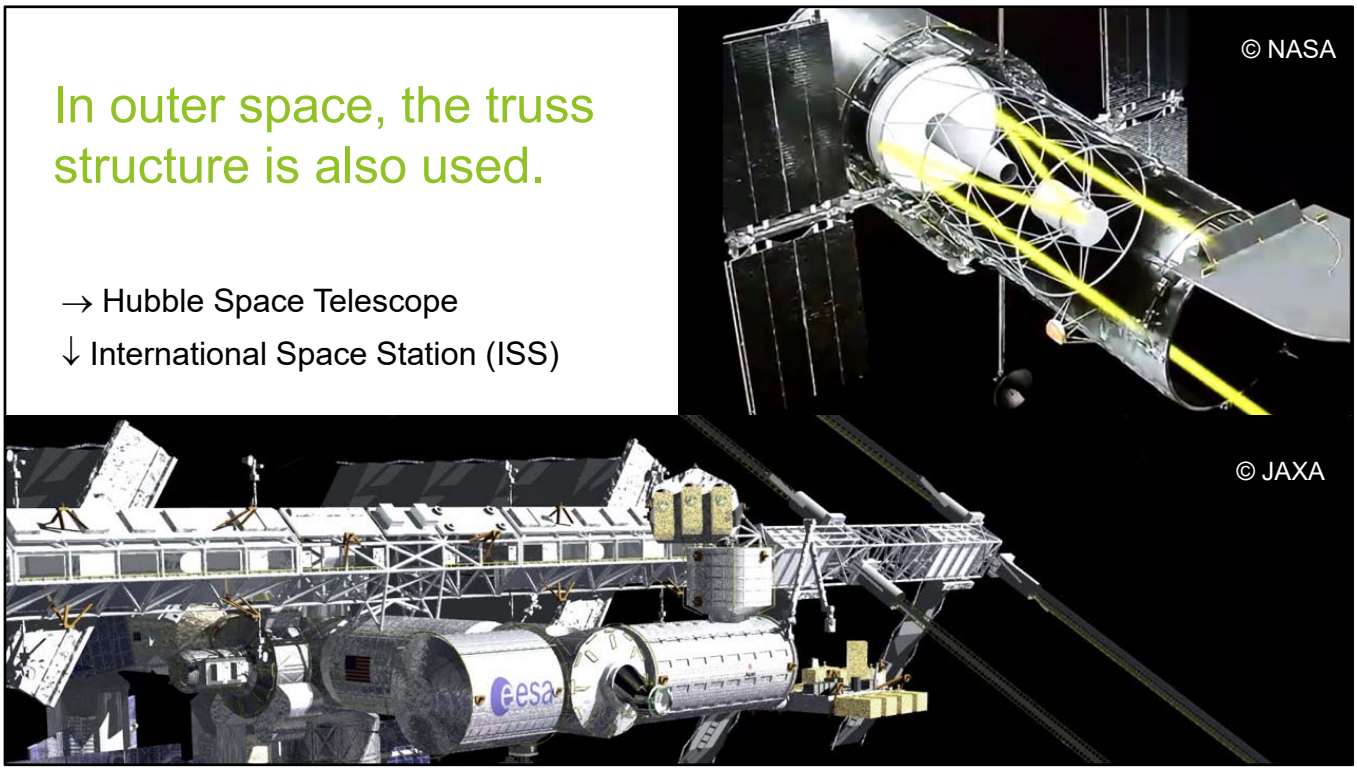
・・・bridges, and towers.

Do you understand that there are triangles in all?

In outer space, the truss structure is also used.

→ Hubble Space Telescope

↓ International Space Station (ISS)



In outer space, it is used for the frame of spacecrafts, like the International Space Station, the Hubble Space Telescope, and more.

Now, what happens when the truss structure is not used?

Lets look at some examples of bridges.

