
NASA

1
00:00:07,590 --> 00:00:03,830
the expedition 36 crew is getting set to

2
00:00:09,910 --> 00:00:07,600
execute the second space-based test of a

3
00:00:12,390 --> 00:00:09,920
system to permit control of a rover on

4
00:00:14,230 --> 00:00:12,400
the ground by a crew member on board an

5
00:00:15,829 --> 00:00:14,240
orbiting spacecraft

6
00:00:17,910 --> 00:00:15,839
for today its flight engineer luca

7
00:00:20,150 --> 00:00:17,920
parmitano who will be at the station's

8
00:00:22,390 --> 00:00:20,160
controls commanding the activity of a

9
00:00:26,070 --> 00:00:22,400
rover called k-10

10
00:00:28,150 --> 00:00:26,080
located at the nasa ames research center

11
00:00:29,990 --> 00:00:28,160
in moffett field california the

12
00:00:32,389 --> 00:00:30,000
investigation is called surface

13
00:00:34,630 --> 00:00:32,399

telerobotics and earlier i spoke with

14
00:00:37,430 --> 00:00:34,640
the payload developer maria boilat at

15
00:00:38,950 --> 00:00:37,440
ames about today's operation and the

16
00:00:41,590 --> 00:00:38,960
results they got from the first

17
00:00:43,750 --> 00:00:41,600
experiment run last month

18
00:00:45,670 --> 00:00:43,760
maria remind us what surface tele

19
00:00:46,709 --> 00:00:45,680
robotics is all about what what's your

20
00:00:49,029 --> 00:00:46,719
goal here

21
00:00:51,110 --> 00:00:49,039
surface cell robotics is an engineering

22
00:00:54,069 --> 00:00:51,120
test of a mission concept so in this

23
00:00:57,270 --> 00:00:54,079
concept uh crew in a vehicle that's

24
00:00:59,670 --> 00:00:57,280
either orbiting say the moon or mars or

25
00:01:01,990 --> 00:00:59,680
perhaps approaching a planetary body

26
00:01:04,469 --> 00:01:02,000
let's say an asteroid would control a

27
00:01:07,750 --> 00:01:04,479
robot on the surface so this is an idea

28
00:01:10,070 --> 00:01:07,760
that's been proposed in several human

29
00:01:11,270 --> 00:01:10,080
exploration architectures and what we're

30
00:01:13,270 --> 00:01:11,280
trying to do is

31
00:01:15,350 --> 00:01:13,280
test the concept see what sorts of

32
00:01:17,030 --> 00:01:15,360
technologies are needed in order to to

33
00:01:19,109 --> 00:01:17,040
realize it

34
00:01:21,350 --> 00:01:19,119
one of the hardest parts of any

35
00:01:24,070 --> 00:01:21,360
planetary mission is safely landing on

36
00:01:25,910 --> 00:01:24,080
the surface and a robot that's on the

37
00:01:28,230 --> 00:01:25,920
surface and controlled by crew that's

38
00:01:30,469 --> 00:01:28,240

orbiting or approaching can get a lot of

39
00:01:33,030 --> 00:01:30,479
the sort of precursor exploration work

40
00:01:35,030 --> 00:01:33,040
done so for example

41
00:01:37,350 --> 00:01:35,040
a robot could be used to help prepare a

42
00:01:38,469 --> 00:01:37,360
landing site to make that surface

43
00:01:41,350 --> 00:01:38,479
landing

44
00:01:44,149 --> 00:01:41,360
simpler for example scouting out a clear

45
00:01:46,630 --> 00:01:44,159
area checking whether the ground is firm

46
00:01:49,749 --> 00:01:46,640
um also possibly even building a landing

47
00:01:51,670 --> 00:01:49,759
strip um to prepare for for humans

48
00:01:54,069 --> 00:01:51,680
that's that that all seems very

49
00:01:56,310 --> 00:01:54,079
reasonable but it also begs the question

50
00:01:58,149 --> 00:01:56,320
about why is this so hard i mean i i see

51
00:02:00,069 --> 00:01:58,159
kids in the park flying remotely

52
00:02:01,749 --> 00:02:00,079
controlled airplanes

53
00:02:02,709 --> 00:02:01,759
but but you got some other issues to

54
00:02:04,789 --> 00:02:02,719
deal with

55
00:02:06,870 --> 00:02:04,799
yes well for one thing the kids

56
00:02:09,669 --> 00:02:06,880
controlling rc airplanes are looking

57
00:02:11,670 --> 00:02:09,679
directly at the airplane so their their

