
NASA
SPACESTATION
LIVE

1
00:00:08,470 --> 00:00:07,030
thank you for joining us here in the

2
00:00:10,790 --> 00:00:08,480
international space station flight

3
00:00:12,709 --> 00:00:10,800
control room as we've mentioned several

4
00:00:15,350 --> 00:00:12,719
times this week marked a big milestone

5
00:00:16,870 --> 00:00:15,360
for the onboard crew specifically scott

6
00:00:18,790 --> 00:00:16,880
scott kelly and mikhail kornienko who

7
00:00:20,470 --> 00:00:18,800
passed the midway point of their mission

8
00:00:22,150 --> 00:00:20,480
here to help talk about that is

9
00:00:23,830 --> 00:00:22,160
associate manager for the human research

10
00:00:25,269 --> 00:00:23,840
program dr john charles thanks so much

11
00:00:27,429 --> 00:00:25,279
for joining us delighted to be here

12
00:00:29,269 --> 00:00:27,439
thank you for the chance so let's set

13
00:00:31,189 --> 00:00:29,279

the stage again for

14
00:00:33,350 --> 00:00:31,199
why we even embarked on a one-year

15
00:00:34,790 --> 00:00:33,360
mission what were the goals of having a

16
00:00:37,990 --> 00:00:34,800
couple of crew members stay up there for

17
00:00:41,270 --> 00:00:38,000
twice the duration of the normal crew

18
00:00:43,670 --> 00:00:41,280
there were several goals one was to

19
00:00:45,830 --> 00:00:43,680
start getting into mars mindset mars

20
00:00:47,750 --> 00:00:45,840
missions will be probably two and a half

21
00:00:49,029 --> 00:00:47,760
years long we've got a lot of experience

22
00:00:51,189 --> 00:00:49,039
with six month missions on the

23
00:00:53,029 --> 00:00:51,199
international space station

24
00:00:55,029 --> 00:00:53,039
inevitably there's going to be somebody

25
00:00:56,389 --> 00:00:55,039
that says how about the gap between six

26
00:00:59,270 --> 00:00:56,399
months and two and a half years what are

27
00:01:01,750 --> 00:00:59,280
you doing about that and so a russian

28
00:01:03,590 --> 00:01:01,760
proposal was was submitted and it was

29
00:01:05,750 --> 00:01:03,600
accepted by the american side to do a

30
00:01:08,390 --> 00:01:05,760
one-year increment to start thinking

31
00:01:11,510 --> 00:01:08,400
about the aspects of a one-year mission

32
00:01:13,350 --> 00:01:11,520
or a mars mission but the the part that

33
00:01:14,950 --> 00:01:13,360
interests the human research program is

34
00:01:16,550 --> 00:01:14,960
really a chance to

35
00:01:18,070 --> 00:01:16,560
like i say see if we've done our

36
00:01:20,630 --> 00:01:18,080
homework correctly we've got lots of

37
00:01:22,070 --> 00:01:20,640
experience with six months and other

38
00:01:23,510 --> 00:01:22,080

shorter missions

39
00:01:25,590 --> 00:01:23,520
on the international space station on

40
00:01:27,749 --> 00:01:25,600
the russian space stations a whole long

41
00:01:29,190 --> 00:01:27,759
line of them on the american sky lab

42
00:01:30,630 --> 00:01:29,200
three-month missions

43
00:01:31,670 --> 00:01:30,640
and lots of experience in space flight

44
00:01:33,590 --> 00:01:31,680
in general

45
00:01:36,149 --> 00:01:33,600
we think we've learned how the human

46
00:01:38,149 --> 00:01:36,159
body responds to space flight so here's

47
00:01:39,510 --> 00:01:38,159
a chance to test it and see whether or

48
00:01:41,429 --> 00:01:39,520
we can predict

49
00:01:42,950 --> 00:01:41,439
changes that might occur in a one year

50
00:01:43,749 --> 00:01:42,960
mission and how close our predictions

51
00:01:46,389 --> 00:01:43,759
are

52
00:01:48,310 --> 00:01:46,399
there shouldn't be that big a difference

53
00:01:50,149 --> 00:01:48,320
we think that the six month flights

54
00:01:51,510 --> 00:01:50,159
pretty much show us what's going to

55
00:01:53,350 --> 00:01:51,520
happen to the human body with a long

56
00:01:54,789 --> 00:01:53,360
space flight wouldn't it be nice to know

57
00:01:56,630 --> 00:01:54,799
if we're right before we start

58
00:01:59,270 --> 00:01:56,640
committing to longer flights so there's

59
00:02:01,510 --> 00:01:59,280
a chance to acquire data on human

60
00:02:04,069 --> 00:02:01,520
adaptation to long-duration space flight

61
00:02:05,830 --> 00:02:04,079
and also to verify our countermeasures

62
00:02:08,070 --> 00:02:05,840
those things that we have those

63
00:02:08,869 --> 00:02:08,080

techniques we've developed to allow us

64
00:02:12,550 --> 00:02:08,879
to

65
