NORTHROP GRUMMAN CRS-13 MISSION TO THE SPACE STATION

WHAT'S ON BOARD

1
00:00:00,270 --> 00:00:15,030
[Music]

2
00:00:20,390 --> 00:00:17,189
sapphire is really a series of six

3
00:00:23,750 --> 00:00:20,400
experiments all aimed at um spacecraft

4
00:00:26,550 --> 00:00:23,760
fire safety fire safety has been a

5
00:00:28,550 --> 00:00:26,560
a a big concern ever since we started

6
00:00:31,269 --> 00:00:28,560
flying you know crude vehicles into

7
00:00:33,190 --> 00:00:31,279
space a lot of uh research has been done

8
00:00:35,750 --> 00:00:33,200
the trouble is there's always a crew

9
00:00:38,229 --> 00:00:35,760
around and you've got to put it into a

10
00:00:40,709 --> 00:00:38,239
into a chamber and keep it confined and

11
00:00:42,310 --> 00:00:40,719
safe from the crew well that's where

12
00:00:44,709 --> 00:00:42,320
northrop grumman's

13
00:00:46,630 --> 00:00:44,719

the cygnus vehicle comes in it's it's

14
00:00:48,869 --> 00:00:46,640
the perfect vehicle for us to do what we

15
00:00:51,670 --> 00:00:48,879
really want to do and that's burn larger

16
00:00:55,189 --> 00:00:51,680
samples because it docks to the station

17
00:00:57,270 --> 00:00:55,199
um it ends up being filled with trash

18
00:00:59,590 --> 00:00:57,280
the crew closes the hatch and when it

19
00:01:01,750 --> 00:00:59,600
does it's at one atmosphere and 21

20
00:01:04,229 --> 00:01:01,760
oxygen and then it goes away and

21
00:01:06,710 --> 00:01:04,239
nobody's on it when we ran sapphire one

22
00:01:08,390 --> 00:01:06,720
two and three the sizes of the samples

23
00:01:10,950 --> 00:01:08,400
instead of running something you know

24
00:01:12,710 --> 00:01:10,960
the size of a note card was really

25
00:01:14,630 --> 00:01:12,720
something about the size of this about a

26
00:01:17,270 --> 00:01:14,640
meter long and about four tenths of a

27
00:01:20,230 --> 00:01:17,280
meter uh meter wide what we really want

28
00:01:22,390 --> 00:01:20,240
to do for sapphire four five and six is

29
00:01:24,469 --> 00:01:22,400
to take what we've learned here and

30
00:01:26,950 --> 00:01:24,479
really make a more sophisticated

31
00:01:28,230 --> 00:01:26,960
experiment and then also

32
00:01:31,429 --> 00:01:28,240
some of our tests are going to be

33
00:01:34,550 --> 00:01:31,439
conducted at a low pressure about 8.2

34
00:01:36,950 --> 00:01:34,560
psia and 34 percent oxygen and if you

35
00:01:38,950 --> 00:01:36,960
know things about combustion you start

36
00:01:40,789 --> 00:01:38,960
increasing the oxygen level

37
00:01:42,069 --> 00:01:40,799
the fire should become more energetic

38
00:01:45,109 --> 00:01:42,079

and those are the kinds of things that

39
00:01:47,749 --> 00:01:45,119
we're going to be doing on sapphire 4.

40
00:01:50,789 --> 00:01:47,759
a bacteriophage is a virus but it's a

41
00:01:53,590 --> 00:01:50,799
virus that only targets bacteria

42
00:01:57,270 --> 00:01:53,600
not our cells not human cells so it's

43
00:01:59,590 --> 00:01:57,280
these bacteria that are the prey to this

44
00:02:01,670 --> 00:01:59,600
predator this predator being the virus

45
00:02:04,149 --> 00:02:01,680
phage technology and looking at and

46
00:02:07,510 --> 00:02:04,159
trying to develop phages

47
00:02:09,430 --> 00:02:07,520
can be a new and novel approach to

48
00:02:11,350 --> 00:02:09,440
targeting and getting rid of pathogenic

49
00:02:13,110 --> 00:02:11,360
bacteria if you take a general

50
00:02:15,750 --> 00:02:13,120
antibiotic right now most of the

51
00:02:17,670 --> 00:02:15,760
bacteria get targeted well what if you

52
00:02:19,270 --> 00:02:17,680
could develop a phage that was highly

53
00:02:22,390 --> 00:02:19,280
specific

54
00:02:25,030 --> 00:02:22,400
to just the pathogen now you keep your

55
00:02:27,110 --> 00:02:25,040
gut microbiome intact

56
00:02:29,350 --> 00:02:27,120
you don't harm everything else but you

57
00:02:31,350 --> 00:02:29,360
get rid of that harmful bacteria now

58
00:02:33,589 --> 00:02:31,360
when you put it in space

59
00:02:35,589 --> 00:02:33,599
now we get a new environment because in

60
00:02:37,350 --> 00:02:35,599
space the one commonality about space is

61
00:02:39,430 --> 00:02:37,360
that biology changes

62
00:02:41,670 --> 00:02:39,440
so in this interaction we know that the

63
00:02:42,869 --> 00:02:41,680

target the host the bacteria which is e

64
00:02:45,910 --> 00:02:42,879
coli

65
00:02:46,949 --> 00:02:45,920
grows faster will the phage become more

66
00:02:49,270 --> 00:02:46,959
lethal

67
00:02:51,270 --> 00:02:49,280
will it become more specific to its its

68
00:02:54,150 --> 00:02:51,280
prey it's host it's the target the

69
00:02:56,390 --> 00:02:54,160
bacteria or will the bacteria win

70
00:02:58,309 --> 00:02:56,400
and become more resistant

71
00:03:00,790 --> 00:02:58,319
and be able to shed away and get away

72
00:03:02,949 --> 00:03:00,800
from that that virus how does this

73
00:03:04,990 --> 00:03:02,959
happen in space we have no idea that's

74
00:03:06,229 --> 00:03:05,000
why we go to space to do this project

75
00:03:08,229 --> 00:03:06,239
[Music]