58
00:02:14,229 --> 00:02:11,680
response and what how they their

59
00:02:17,110 --> 00:02:14,239
feedback to that control is very uh

60
00:02:18,630 --> 00:02:17,120
immediate whereas a crew member in in an

61
00:02:20,390 --> 00:02:18,640
approaching vehicle or an orbiting

62
00:02:21,510 --> 00:02:20,400
vehicle will have some communication

63
00:02:23,030 --> 00:02:21,520

delays

64
00:02:25,270 --> 00:02:23,040
there are still some pretty vast

65
00:02:26,630 --> 00:02:25,280
distances between where the robot is and

66
00:02:27,750 --> 00:02:26,640
where the crew is

67
00:02:29,670 --> 00:02:27,760
and so

68
00:02:30,790 --> 00:02:29,680
those delays even if it's just a few

69
00:02:32,710 --> 00:02:30,800
seconds

70
00:02:34,630 --> 00:02:32,720
can make controlling

71
00:02:36,710 --> 00:02:34,640
a robot very difficult it can make

72
00:02:39,030 --> 00:02:36,720
joysticking for example

73
00:02:41,830 --> 00:02:39,040
hard to do because you need

74
00:02:44,070 --> 00:02:41,840
so much higher level of concentration

75
00:02:47,110 --> 00:02:44,080
in order to perform that task

76
00:02:49,670 --> 00:02:47,120
so what we're doing is called

77
00:02:52,229 --> 00:02:49,680
supervisory control where

78
00:02:54,309 --> 00:02:52,239
our robot is is pretty smart it can it

79
00:02:56,710 --> 00:02:54,319
can perform a variety of tasks it can

80
00:02:58,869 --> 00:02:56,720
keep itself safe and so

81
00:03:00,949 --> 00:02:58,879
the astronaut will actually send a

82
00:03:03,350 --> 00:03:00,959
sequence of tasks for the robot to do

83
00:03:05,509 --> 00:03:03,360
and just monitor how it's doing its job

84
00:03:07,910 --> 00:03:05,519
making sure it's doing it correctly

85
00:03:09,670 --> 00:03:07,920
so then if the robot has any difficulty

86
00:03:12,149 --> 00:03:09,680
you know gets into trouble

87
00:03:13,990 --> 00:03:12,159
he can step in with manual control

88
00:03:16,470 --> 00:03:14,000

now you've done this once before with

89
00:03:18,550 --> 00:03:16,480
chris cassidy in june how did that one

90
00:03:21,270 --> 00:03:18,560
go that went really well we were very

91
00:03:23,830 --> 00:03:21,280
happy with how that that went uh chris

92
00:03:26,869 --> 00:03:23,840
managed to uh pick up how to control the

93
00:03:29,270 --> 00:03:26,879
robot very easily so he he completed not

94
00:03:31,270 --> 00:03:29,280
only the the first phase of our our

95
00:03:34,070 --> 00:03:31,280
simulated mission but was able to

96
00:03:37,910 --> 00:03:34,080
continue on and get ahead of schedule

97
00:03:40,390 --> 00:03:37,920
and start deploying a telescope

98
00:03:42,789 --> 00:03:40,400
so we did have one slight hardware

99
00:03:45,190 --> 00:03:42,799
hiccup towards the end of the session

100
00:03:47,990 --> 00:03:45,200
where our deployment device had

101
00:03:49,509 --> 00:03:48,000
a little hiccup and so um we think we

102
00:03:52,070 --> 00:03:49,519
fixed that for this next session with

103
00:03:54,229 --> 00:03:52,080
luca you mentioned that he picked up on

104
00:03:56,390 --> 00:03:54,239
how to control a robot how does the

105
00:03:58,309 --> 00:03:56,400
astronaut control the robot what's the

106
00:04:00,070 --> 00:03:58,319
interface what do they use so as i

107
00:04:02,470 --> 00:04:00,080
mentioned joysticking is very difficult

108
00:04:05,670 --> 00:04:02,480
in this situation so what we use is a

109
00:04:07,509 --> 00:04:05,680
graphical user interface um or gui uh

110
00:04:10,710 --> 00:04:07,519
it's running on a laptop onboard the

111
00:04:12,869 --> 00:04:10,720
station and um luca will see images from

112
00:04:15,670 --> 00:04:12,879
the robot's cameras

113
00:04:18,710 --> 00:04:15,680

he'll see 3d renderings of the of the

114
00:04:20,629 --> 00:04:18,720
robot and its surrounding terrain

