



**Space**to**Ground**

1  
00:00:00,700 --> 00:00:02,560  
[music]

2  
00:00:02,700 --> 00:00:04,660  
"HOUSTON, STATION  
ON SPACE TO GROUND."

3  
00:00:06,740 --> 00:00:08,040  
GO ANTARES!

4  
00:00:09,720 --> 00:00:12,120  
WELCOME TO SPACE TO  
GROUND, I'M DAN HUOT.

5  
00:00:12,160 --> 00:00:14,660  
THIS WEEK STARTED OFF  
HOW ALL WEEKS SHOULD:

6  
00:00:14,700 --> 00:00:15,800  
WITH A ROCKET LAUNCH.

7  
00:00:16,600 --> 00:00:20,340  
ORBITAL ATK'S ANTARES LIFTED  
OFF ON MONDAY MORNING,

8  
00:00:20,340 --> 00:00:22,540  
ILLUMINATING THE  
VIRGINIA NIGHT SKY

9  
00:00:22,540 --> 00:00:25,480  
AND DELIVERING THE CYGNUS  
SPACECRAFT INTO ORBIT.

10  
00:00:25,780 --> 00:00:27,656  
FOLLOWING THE TEXTBOOK LAUNCH

11  
00:00:27,656 --> 00:00:30,786  
AND A THREE DAY TRIP CIRCLING  
THE GLOBE, CYGNUS ARRIVED

12

00:00:30,786 --> 00:00:33,406

AT THE STATION ON  
THURSDAY AND WAS SNAGGED

13

00:00:33,406 --> 00:00:35,516

BY NASA ASTRONAUT SCOTT TINGLE.

14

00:00:35,516 --> 00:00:39,616

THE VEHICLE, PACKED WITH  
ABOUT 7,400 POUNDS OF CARGO,

15

00:00:39,856 --> 00:00:41,826

WAS ATTACHED TO THE  
EARTH FACING SIDE

16

00:00:41,826 --> 00:00:44,816

OF THE UNITY MODULE BEFORE  
THE CREW OPENED THE HATCH

17

00:00:44,840 --> 00:00:45,580

AND GOT TO WORK.

18

00:00:46,220 --> 00:00:49,120

AND COMING SOON TO A  
SPACE STATION NEAR YOU:

19

00:00:49,120 --> 00:00:51,700

ONE OF THE COLDEST  
SPOTS IN THE UNIVERSE.

20

00:00:52,380 --> 00:00:55,876

THE COLD ATOM LABORATORY  
IS A PHYSICS EXPERIMENT

21

00:00:55,876 --> 00:00:57,246

THAT WILL BE PRODUCING CLOUDS

22

00:00:57,246 --> 00:01:01,260

OF ULTRA-COLD ATOMS CALLED  
BOSE-EINSTEIN CONDENSATES,

23  
00:01:01,260 --> 00:01:05,860  
OR BECS, WHERE ATOMS BEHAVE MORE  
LIKE WAVES INSTEAD OF PARTICLES.

24  
00:01:06,420 --> 00:01:10,136  
TO DO ALL THIS, ATOMS WILL BE  
CHILLED TO ABOUT 10 BILLIONTHS

25  
00:01:10,136 --> 00:01:12,216  
OF A DEGREE ABOVE ABSOLUTE ZERO,

26  
00:01:12,686 --> 00:01:14,626  
WHICH IS ABOUT 10  
BILLION TIMES COLDER

27  
00:01:14,626 --> 00:01:17,080  
THAN THE AVERAGE  
TEMPERATURE OF DEEP SPACE.

28  
00:01:17,680 --> 00:01:20,360  
THANKS TO THE STATION'S  
MICROGRAVITY ENVIRONMENT,

29  
00:01:20,466 --> 00:01:23,746  
SCIENTISTS WILL BE ABLE  
TO OBSERVE THE BECS FOR UP

30  
00:01:23,746 --> 00:01:27,706  
TO TEN SECONDS, WAY LONGER THAN  
THE FRACTIONS OF A SECOND WE SEE

31  
00:01:27,706 --> 00:01:30,346  
IN SIMILAR EXPERIMENTS  
HERE ON EARTH.

32  
00:01:30,346 --> 00:01:33,266  
SCIENTISTS ARE HOPING TO ADDRESS

## SOME FUNDAMENTAL QUESTIONS

- 33  
00:01:33,266 --> 00:01:36,346  
IN SCIENCE, LIKE THE NATURE  
OF GRAVITY, DARK MATTER
- 34  
00:01:36,346 --> 00:01:39,576  
AND DARK ENERGY, AND COULD  
ALSO HELP IMPROVE TECHNOLOGIES
- 35  
00:01:39,626 --> 00:01:43,876  
LIKE ATOMIC CLOCKS USED IN SPACE  
NAVIGATION OR QUANTUM SENSORS
- 36  
00:01:43,876 --> 00:01:47,296  
ON SPACECRAFT USED FOR THINGS  
LIKE MONITORING EARTH'S CLIMATE
- 37  
00:01:47,606 --> 00:01:50,096  
OR THE MAKEUP OF OTHER  
PLANETS AND ASTEROIDS.
- 38  
00:01:50,346 --> 00:01:54,236  
THIS WEEK'S TWITTER QUESTION  
COMES FROM MARK WILSON WHO WANTS
- 39  
00:01:54,236 --> 00:01:57,276  
TO KNOW HOW WE WEIGH  
ASTRONAUTS IN MICROGRAVITY.
- 40  
00:01:57,306 --> 00:02:00,286  
WELL A SCALE ISN'T MUCH  
USE, SO WE HAD TO TURN
- 41  
00:02:00,286 --> 00:02:01,456  
TO SOME FUNDAMENTAL PHYSICS.
- 42  
00:02:02,716 --> 00:02:05,946  
NEWTON'S SECOND LAW OF MOTION  
TEACHES US WE CAN CALCULATE

43

00:02:06,076 --> 00:02:09,946  
FORCE BY MULTIPLYING AN OBJECTS  
MASS BY ITS ACCELERATION.

44

00:02:10,756 --> 00:02:14,056  
USING THE SPACE LINEAR  
ACCELERATION MASS MEASUREMENT

45

00:02:14,086 --> 00:02:16,896  
DEVICE, OR SLAMMD, WE  
CAN USE TWO SPRINGS

46

00:02:16,996 --> 00:02:19,786  
TO GENERATE A KNOWN FORCE  
AGAINST AN ASTRONAUT

47

00:02:20,126 --> 00:02:22,096  
AND MEASURE THE RESULTING  
ACCELERATION.

48

00:02:22,736 --> 00:02:25,966  
WITH TWO OF THE THREE VARIABLES  
IN OUR EQUATION NOW KNOWN,

49

00:02:26,276 --> 00:02:27,306  
WE CAN CALCULATE MASS!

50

00:02:28,356 --> 00:02:31,206  
HOPE YOU LIKE WHAT WE'VE DONE  
WITH THE PLACE AND KEEP SENDING

51

00:02:31,206 --> 00:02:33,996  
IN YOUR QUESTIONS USING  
THE HASHTAG SPACETOGROUND,

52

00:02:34,286 --> 00:02:35,166  
WE'LL SEE YOU NEXT WEEK.