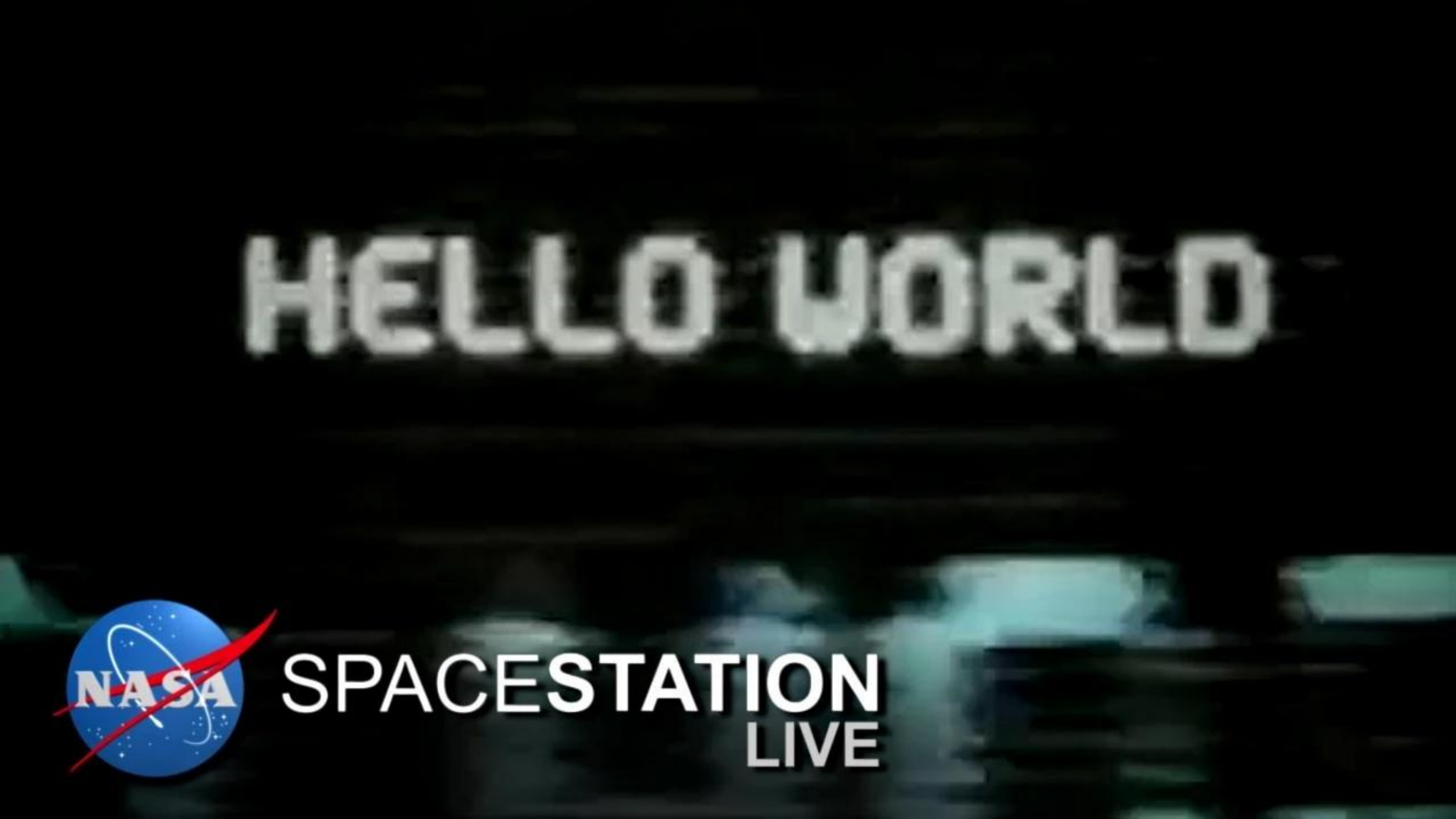
HELLO WORLD
NASA
SPACESTATION
LIVE

1
00:00:08,629 --> 00:00:06,869
right now spacecraft communicate and

2
00:00:11,030 --> 00:00:08,639
send data back and forth using radio

3
00:00:12,950 --> 00:00:11,040
frequencies much like your car radio

4
00:00:15,190 --> 00:00:12,960
well the opals investigation is proving

5
00:00:16,550 --> 00:00:15,200
that it can now be done with lasers i

6
00:00:18,870 --> 00:00:16,560
caught up with matt abrahamson at the

7
00:00:21,510 --> 00:00:18,880
jet propulsion laboratory to learn why

8
00:00:23,269 --> 00:00:21,520
opals may be the gem scientists are

9
00:00:24,870 --> 00:00:23,279
looking for

10
00:00:26,470 --> 00:00:24,880
we launched up to the space station in

11
00:00:27,830 --> 00:00:26,480
april 2014

12
00:00:29,990 --> 00:00:27,840
and we're a technology demonstration

13
00:00:32,790 --> 00:00:30,000

mission for laser communications

14
00:00:34,790 --> 00:00:32,800
technology that's sending data over

15
00:00:37,430 --> 00:00:34,800
laser beams rather than radio waves why

16
00:00:39,110 --> 00:00:37,440
is that so important uh well basically a

17
00:00:41,350 --> 00:00:39,120
laser beam is much more focused than a

18
00:00:42,709 --> 00:00:41,360
radio wave so for the

19
00:00:44,549 --> 00:00:42,719
smaller amount of power that's

20
00:00:45,830 --> 00:00:44,559
transmitted you can transmit much more

21
00:00:48,069 --> 00:00:45,840
information

22
00:00:50,310 --> 00:00:48,079
it's also at a higher frequency than

23
00:00:51,910 --> 00:00:50,320
radio waves so you can pack more bits

24
00:00:53,830 --> 00:00:51,920
into that same data stream so you can

25
00:00:55,590 --> 00:00:53,840
get data rates that are 10 to 100 times

26
00:00:57,670 --> 00:00:55,600
faster than the potential for radio

27
00:00:59,590 --> 00:00:57,680
waves so we've we've practiced this a

28
00:01:02,069 --> 00:00:59,600
few times we've we've seen it in action

29
00:01:03,670 --> 00:01:02,079
how'd it work oh worked great um we got

30
00:01:05,189 --> 00:01:03,680
up there in april as i mentioned uh we

31
00:01:07,670 --> 00:01:05,199
started operating in may

32
00:01:09,429 --> 00:01:07,680
uh everything checked out as as expected

33
00:01:11,109 --> 00:01:09,439
uh went through a few checks to make

34
00:01:12,870 --> 00:01:11,119
sure we can point because one of the

35
00:01:14,149 --> 00:01:12,880
major technologies of this is to

36
00:01:14,950 --> 00:01:14,159
demonstrate that we can point within a

37
00:01:16,789 --> 00:01:14,960
few

38
00:01:17,749 --> 00:01:16,799

micro radians of the target ground

39
00:01:20,550 --> 00:01:17,759
station

40
00:01:22,149 --> 00:01:20,560
and we had our first success on june 5th

41
00:01:24,070 --> 00:01:22,159
we were able to actually transmit a high

42
00:01:26,710 --> 00:01:24,080
definition video from the space station

43
00:01:34,310 --> 00:01:26,720
on opals down to our ground station

44
00:01:38,069 --> 00:01:36,630
so how does that work with is there crew