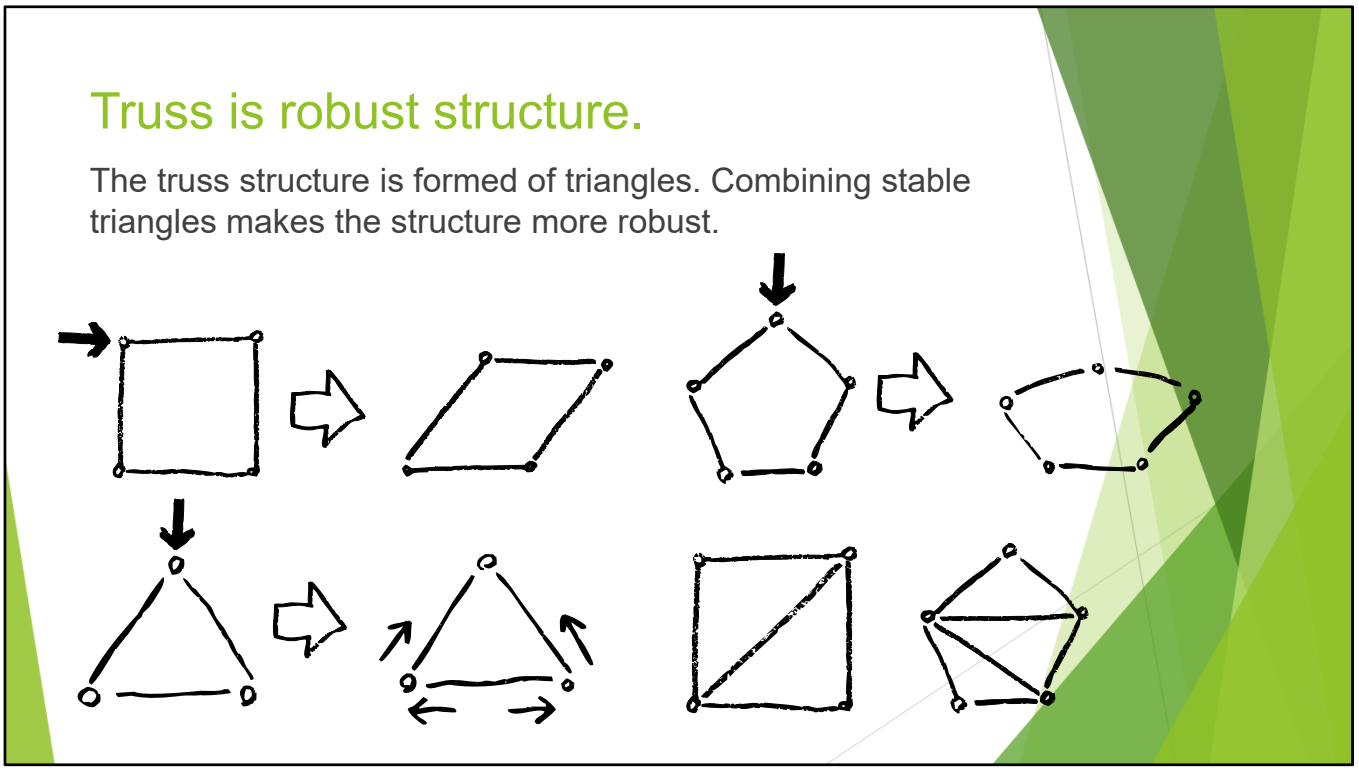
cross over a puddle or a creek, it seems to be okay with a thin piece of wooden board.

When there is a big river, a stone bridge may be possible to be built.

So then, how can you cross an ocean? Would you stack a stone?

After all, truss structure is essential.

When you try to make something big and sturdy at a minimum requirement, the truss structure is needed.

