
NASA
SPACESTATION
LIVE

1
00:00:09,430 --> 00:00:07,110
the main task for all the crew members

2
00:00:11,270 --> 00:00:09,440
on board is executing the hundreds of

3
00:00:13,350 --> 00:00:11,280
science experiments taking place at any

4
00:00:15,350 --> 00:00:13,360
time during their expeditions

5
00:00:17,109 --> 00:00:15,360
the space station testing ground for a

6
00:00:19,029 --> 00:00:17,119
number of technologies that are going to

7
00:00:21,429 --> 00:00:19,039
make future missions beyond low earth

8
00:00:22,870 --> 00:00:21,439
orbit possible giving us the chance to

9
00:00:25,830 --> 00:00:22,880
test everything from life support

10
00:00:28,550 --> 00:00:25,840
systems to delays in communication even

11
00:00:30,230 --> 00:00:28,560
ways to grow food for the crews to eat

12
00:00:32,470 --> 00:00:30,240
one of those experiments on board right

13
00:00:34,709 --> 00:00:32,480

now is a compact greenhouse known as

14
00:00:37,110 --> 00:00:34,719
veggie which so far has grown lettuce

15
00:00:39,030 --> 00:00:37,120
and flowers and is going to be getting

16
00:00:41,670 --> 00:00:39,040
more seeds on the next spacex dragon

17
00:00:44,150 --> 00:00:41,680
mission targeted to launch next month

18
00:00:47,029 --> 00:00:44,160
recently my colleague brandy dean talked

19
00:00:49,190 --> 00:00:47,039
with dr joya masa the veggie project

20
00:00:50,790 --> 00:00:49,200
scientists about the experiment and why

21
00:00:53,750 --> 00:00:50,800
it's important to have a compact

22
00:00:55,910 --> 00:00:53,760
greenhouse for future space missions

23
00:00:58,150 --> 00:00:55,920
well veggies really a test fed for

24
00:01:00,310 --> 00:00:58,160
future life support technologies you

25
00:01:02,950 --> 00:01:00,320
know we're learning how to grow food for

26
00:01:05,910 --> 00:01:02,960
the astronauts um as they're away from

27
00:01:07,190 --> 00:01:05,920
earth longer you know longer durations

28
00:01:08,789 --> 00:01:07,200
and so

29
00:01:11,350 --> 00:01:08,799
right now we're

30
00:01:13,190 --> 00:01:11,360
we're using veggie to start to figure

31
00:01:14,710 --> 00:01:13,200
out the best ways to grow different

32
00:01:15,910 --> 00:01:14,720
types of crops

33
00:01:18,149 --> 00:01:15,920
and

34
00:01:20,310 --> 00:01:18,159
we'd like to be able to use it to give

35
00:01:22,149 --> 00:01:20,320
them supplemental salads on space

36
00:01:24,070 --> 00:01:22,159
station you know they don't get regular

37
00:01:26,149 --> 00:01:24,080
supplies of produce

38
00:01:28,310 --> 00:01:26,159

so one of the things that we often hear

39
00:01:30,950 --> 00:01:28,320
from the crew is that they really want

40
00:01:33,590 --> 00:01:30,960
more fresh vegetables so

41
00:01:36,469 --> 00:01:33,600
that um is kind of our near-term goal

42
00:01:39,030 --> 00:01:36,479
and as we learn more about growing these

43
00:01:42,230 --> 00:01:39,040
types of crops we'll be able to develop

44
00:01:45,030 --> 00:01:42,240
um more continuous types of productions

45
00:01:47,510 --> 00:01:45,040
the other big aspect i think you know

46
00:01:50,230 --> 00:01:47,520
for for nutrition for crew health you

47
00:01:52,950 --> 00:01:50,240
know a lot of the the foods may

48
00:01:55,429 --> 00:01:52,960
not store well for really long durations

49
00:01:57,590 --> 00:01:55,439
or um there might be some nutrients that

50
00:02:00,469 --> 00:01:57,600
the the package diet is a little low in