45
00:01:40,310 --> 00:01:38,079
involvement with this or is it just

46
00:01:41,670 --> 00:01:40,320
strictly from the ground uh there's no

47
00:01:43,670 --> 00:01:41,680
crew involvement we're an external

48
00:01:45,749 --> 00:01:43,680
payload so we sit on the outside on

49
00:01:47,590 --> 00:01:45,759
express logistics carrier one and

50
00:01:49,030 --> 00:01:47,600
everything's ground commanded from jpl

51
00:01:50,469 --> 00:01:49,040
we send the commands from there they go

52
00:01:52,469 --> 00:01:50,479
over to marshall space flight center

53
00:01:54,550 --> 00:01:52,479
then to johnson space flight center to

54
00:01:56,149 --> 00:01:54,560
white sands up through tdrs all the way

55
00:01:58,310 --> 00:01:56,159
over to our payload in a matter of a few

56
00:02:00,069 --> 00:01:58,320
seconds which is uh kind of incredible

57
00:02:02,310 --> 00:02:00,079
uh so we command each step in the

58
00:02:04,389 --> 00:02:02,320
process uh to prepare for

59
00:02:05,670 --> 00:02:04,399
uh this transmission and uh during the

60
00:02:07,350 --> 00:02:05,680
actual time period of the transmission

61
00:02:09,190 --> 00:02:07,360
which is about two and a half minutes

62
00:02:10,630 --> 00:02:09,200
when we pass over the ground station

63
00:02:12,150 --> 00:02:10,640

everything's automated at that point so

64
00:02:14,070 --> 00:02:12,160
we have this closed-loop tracking over

65
00:02:15,510 --> 00:02:14,080
them that will track a ground station

66
00:02:16,790 --> 00:02:15,520
and transmit that video down to the

67
00:02:18,790 --> 00:02:16,800
ground

68
00:02:20,630 --> 00:02:18,800
it's the story of an endless search to

69
00:02:22,470 --> 00:02:20,640
serve the communications needs of

70
00:02:23,910 --> 00:02:22,480
america

71
00:02:25,430 --> 00:02:23,920
why the hurry

72
00:02:27,510 --> 00:02:25,440
so when we transmit things you

73
00:02:30,150 --> 00:02:27,520
transmitted a video are you trying to

74
00:02:32,150 --> 00:02:30,160
transmit several things at once or is it

75
00:02:33,830 --> 00:02:32,160
one at a time how does that work uh it's

76
00:02:35,350 --> 00:02:33,840
one video and we'll continuously loop it

77
00:02:37,509 --> 00:02:35,360
so there may be dropouts during the

78
00:02:38,869 --> 00:02:37,519
middle of the transmission

79
00:02:40,550 --> 00:02:38,879
typically we're transmitting 50 megabits

80
00:02:43,030 --> 00:02:40,560
per second and our standard video is

81
00:02:44,550 --> 00:02:43,040
about 175 megabits so every three and a

82
00:02:46,630 --> 00:02:44,560
half seconds you'll get a new copy of

83
00:02:48,229 --> 00:02:46,640
the video but you could have dropouts in

84
00:02:50,470 --> 00:02:48,239
the middle so we have an algorithm that

85
00:02:51,750 --> 00:02:50,480
if you do have a few packet dropouts

86
00:02:53,509 --> 00:02:51,760
when we reconstruct it on the ground you

87
00:02:54,470 --> 00:02:53,519
can take different portions of the video

88
00:02:55,750 --> 00:02:54,480

from

89
