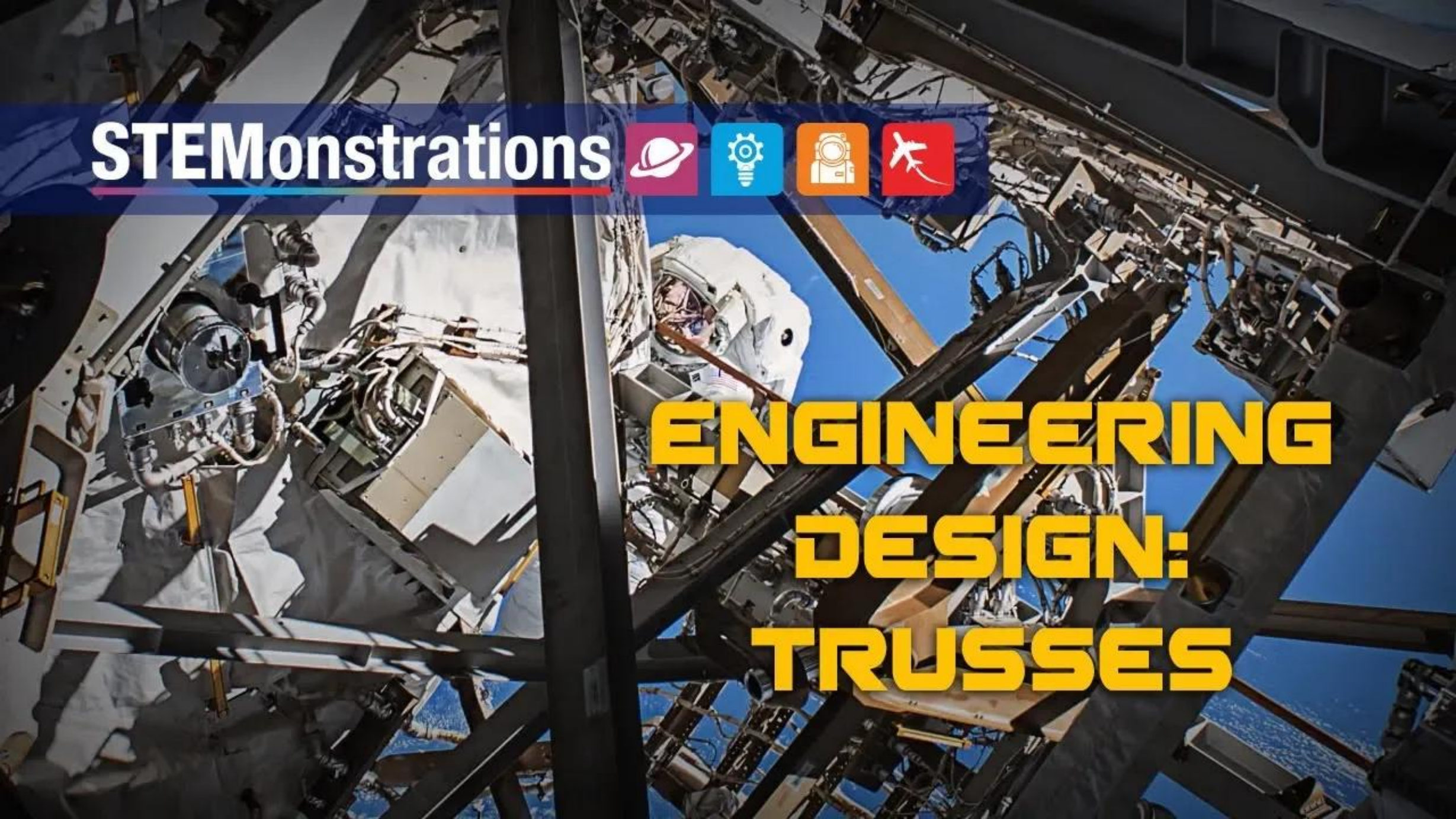
STEMonstrations
ENGINEERING DESIGN: TRUSSES

1
00:00:16,610 --> 00:00:21,060
Hey there! I'm NASA astronaut Ricky Arnold. Welcome aboard the International

2
00:00:21,060 --> 00:00:26,369
Space Station. Today we're going to talk about the space station truss. The truss

3
00:00:26,369 --> 00:00:32,250
segment is just about the little better 100 meters from side to side. A truss is

4
00:00:32,250 --> 00:00:36,449
a segment or part of the whole integrated truss structure. The trusses

5
00:00:36,449 --> 00:00:40,890
are used to support the 16 solar array panels which provide energy for us and

6
00:00:40,890 --> 00:00:44,699
radiators which get rid of excess heat that builds up inside the space station.