51
00:02:03,350 --> 00:02:00,479
so having this additional fresh

52
00:02:05,590 --> 00:02:03,360
available um nutrition for them could be

53
00:02:07,590 --> 00:02:05,600
really important as they're you know

54
00:02:09,589 --> 00:02:07,600
gone longer from earth

55
00:02:11,510 --> 00:02:09,599
and i think also the psychological

56
00:02:13,190 --> 00:02:11,520
benefit of having something green and

57
00:02:15,110 --> 00:02:13,200
growing when they're living and working

58
00:02:17,350 --> 00:02:15,120
in an extreme environment can be very

59
00:02:19,910 --> 00:02:17,360
important so we're using this you know

60
00:02:22,150 --> 00:02:19,920
it's a very small system for now but

61
00:02:25,430 --> 00:02:22,160
we're using it as a test bed to to

62
00:02:27,589 --> 00:02:25,440
develop larger systems as we develop our

63
00:02:29,430 --> 00:02:27,599

plans for the journey to mars

64
00:02:31,190 --> 00:02:29,440
those all sound like good reasons and i

65
00:02:33,190 --> 00:02:31,200
know you have already a couple of crops

66
00:02:35,110 --> 00:02:33,200
under your belt i think you used some of

67
00:02:37,190 --> 00:02:35,120
your lessons learned from the first

68
00:02:39,589 --> 00:02:37,200
harvest of lettuce to to put into the

69
00:02:41,589 --> 00:02:39,599
second harvest and then you um grew

70
00:02:43,190 --> 00:02:41,599
flowers on the next on the next round

71
00:02:45,990 --> 00:02:43,200
can you tell me a little bit about

72
00:02:48,790 --> 00:02:46,000
what the what the appeal of flowers were

73
00:02:51,430 --> 00:02:48,800
well so we selected the zinnia flowers

74
00:02:53,589 --> 00:02:51,440
as a test crop and we actually weren't

75
00:02:55,830 --> 00:02:53,599
sure when we would get the approval for

76
00:02:57,750 --> 00:02:55,840
the crew to to eat the lettuce and we

77
00:02:59,589 --> 00:02:57,760
didn't quite know when we were planning

78
00:03:01,509 --> 00:02:59,599
all this you know at what order would

79
00:03:03,509 --> 00:03:01,519
they would they be able to you know grow

80
00:03:05,270 --> 00:03:03,519
the second batch of lettuce right away

81
00:03:06,630 --> 00:03:05,280
we didn't want them to do that if we

82
00:03:09,030 --> 00:03:06,640
hadn't gotten

83
00:03:11,509 --> 00:03:09,040
the data back from the first set

84
00:03:14,149 --> 00:03:11,519
so we could get the food safety analysis

85
00:03:15,110 --> 00:03:14,159
performed to to have the crew able to

86
00:03:17,830 --> 00:03:15,120
eat them

87
00:03:19,430 --> 00:03:17,840
so instead we sent flowers that weren't

88
00:03:21,430 --> 00:03:19,440

really something that they'd like to eat

89
00:03:23,830 --> 00:03:21,440
but that were something that will give

90
00:03:26,149 --> 00:03:23,840
us a lot of information and something we

91
00:03:28,949 --> 00:03:26,159
hoped that they would enjoy to grow and

92
00:03:31,830 --> 00:03:28,959
they actually seemed to enjoy them

93
00:03:33,750 --> 00:03:31,840
we also wanted to test a longer duration

94
00:03:36,470 --> 00:03:33,760
crop and veggie and so the flowers

95
00:03:38,309 --> 00:03:36,480
actually take twice as long or more than

96
00:03:41,270 --> 00:03:38,319
lettuce we ended up growing this set of

97
00:03:43,670 --> 00:03:41,280
flowers for 90 days up there so this was

98
00:03:45,589 --> 00:03:43,680
a long duration test and it gave us a

99
00:03:48,309 --> 00:03:45,599