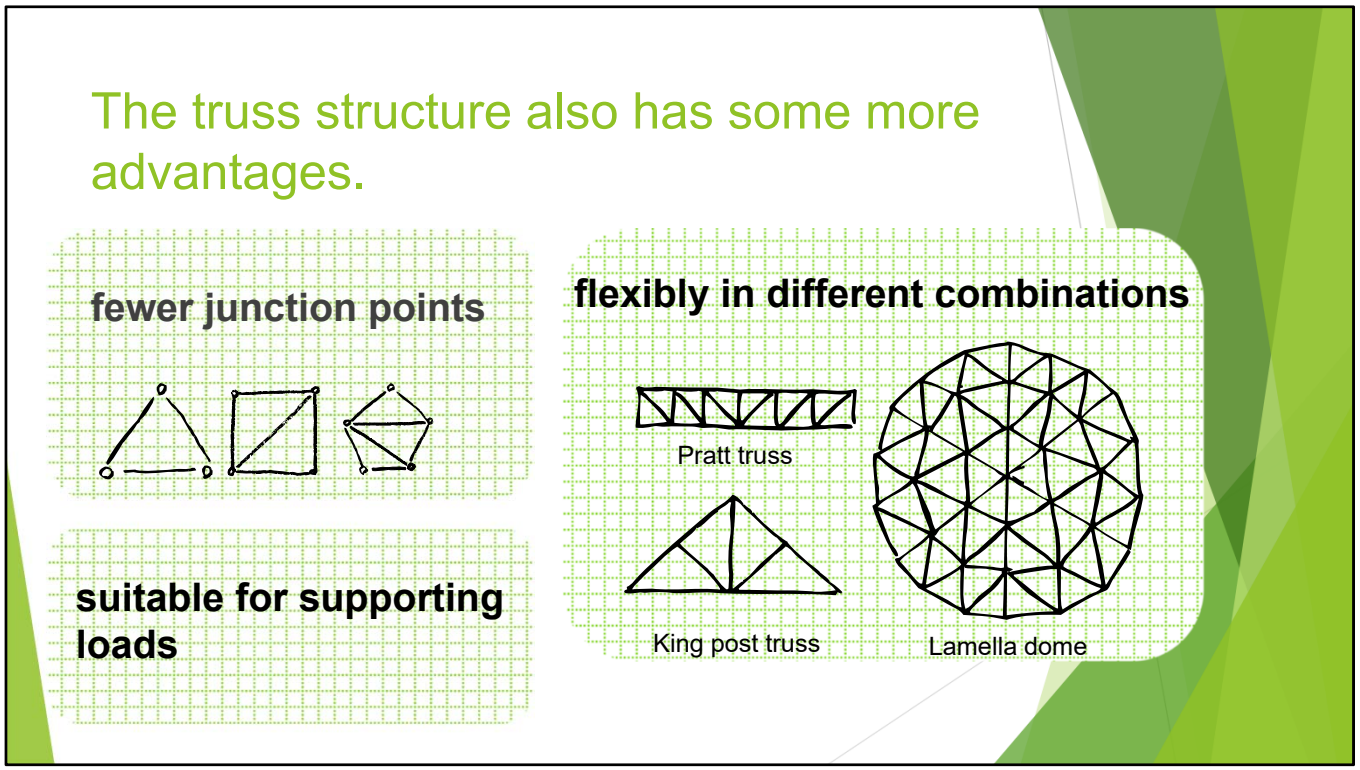


So now, I will explain the truss.

After some trial, you'll find that the truss structure is the robust structure you want.

The truss structure consists of triangles, and it is more robust thananyother shapes.

On the other hand, if a quadrangle or a pentagon is divided into triangles, it will become more robust.



Compared to a quadrangle, the truss structure is robust and simple which makes it easilier to assemble because it has fewer junction points and elements.

Also, because the structure is based on triangles, it can be used to combine it in various ways, which means there is potential for expansion. For example, pratt truss, king post truss, and lamella dome.

And, its robustness makes itself suitable to construct elements to support loads such as columns and beams, rather than as housing.

How could you make the larger and more robust structure?

1. Make a large self-supporting structure.
2. You can use only the **12 straws** and tape on the desk.
3. Think by yourself and see what you can make.
4. We will coalesce in the group at the end!

Then, what kind of combination is better for making something larger and more robust?

There are 12 straws and tapes.
Each person can use 12 straw.

We use this limited material to make it.

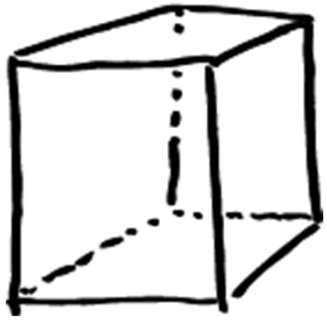
At the end, we will coalesce what we have made.

I will give you 10 minutes. Lets begin!

Let's think about a large self-supporting structure?

The structure that can be made with 12 poles is…

- Regular hexahedron
- Regular octahedron



The structure that can be made with 12 pole is…

Regular hexahedron and Regular octahedron

A rectangular hexahedronis made of square.

An octahedron is made of triangles.

Let‘s compare the difference in strength.

Hexahedrons will fall off if you add power.

The octahedron is lifted. You can keep its shapes.

This octahedron leads to various directions.

how is it?Were you able to combine it within your group?

If there are no cooperation, you cannot combine it.

Additional example

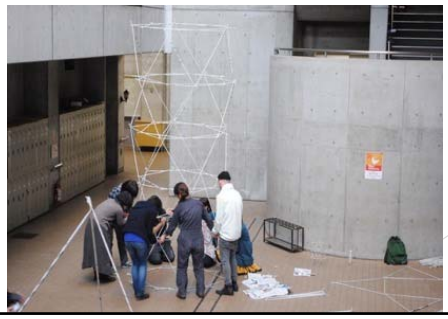
This structure has other uses as well.