7
00:00:44,699 --> 00:00:49,020
The design of the truss involves triangles and beams which can be seen on

8
00:00:49,020 --> 00:00:52,620
earth and structures like bridges. Why triangles?

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00:00:52,620 --> 00:00:56,670
Well this is because of their unique geometric properties, their methods of

10
00:00:56,670 --> 00:01:01,050
transferring loads, and their spacial openness. Triangles are more rigid than

11
00:01:01,050 --> 00:01:05,399
rectangular shapes because they have
fewer joints. The larger number of joints

12
00:01:05,399 --> 00:01:11,039
in a shape the more prone that shape is
to being impacted by shear forces. What I'd

13
00:01:11,039 --> 00:01:14,280
like to talk a little bit about today is
some of the forces that can act upon the

14
00:01:14,280 --> 00:01:19,320
truss. Well the first force I want to
talk about is compression force and

15
00:01:19,320 --> 00:01:24,450
compression force is just like it sounds
two things being pushed together so if

16
00:01:24,450 --> 00:01:27,780
we apply a compression force to the
truss what do you think is going to

17
00:01:27,780 --> 00:01:36,330
happen? Let me go ahead and do it
and you can see right here where the

18
00:01:36,330 --> 00:01:43,680
truss would bend. What do you think the
opposite force of compression is now?

19
00:01:43,680 --> 00:01:47,520
it's gonna right it's gonna be pulling
apart we call that a tension force. And a

20
00:01:47,520 --> 00:01:52,740
tension force is what's gonna help maybe
even rigidize the truss segment but it

21
00:01:52,740 --> 00:01:56,369
also could potentially pull it apart. I'm
not gonna pull apart this tape measure

22
00:01:56,369 --> 00:02:01,500
because we probably need it later for
for some work we have to do. Now if you

23
00:02:01,500 --> 00:02:04,740
look carefully this next force I want to
talk about is basically kind of like a

24
00:02:04,740 --> 00:02:10,739
twisting force and we call it torsion
and even when I just let go of the the

25
00:02:10,739 --> 00:02:14,370
tape measure you can see it will
actually start to happen a little bit.

26
00:02:14,370 --> 00:02:18,570
You can start to see because the center
of mass is actually right here where

27
00:02:18,570 --> 00:02:23,489
most of the tape measure is located and
when I let it go the tape measure itself

28
00:02:23,489 --> 00:02:29,069
starts to twist just a little bit.
Finally the fourth force that connect

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00:02:29,069 --> 00:02:34,829
along a truss segment is it can occur at
a single point where a two opposing

30
00:02:34,829 --> 00:02:39,180
forces work on a single point along the
truss just like they can upon the

31
00:02:39,180 --> 00:02:42,450
Earth's surface
think about some earthquakes you can

32
00:02:42,450 --> 00:02:45,810
have a plate that is or along a fault
line where a part of the one side of the

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00:02:45,810 --> 00:02:49,349
fault line is moving upward or being
forced upward while the other side is

34
00:02:49,349 --> 00:02:54,030
moving downward and that force in at one
point and opposite directions is called

35
00:02:54,030 --> 00:02:58,230
a shear force and we could also have
that have that happen on the truss

36
00:02:58,230 --> 00:03:05,700
segment. Something like this. One thing to
think about where do these forces come

37
00:03:05,700 --> 00:03:10,650
from? One force even though we're up here
largely out of the Earth's atmosphere we

38
00:03:10,650 --> 00:03:15,139
do still have drag with the Earth's
atmosphere which can impart loads on the

39
00:03:15,139 --> 00:03:20,639
impart a force on the truss
segment. Another I already hinted at

40
00:03:20,639 --> 00:03:25,379
earlier is crew working inside we're up
here we're exercising we're moving

41
00:03:25,379 --> 00:03:29,189
really heavy pieces equipment of
equipment around so we have an amazing

42
00:03:29,189 --> 00:03:33,959
engineering team on the ground and we
have specific disciplines that are their

43
00:03:33,959 --> 00:03:37,379
job is to monitor all the forces
imparted upon the International Space

44
00:03:37,379 --> 00:03:41,669
Station. They keep track of all those
various forces I talked about where they

45
00:03:41,669 --> 00:03:44,939
could be coming from the atmosphere
visiting vehicles or even things that

46
00:03:44,939 --> 00:03:48,359
the crew are doing inside the space
station and to make sure that those

47
00:03:48,359 --> 00:03:53,159
forces are significant enough to cause
any damage to this wonderful laboratory

48
00:03:53,159 --> 00:03:57,780
and living space we have up here in
low-earth orbit. Thanks so much for