115
00:04:22,950 --> 00:04:20,639
and then he'll use button presses

116
00:04:24,870 --> 00:04:22,960
basically to control the robot when he's

117
00:04:25,749 --> 00:04:24,880
taking over manual control

118
00:04:27,909 --> 00:04:25,759
he'll

119
00:04:31,189 --> 00:04:27,919
be able to send fairly simple commands

120
00:04:33,990 --> 00:04:31,199
so for example drive forward one meter

121
00:04:35,830 --> 00:04:34,000
or rotate 15 degrees to the right or

122
00:04:37,590 --> 00:04:35,840
take an image

123
00:04:39,830 --> 00:04:37,600
and so those are you know fairly low

124
00:04:41,830 --> 00:04:39,840
level commands that he can do manually

125
00:04:43,670 --> 00:04:41,840
for the most part though he'll be just

126
00:04:44,710 --> 00:04:43,680
uploading uh

127
00:04:46,629 --> 00:04:44,720
basically

128
00:04:49,110 --> 00:04:46,639
task plans to the robot so the robot

129
00:04:51,430 --> 00:04:49,120
will will run his tasks autonomously and

130
00:04:54,310 --> 00:04:51,440
he'll step in just when needed

131
00:04:56,550 --> 00:04:54,320
in terms of of this experiment what are

132
00:04:58,950 --> 00:04:56,560
the objectives now i think you said that

133
00:05:00,950 --> 00:04:58,960
you're really picking up on the same

134
00:05:03,990 --> 00:05:00,960
simulation that you started with the

135
00:05:07,350 --> 00:05:04,000
first the first session that's right so

136
00:05:09,590 --> 00:05:07,360
our simulated mission is um to deploy a

137
00:05:13,749 --> 00:05:09,600
radio telescope on the far side of the

138
00:05:16,629 --> 00:05:13,759

the moon so the idea is that um crew

139
00:05:18,310 --> 00:05:16,639
either orbiting the moon or the uh l2

140
00:05:20,950 --> 00:05:18,320
lagrange point on the far side of the

141
00:05:23,029 --> 00:05:20,960
moon could control a robot on the far

142
00:05:25,270 --> 00:05:23,039
side that doesn't have direct line of

143
00:05:28,070 --> 00:05:25,280
sight to the earth

144
00:05:30,070 --> 00:05:28,080
and would deploy a radio telescope so

145
00:05:33,590 --> 00:05:30,080
this radio telescope would be used to

146
00:05:35,510 --> 00:05:33,600
look at the cosmic dawn so this is

147
00:05:37,350 --> 00:05:35,520
just it's after the big bang when when

148
00:05:39,189 --> 00:05:37,360
the first stars and and the first

149
00:05:42,150 --> 00:05:39,199
galaxies were forming

150
00:05:44,790 --> 00:05:42,160
um so in the first session chris

151
00:05:46,950 --> 00:05:44,800
performed what was basically scouting of

152
00:05:49,430 --> 00:05:46,960
the site so this is we've had orbital

153
00:05:51,990 --> 00:05:49,440
data of the site and we have an idea of

154
00:05:53,749 --> 00:05:52,000
where we want to deploy the telescope

155
00:05:55,510 --> 00:05:53,759
and so first we need to send the robot

156
00:05:57,909 --> 00:05:55,520
around to make sure that that area is

157
00:06:00,309 --> 00:05:57,919
actually clear for deployment so the

158
00:06:02,309 --> 00:06:00,319
second part that we're going to do today

159
00:06:04,629 --> 00:06:02,319
that that luco will be performing is the

160
00:06:07,189 --> 00:06:04,639
actual deployment of the telescope

161
00:06:09,029 --> 00:06:07,199
so the telescope's made up of um three

162
00:06:11,110 --> 00:06:09,039
arms and the arms are the are long

163
00:06:14,150 --> 00:06:11,120

strips of kapton film

164
00:06:16,309 --> 00:06:14,160
um and for an actual radio telescope the

165
00:06:18,230 --> 00:06:16,319
antennas would be embedded in the kapton

166
00:06:20,070 --> 00:06:18,240
film uh for our test it's just the film

167
00:06:22,070 --> 00:06:20,080
we're not actually deploying a working

168
00:06:24,469 --> 00:06:22,080
radio telescope

169
00:06:28,070 --> 00:06:24,479
and so the the robot will actually spool

170
00:06:30,150 --> 00:06:28,080