I will introduce additional examples from now.

I've done activities like this at elementary schools and universities...








At our elementary school, first, we have the students meet and talk about their strategy.

Then, we will begin by making poles.

Working together in groups, we also make developmental shapes, such as regular icosahedrons.
We will continue connecting them until finally, they form a very large structure.
The children work together to battle gravity, talking and exchanging ideas.

You can also do this in university classes.

University students will think about it practically and seriously, and compete against one another in groups.
This time, we made them based on the mission to get a higher performing structure.

...at the Japan International Cooperation Agency, and overseas in Sweden.

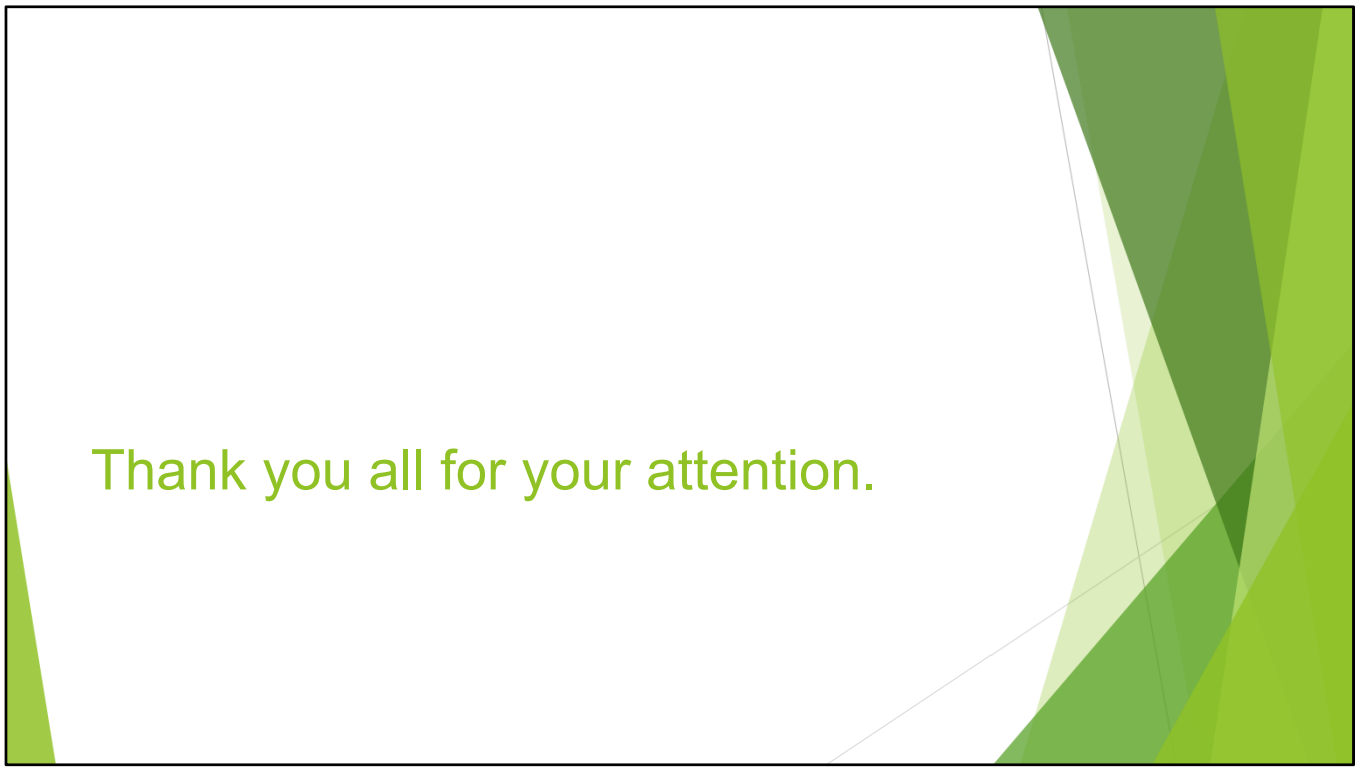
It can also be used as a communication tool.
We can do this activity with people from Japan International Cooperation Agency (who are on educational visits to Japan),
and we also can do it in Sweden.
We can attempt to communicate and overcome the linguistic barrier.

（正20面体を紹介）

Actually prepared a regular icosahedron.

So how do you use the truss structure?

So this is what I've been doing. Ihope you like it.



Thank you very much.