lot of information about long duration

100
00:03:51,030 --> 00:03:48,319
crops and flowering is really important

101
00:03:52,550 --> 00:03:51,040
for fruiting crops such as tomato which

102
00:03:54,149 --> 00:03:52,560
we hope to grow in the next couple of

103
00:03:56,309 --> 00:03:54,159
years because you have to have flowers

104
00:03:59,429 --> 00:03:56,319
before you can produce fruit and so

105
00:04:01,830 --> 00:03:59,439
flowering is a little harder in plants

106
00:04:03,830 --> 00:04:01,840
you know it takes a little more strict

107
00:04:06,309 --> 00:04:03,840
environmental conditions than just

108
00:04:08,470 --> 00:04:06,319
producing leaves so we really needed to

109
00:04:11,110 --> 00:04:08,480
see if veggie and the environment on the

110
00:04:13,270 --> 00:04:11,120
international space station were capable

111
00:04:15,830 --> 00:04:13,280
of producing everything that the plants

112
00:04:17,590 --> 00:04:15,840
needed for producing flowers

113
00:04:19,030 --> 00:04:17,600

wow i know i get excited about fresh

114
00:04:21,349 --> 00:04:19,040
tomatoes here on the ground so i'm sure

115
00:04:23,110 --> 00:04:21,359
they would on the space station oh yeah

116
00:04:24,950 --> 00:04:23,120
but i guess um i know you had a few

117
00:04:26,629 --> 00:04:24,960
setbacks even with the zinnia so can you

118
00:04:28,150 --> 00:04:26,639
tell us what you learned from that how

119
00:04:29,510 --> 00:04:28,160
you eventually got them on track and

120
00:04:32,550 --> 00:04:29,520
growing

121
00:04:35,110 --> 00:04:32,560
well um it was really scott kelly he did

122
00:04:36,870 --> 00:04:35,120
all the leg work for getting the zinnias

123
00:04:38,870 --> 00:04:36,880
on track and growing he did a wonderful

124
00:04:41,430 --> 00:04:38,880
job um so

125
00:04:43,830 --> 00:04:41,440
so one of the issues that we've been

126
00:04:46,150 --> 00:04:43,840
having with veggie is getting sufficient

127
00:04:49,189 --> 00:04:46,160
water to the plants you know plant roots

128
00:04:51,110 --> 00:04:49,199
need both water and oxygen and that's

129
00:04:53,270 --> 00:04:51,120
really tricky in microgravity where

130
00:04:55,110 --> 00:04:53,280
water tends to kind of form a ball and

131
00:04:57,670 --> 00:04:55,120
then the air

132
00:04:59,670 --> 00:04:57,680
may or may not you know mix well with

133
00:05:01,670 --> 00:04:59,680
with the water and so

134
00:05:03,270 --> 00:05:01,680
trying to get the right balance of water

135
00:05:07,189 --> 00:05:03,280
and air in the root zone has been kind

136
00:05:10,230 --> 00:05:07,199
of a challenge um so with the lettuce

137
00:05:12,150 --> 00:05:10,240
we had the crew water the the plants and

138
00:05:13,749 --> 00:05:12,160

we kind of knew the growth rate of

139
00:05:14,870 --> 00:05:13,759
lettuce and knew the amount of water to

140
00:05:16,629 --> 00:05:14,880
apply

141
00:05:18,790 --> 00:05:16,639
with the zinnias they were growing a

142
00:05:21,350 --> 00:05:18,800
little more slowly than we expected and

143
00:05:23,350 --> 00:05:21,360
so they didn't use as much water as we

144
00:05:25,270 --> 00:05:23,360
thought they would

145
00:05:27,909 --> 00:05:25,280
so there was actually too much water

146
00:05:30,150 --> 00:05:27,919
building up in the compartment and this

147
00:05:33,029 --> 00:05:30,160
led to some fungal growth on some of the

148
00:05:35,110 --> 00:05:33,039