76
00:03:10,710 --> 00:03:08,239
space provides a really

77
00:03:13,430 --> 00:03:10,720
unique environment to study

78
00:03:15,670 --> 00:03:13,440
phenomena like like bone and muscle loss

79
00:03:18,470 --> 00:03:15,680
because things happen so much faster and

80
00:03:20,070 --> 00:03:18,480
that increases the our ability to

81
00:03:23,509 --> 00:03:20,080
assess

82
00:03:25,990 --> 00:03:23,519
drug therapies and and exercise programs

83
00:03:29,270 --> 00:03:26,000
that can mitigate the loss of bone and

84
00:03:31,670 --> 00:03:29,280
muscle bone is a living tissue it's not

85
00:03:33,630 --> 00:03:31,680
a static piece of rock that's in your

86
00:03:36,869 --> 00:03:33,640
body what we're looking at is that

87
00:03:39,030 --> 00:03:36,879
pre-osteoblast those cells are on the

88
00:03:41,670 --> 00:03:39,040

verge of being a mature bone cell which

89
00:03:44,070 --> 00:03:41,680
can produce a lot of of the bone matrix

90
00:03:46,070 --> 00:03:44,080
that mineralizes and becomes south bone

91
00:03:48,070 --> 00:03:46,080
the question is how does space flight in

92
00:03:51,509 --> 00:03:48,080
microgravity specifically

93
00:03:53,110 --> 00:03:51,519
affect the um the changes in in this

94
00:03:54,229 --> 00:03:53,120
gene expression well the other thing

95
00:03:56,630 --> 00:03:54,239
we're going to be looking at is

96
00:03:58,390 --> 00:03:56,640
metabolic pathways that's occurring on

97
00:04:00,390 --> 00:03:58,400
the space station and that actually

98
00:04:01,830 --> 00:04:00,400
follows on with the genomic studies that

99
00:04:03,509 --> 00:04:01,840
we're doing so it gives you a more

100
00:04:06,470 --> 00:04:03,519
complete picture of what's happening to

101
00:04:09,350 --> 00:04:06,480
the cells this flight is a second time

102
00:04:12,390 --> 00:04:09,360
up for us we flew an experiment using

103
00:04:14,710 --> 00:04:12,400
these cells back in 2016. in this case

104
00:04:16,870 --> 00:04:14,720
we're looking at a much tighter

105
00:04:19,349 --> 00:04:16,880
environment and we have a greater number

106
00:04:21,430 --> 00:04:19,359
of cultures as well

107
00:04:23,350 --> 00:04:21,440
this is a scanning electron micrograph

108
00:04:24,629 --> 00:04:23,360
that i took from some debris that was

109
00:04:26,710 --> 00:04:24,639
collected by

110
00:04:28,790 --> 00:04:26,720
our crew members so currently the iss

111
00:04:31,350 --> 00:04:28,800
has a blind spot in which we cannot

112
00:04:32,390 --> 00:04:31,360
perform this analysis on orbit

113
00:04:33,590 --> 00:04:32,400

and

114
00:04:35,189 --> 00:04:33,600
it takes quite a while to get this

115
00:04:37,110 --> 00:04:35,199
debris back on earth

116
00:04:38,150 --> 00:04:37,120
and it's an even bigger problem

117
00:04:40,390 --> 00:04:38,160
when

118
00:04:42,710 --> 00:04:40,400
a sample return is not an option such as

119
00:04:46,390 --> 00:04:42,720
for deep exploration space flight so for

120
00:04:48,550 --> 00:04:46,400
the past few years my small company voxa

121
00:04:52,070 --> 00:04:48,560
has been working together with nasa to

122
00:04:55,430 --> 00:04:52,080
extend the capabilities on iss to

123
00:04:58,469 --> 00:04:55,440
be able to identify and study the

124
00:04:59,909 --> 00:04:58,479
structures uh a very small scale for

125
00:05:01,510 --> 00:04:59,919
small scale we're talking about things

126
00:05:03,270 --> 00:05:01,520
that are on the order of one to ten

127
00:05:04,629 --> 00:05:03,280
microns and maybe even smaller than that

128
00:05:06,070 --> 00:05:04,639
and this is a

129
00:05:08,310 --> 00:05:06,080
terrestrial instrument that we developed

130
00:05:10,390 --> 00:05:08,320
initially and extended its capabilities

131
00:05:13,430 --> 00:05:10,400
with nasa the strengths of electron

132
00:05:15,029 --> 00:05:13,440
microscopy are twofold the first is the

133
00:05:18,310 --> 00:05:15,039
ability to see very very small

134
00:05:21,670 --> 00:05:18,320
structures and down to the nanoscale

135
00:05:23,430 --> 00:05:21,680
and secondarily it has a capability of

136
00:05:25,189 --> 00:05:23,440
identifying

137
00:05:27,110 --> 00:05:25,199
the chemical composition in particular

138
00:05:29,990 --> 00:05:27,120

the atoms and the quantities of atoms

139
00:05:31,990 --> 00:05:30,000
inside that structure looking ahead when

140
00:05:35,270 --> 00:05:32,000
we start going to the moon

141
00:05:37,270 --> 00:05:35,280
building gateway and eventually to mars

142
00:05:40,469 --> 00:05:37,280
this platform which is really a research

143
00:05:43,010 --> 00:05:40,479
platform for future exploration will aid