00:02:58,869 --> 00:02:55,760
different packets that were received and

90
00:03:00,470 --> 00:02:58,879
reconstruct one video now in practice

91
00:03:02,309 --> 00:03:00,480
it worked much better than expected so

92
00:03:05,110 --> 00:03:02,319
our bit error rate was so low it seemed

93
00:03:06,869 --> 00:03:05,120
like every copy we got the full copy

94
00:03:08,309 --> 00:03:06,879
there were a few instances where we hit

95
00:03:09,270 --> 00:03:08,319
clouds and if you hit a cloud with the

96
00:03:10,790 --> 00:03:09,280
laser

97
00:03:12,470 --> 00:03:10,800
you have a drop out so we did have a

98
00:03:14,630 --> 00:03:12,480
couple instances we had 10 seconds of

99
00:03:16,070 --> 00:03:14,640
drop out but we'd have enough of the

100
00:03:18,550 --> 00:03:16,080
video transmission to reconstruct a

101
00:03:20,470 --> 00:03:18,560
complete video at the end how does this

102
00:03:22,149 --> 00:03:20,480
translate to

103
00:03:22,949 --> 00:03:22,159
long-duration missions this is what

104
00:03:25,589 --> 00:03:22,959
we're

105
00:03:27,190 --> 00:03:25,599
right

106
00:03:28,630 --> 00:03:27,200
so i think this is really important for

107
00:03:30,869 --> 00:03:28,640
deep space

108
00:03:32,710 --> 00:03:30,879
from jpl's perspective we'd like to put

109
00:03:34,470 --> 00:03:32,720
one of these on a mars orbiter or even a

110
00:03:35,670 --> 00:03:34,480
mars rover

111
00:03:37,589 --> 00:03:35,680
and then that really increases the

112
00:03:38,710 --> 00:03:37,599
bandwidth of the amount of science data

113
00:03:41,190 --> 00:03:38,720

you can get back from the surface of

114
00:03:43,030 --> 00:03:41,200
mars instead of taking snapshots of

115
00:03:44,229 --> 00:03:43,040
images you could take video data and

116
00:03:45,509 --> 00:03:44,239
send that back to earth you can't do

117
00:03:47,670 --> 00:03:45,519
that right now

118
00:03:49,670 --> 00:03:47,680
it also will be a big game changer in

119
00:03:51,110 --> 00:03:49,680
terms of manned space flight

120
00:03:52,470 --> 00:03:51,120
we're going out to deep space even to

121
00:03:53,910 --> 00:03:52,480
the moon

122
00:03:56,470 --> 00:03:53,920
you want to have as much bandwidth as

123
00:03:58,309 --> 00:03:56,480
possible to talk to those astronauts and

124
00:04:00,630 --> 00:03:58,319
you're going to need laser con for that

125
00:04:01,990 --> 00:04:00,640
so what's next for opals well we're

126
00:04:03,910 --> 00:04:02,000
going to be on the station through

127
00:04:05,509 --> 00:04:03,920
february 2016. uh that's our current

128
00:04:07,830 --> 00:04:05,519
decommissioning date

129
00:04:09,509 --> 00:04:07,840
and we have a few more uh demonstrations

130
00:04:11,110 --> 00:04:09,519
that we're looking to do we just

131
00:04:12,710 --> 00:04:11,120
completed one which is an adaptive

132
00:04:15,190 --> 00:04:12,720
optics experiment

133
00:04:16,949 --> 00:04:15,200
in that experiment we took a test bed

134
00:04:18,789 --> 00:04:16,959
that would take the opal signals it was