plants that were in there and some some

149
00:05:37,510 --> 00:05:35,120
some responses of some of the plants you

150
00:05:40,710 --> 00:05:37,520
know they just were not happy and so

151
00:05:42,710 --> 00:05:40,720
scott noticed this he let us know

152
00:05:44,550 --> 00:05:42,720
you know we came up with some strategies

153
00:05:46,790 --> 00:05:44,560
that he could use including turning the

154
00:05:48,469 --> 00:05:46,800
fans on to hire

155
00:05:50,790 --> 00:05:48,479
and you know obviously cutting back on

156
00:05:53,189 --> 00:05:50,800
the amount of water and he took over the

157
00:05:55,189 --> 00:05:53,199
role of an autonomous gardener so this

158
00:05:57,029 --> 00:05:55,199
was a really big deal because this was

159
00:05:58,629 --> 00:05:57,039
something that the veggie team had

160
00:06:00,710 --> 00:05:58,639
wanted to get to the point where the

161
00:06:03,749 --> 00:06:00,720
crew could could do all of the gardening

162
00:06:05,510 --> 00:06:03,759
kind of on their own and just ask us for

163
00:06:07,510 --> 00:06:05,520

advice they're the ones who are seeing

164
00:06:08,950 --> 00:06:07,520
the plants and growing the plants

165
00:06:10,629 --> 00:06:08,960
but you know the way things are

166
00:06:12,790 --> 00:06:10,639
conducted on the space station it was a

167
00:06:15,510 --> 00:06:12,800
little challenging to

168
00:06:17,590 --> 00:06:15,520
um to implement that because you know we

169
00:06:20,469 --> 00:06:17,600
have to have procedures for everything

170
00:06:22,390 --> 00:06:20,479
so when when scott had asked you know

171
00:06:23,990 --> 00:06:22,400
let me figure out how to deal with this

172
00:06:26,469 --> 00:06:24,000
we were delighted because that was

173
00:06:28,710 --> 00:06:26,479
really what we wanted to be able to do

174
00:06:31,909 --> 00:06:28,720
and and he did a wonderful job he

175
00:06:34,469 --> 00:06:31,919
managed to um you know save a couple of

176
00:06:36,790 --> 00:06:34,479
the plants that that were having some

177
00:06:39,510 --> 00:06:36,800
issues and they grew and they flowered

178
00:06:41,510 --> 00:06:39,520
really well and we had um you know we're

179
00:06:43,029 --> 00:06:41,520
bringing back samples of some of the

180
00:06:45,270 --> 00:06:43,039
fungus that grew on some of the other

181
00:06:47,590 --> 00:06:45,280
plants so we'll be able to figure out

182
00:06:49,589 --> 00:06:47,600
really what that was and and figure out

183
00:06:50,790 --> 00:06:49,599
how to prevent it in the future

184
00:06:52,710 --> 00:06:50,800
you mentioned that you'll be getting a

185
00:06:54,230 --> 00:06:52,720
look back at some of the some of the

186
00:06:56,230 --> 00:06:54,240
plants when when do you expect to

187
00:06:57,270 --> 00:06:56,240
receive them and i know that that takes

188
00:06:59,430 --> 00:06:57,280

a while some time to get things back

189
00:07:02,150 --> 00:06:59,440
from the space station so the second set

190
00:07:03,830 --> 00:07:02,160
of lettuce that they grew they they ate

191
00:07:06,790 --> 00:07:03,840
some of it but they also saved some of

192
00:07:09,909 --> 00:07:06,800
that for science and we had um

193
00:07:12,390 --> 00:07:09,919
swabs as well to look at microbiology

194
00:07:14,870 --> 00:07:12,400
and and some plant pillow samples and

195
00:07:18,309 --> 00:07:14,880
those are coming back on the next spacex

196
00:07:19,589 --> 00:07:18,319