out these these roles of captain film

171
00:06:32,550 --> 00:06:30,160
you didn't just happen to have a spare

172
00:06:34,870 --> 00:06:32,560
radio telescope playing around

173
00:06:37,189 --> 00:06:34,880
no no um yeah that's uh pretty

174
00:06:38,790 --> 00:06:37,199
complicated and for for our purposes

175
00:06:40,950 --> 00:06:38,800
we're looking at the

176
00:06:42,710 --> 00:06:40,960
rover's job not the radio telescopes job

177
00:06:44,790 --> 00:06:42,720
so it's fine that the uh there aren't

178
00:06:47,510 --> 00:06:44,800
actual antennas in the cap

179
00:06:50,309 --> 00:06:47,520
and in this case it's a again a planned

180
00:06:51,510 --> 00:06:50,319
sequence of movements rather than just

181
00:06:53,029 --> 00:06:51,520
luca

182
00:06:55,270 --> 00:06:53,039
indulging himself

183
00:06:57,589 --> 00:06:55,280
yeah so the robot is going to spool out

184
00:06:59,510 --> 00:06:57,599
you know each each of the the antenna

185
00:07:01,430 --> 00:06:59,520
arrays and

186
00:07:03,189 --> 00:07:01,440
he's going to monitor to make sure that

187
00:07:04,870 --> 00:07:03,199
there aren't any kinks and that the

188
00:07:07,270 --> 00:07:04,880

robots you know

189
00:07:09,510 --> 00:07:07,280
doing it properly also we'll be taking

190
00:07:12,390 --> 00:07:09,520
images as we deploy to make sure that

191
00:07:14,150 --> 00:07:12,400
there are no tears in the uh in the film

192
00:07:16,390 --> 00:07:14,160
and uh you know that

193
00:07:18,309 --> 00:07:16,400
that it's all going according to plan

194
00:07:21,189 --> 00:07:18,319
and then he can take over manual control

195
00:07:23,749 --> 00:07:21,199
if uh if it isn't

196
00:07:25,670 --> 00:07:23,759
assuming this goes as you have planned

197
00:07:27,749 --> 00:07:25,680
what's the next step are there more

198
00:07:29,430 --> 00:07:27,759
similar sessions with this crew

199
00:07:31,350 --> 00:07:29,440
uh yes we're going to have one more test

200
00:07:33,589 --> 00:07:31,360
session next month with the crew of

201
00:07:35,589 --> 00:07:33,599
expedition 36 so we haven't been

202
00:07:37,830 --> 00:07:35,599
assigned our crew member yet so

203
00:07:42,469 --> 00:07:37,840
perhaps if we get karen nyberg we'll

204
00:07:43,909 --> 00:07:42,479
have a trifecta of expedition 36

205
00:07:45,990 --> 00:07:43,919
and then after that we'll we'll look at

206
00:07:48,390 --> 00:07:46,000
our data um to determine how well our

207
00:07:50,150 --> 00:07:48,400
systems worked uh where we can improve

208
00:07:52,070 --> 00:07:50,160
um you know where are the gaps in the

209
00:07:54,070 --> 00:07:52,080
current technology so so what

210
00:07:56,150 --> 00:07:54,080
technologies do do we need to develop in

211
00:07:59,830 --> 00:07:56,160
order to to have this mission concept

212
00:08:01,990 --> 00:07:59,840
work um and then k-10 our little robot

213
00:08:04,469 --> 00:08:02,000

is slated to do some science field work

214
00:08:06,469 --> 00:08:04,479
in in the mojave desert next year

215
00:08:09,350 --> 00:08:06,479
then that be part of

216
00:08:12,550 --> 00:08:09,360
of this uh experiment as well um it's

217
00:08:14,950 --> 00:08:12,560
it's a different uh project uh it's it's

218
00:08:17,189 --> 00:08:14,960
similar work to what you would use the

219
00:08:19,670 --> 00:08:17,199
robot for on the ground but we won't be

220
00:08:21,749 --> 00:08:19,680
using uh crew members to control it all

221
00:08:23,670 --> 00:08:21,759
right maria thank you very much for the

222
00:08:26,070 --> 00:08:23,680
update and uh and good luck with with

223
00:08:28,390 --> 00:08:26,080
today's experiment thank you maria blatt

224
00:08:30,550 --> 00:08:28,400
is the payload developer and project

225
00:08:33,110 --> 00:08:30,560
technical lead for the surface tele