135
00:04:20,390 --> 00:04:18,799
received at the telescope and it

136
00:04:22,469 --> 00:04:20,400
corrects all the atmospheric distortion

137
00:04:23,990 --> 00:04:22,479
that occurred as it was transmitted down

138
00:04:25,909 --> 00:04:24,000

we're able to couple that new fiber

139
00:04:28,870 --> 00:04:25,919
optics cable and that just demonstrates

140
00:04:30,469 --> 00:04:28,880
that we're able to take this signal and

141
00:04:31,830 --> 00:04:30,479
transmit to fiber optics cable possibly

142
00:04:33,189 --> 00:04:31,840
for transmission out to other ground

143
00:04:34,310 --> 00:04:33,199
stations those important technology to

144
00:04:35,749 --> 00:04:34,320
test out

145
00:04:37,749 --> 00:04:35,759
the next thing we'll be testing is a

146
00:04:39,270 --> 00:04:37,759
platform characterization experiment

147
00:04:41,110 --> 00:04:39,280
that's an attempt to try to measure the

148
00:04:42,629 --> 00:04:41,120
vibration or the shaking on the space

149
00:04:43,909 --> 00:04:42,639
station so it's not really output

150
00:04:45,909 --> 00:04:43,919
communications but based on our

151
00:04:47,670 --> 00:04:45,919
capabilities using lasers we can get

152
00:04:48,950 --> 00:04:47,680
some useful measurements out of it and

153
00:04:50,550 --> 00:04:48,960
then the fall time frame we're looking

154
00:04:51,670 --> 00:04:50,560
to do more transmissions to our foreign

155
00:04:53,990 --> 00:04:51,680
partners

156
00:04:56,310 --> 00:04:54,000
that's issa in the tenerife canary

157
00:04:57,270 --> 00:04:56,320
islands that's dlr and oberfunhoff in

158
00:05:00,070 --> 00:04:57,280
germany

159
00:05:02,870 --> 00:05:00,080
nict in tokyo japan and possibly canes

160
00:05:04,469 --> 00:05:02,880
in nice france so those will be nice

161
00:05:06,710 --> 00:05:04,479
collaboration to have before we begin

162
00:05:08,870 --> 00:05:06,720
the program in february

163
00:05:10,870 --> 00:05:08,880

so it's important to have those other

164
00:05:12,070 --> 00:05:10,880
ground stations around the world

165
00:05:13,430 --> 00:05:12,080
that's right i think both for

166
00:05:15,749 --> 00:05:13,440
collaboration

167
00:05:18,230 --> 00:05:15,759
and also looking at the variations you

168
00:05:20,629 --> 00:05:18,240
get with geometry variations

169
00:05:22,790 --> 00:05:20,639
when we operate in california the

170
00:05:25,110 --> 00:05:22,800
weather is fairly good for transmission

171
00:05:26,629 --> 00:05:25,120
of laser beams we operate in germany

172
00:05:28,469 --> 00:05:26,639
it's a little more challenging and so we

173
00:05:30,950 --> 00:05:28,479
learn new things uh it's also a much

174
00:05:32,550 --> 00:05:30,960
higher latitude in the planet and so the

175
00:05:35,189 --> 00:05:32,560
link availability and one we can

176
00:05:37,029 --> 00:05:35,199
transmit is quite a bit different from

177
00:05:38,230 --> 00:05:37,039
transmitting california and so by

178
00:05:40,469 --> 00:05:38,240
looking at those variations we're