flight when it returns spacex 8 and also

197
00:07:21,589 --> 00:07:19,599
our zinnia

198
00:07:23,749 --> 00:07:21,599
fungal samples will be coming back on

199
00:07:26,550 --> 00:07:23,759
that flight as well as some of the

200
00:07:27,749 --> 00:07:26,560
flowers from the zinnia experiment so

201
00:07:30,150 --> 00:07:27,759
we had

202
00:07:32,070 --> 00:07:30,160
scott save some of these flowers and

203
00:07:33,909 --> 00:07:32,080
we're going to look to see if seeds have

204
00:07:35,350 --> 00:07:33,919
developed and if those seeds are viable

205
00:07:38,150 --> 00:07:35,360
so those are all coming back when the

206
00:07:39,830 --> 00:07:38,160
next spacex flight returns

207
00:07:42,230 --> 00:07:39,840
and then we'll have the rest of the

208
00:07:45,029 --> 00:07:42,240
zinnia plant samples and plant pillows

209
00:07:47,510 --> 00:07:45,039
coming back on spacex nine when that one

210
00:07:49,909 --> 00:07:47,520
returns okay and you're also sending

211
00:07:52,230 --> 00:07:49,919
some new seeds up on on spacex so can

212
00:07:55,110 --> 00:07:52,240
you tell us what what to expect next

213
00:07:56,790 --> 00:07:55,120

yes so we're really excited um the next

214
00:07:58,390 --> 00:07:56,800
set of seats we're sending we're sending

215
00:08:00,230 --> 00:07:58,400
some more of the red romaine lettuce

216
00:08:02,469 --> 00:08:00,240
because the crew obviously enjoyed

217
00:08:05,189 --> 00:08:02,479
growing and eating that but we're also

218
00:08:07,670 --> 00:08:05,199
sending um a small chinese cabbage the

219
00:08:11,110 --> 00:08:07,680
varieties called tokyo bakana

220
00:08:13,350 --> 00:08:11,120
and it's a it's a really delicious

221
00:08:14,469 --> 00:08:13,360
chinese cabbage it grows really fast and

222
00:08:17,189 --> 00:08:14,479
it's you know

223
00:08:19,430 --> 00:08:17,199
eaten raw in salads and we actually

224
00:08:21,670 --> 00:08:19,440
selected this variety we did a whole

225
00:08:23,749 --> 00:08:21,680
series of tests with a number of

226
00:08:26,390 --> 00:08:23,759
different leafy green crops

227
00:08:29,189 --> 00:08:26,400
and we looked at the growth

228
00:08:30,629 --> 00:08:29,199
of these in plant pillows we looked at

229
00:08:33,350 --> 00:08:30,639
the um

230
00:08:36,149 --> 00:08:33,360
the nutrition of the actual crops and

231
00:08:37,750 --> 00:08:36,159
then we looked at the

232
00:08:39,670 --> 00:08:37,760
organoleptic

233
00:08:42,469 --> 00:08:39,680
which factors which is basically the

234
00:08:45,110 --> 00:08:42,479
taste tests so we we grew them and we

235
00:08:47,030 --> 00:08:45,120
sent produce to johnson space center

236
00:08:49,269 --> 00:08:47,040
where they have a food lab and in the

237
00:08:52,150 --> 00:08:49,279
food lab they actually conducted taste

238
00:08:53,829 --> 00:08:52,160

tests so a number of people got to taste

239
00:08:55,509 --> 00:08:53,839
the different varieties that we sent and

240
00:08:57,910 --> 00:08:55,519
this one was the highest rated so

241
00:08:59,269 --> 00:08:57,920
everyone loved it in terms of flavor and

242
00:09:01,430 --> 00:08:59,279
texture and

243
00:09:03,990 --> 00:09:01,440
it was just really really highly

244
00:09:06,150 --> 00:09:04,000
approved so because of that we we move

245
00:09:07,750 --> 00:09:06,160
forward to send this crop as the next

246
00:09:09,430 --> 00:09:07,760
crop that we're flying to see if the