00:02:14,309 --> 00:02:12,560
confidence they can go forward with with

66
00:02:16,470 --> 00:02:14,319
known medical

67
00:02:18,229 --> 00:02:16,480
changes in their bodies and see whether

68
00:02:20,869 --> 00:02:18,239
they really do work on longer missions

69
00:02:23,110 --> 00:02:20,879
so a good outcome for this mission will

70
00:02:25,030 --> 00:02:23,120
be no surprises

71
00:02:26,550 --> 00:02:25,040
so one of the major activities they've

72
00:02:29,350 --> 00:02:26,560
been doing this week is part of the

73
00:02:31,830 --> 00:02:29,360
fluids shift research they're even

74
00:02:33,110 --> 00:02:31,840
working on that uh today can you tell us

75
00:02:34,710 --> 00:02:33,120
a little bit about that i know part of

76
00:02:36,710 --> 00:02:34,720
that was to look at obviously the fluid

77
00:02:38,390 --> 00:02:36,720
shift changes and specifically changes

78
00:02:40,309 --> 00:02:38,400
to vision which has been observed in

79
00:02:43,030 --> 00:02:40,319
some crew members

80
00:02:44,710 --> 00:02:43,040
astronauts on previous space station

81
00:02:46,390 --> 00:02:44,720
missions

82
00:02:49,430 --> 00:02:46,400
not that far back in the past in the

83
00:02:51,509 --> 00:02:49,440
last seven or eight years have reported

84
00:02:53,110 --> 00:02:51,519
decreased visual acuity with time and

85
00:02:55,190 --> 00:02:53,120
flight

86
00:02:56,790 --> 00:02:55,200
we had always seen changes in visual

87
00:02:57,990 --> 00:02:56,800
acuity on shorter flights even on

88
00:03:00,390 --> 00:02:58,000

shuttle flights

89
00:03:02,470 --> 00:03:00,400
but it was always of a variable nature

90
00:03:04,309 --> 00:03:02,480
and never long lasting enough to really

91
00:03:05,750 --> 00:03:04,319
concern the flight surgeons in a

92
00:03:07,509 --> 00:03:05,760
significant way

93
00:03:09,350 --> 00:03:07,519
but about the the middle of the last

94
00:03:11,190 --> 00:03:09,360
decade or slightly there slightly

95
00:03:13,190 --> 00:03:11,200
thereafter some astronauts were

96
00:03:15,670 --> 00:03:13,200
reporting that they were

97
00:03:17,350 --> 00:03:15,680
losing a lot of their near visual field

98
00:03:19,589 --> 00:03:17,360
and unable to do things like read a

99
00:03:21,190 --> 00:03:19,599
checklist which is kind of a bummer when

100
00:03:22,229 --> 00:03:21,200
you're trying to fly a soyuz back to a

101
00:03:23,750 --> 00:03:22,239
landing

102
00:03:26,149 --> 00:03:23,760
so we became uh

103
00:03:28,630 --> 00:03:26,159
motivated to understand the problem the

104
00:03:30,789 --> 00:03:28,640
problem seems to be related to an actual

105
00:03:32,710 --> 00:03:30,799
change in the shape of the of the eye of

106
00:03:34,869 --> 00:03:32,720
the globe of the eye in space flight a

107
00:03:36,710 --> 00:03:34,879
flattening of the globe as if there is a

108
00:03:39,030 --> 00:03:36,720
force pushing against the back of the

109
00:03:40,949 --> 00:03:39,040
eye and making the eyes focal length

110
00:03:42,869 --> 00:03:40,959
shorter

111
00:03:44,470 --> 00:03:42,879
what what could be doing that well and

112
00:03:46,390 --> 00:03:44,480
that's based on direct measurements with

113
00:03:47,910 --> 00:03:46,400

ultrasound and pre and post-flight

114
00:03:51,030 --> 00:03:47,920
flight measurements with magnetic

115
00:03:52,149 --> 00:03:51,040
resonance imaging so it's it's pretty

116
00:03:54,229 --> 00:03:52,159
pretty

117
00:03:55,990 --> 00:03:54,239
real it's not it's not a it's not a

118
00:03:57,110 --> 00:03:56,000
hypothesis per se

119
00:03:59,589 --> 00:03:57,120
one of the things that happens in the

120
00:04:01,110 --> 00:03:59,599
human body is the body's body fluids

121
00:04:03,429 --> 00:04:01,120
distribute equally up and down the

122
00:04:05,670 --> 00:04:03,439
entire body which has the effect of

123
00:04:07,509 --> 00:04:05,680
being a net headword fluid shift hence

124
00:04:09,750 --> 00:04:07,519
the name fluid shifts

125
00:04:11,750 --> 00:04:09,760
if fluid shifts are implicated in the

126
00:04:13,670 --> 00:04:11,760
loss of visual acuity because of

127
00:04:15,429 --> 00:04:13,680
pressure pushing on the back of the eye

128
00:04:16,870 --> 00:04:15,439
and presumably the fluids would sort of

129
00:04:18,870 --> 00:04:16,880
accumulate in the upper part of the body

130
00:04:20,629 --> 00:04:18,880
fill up the spaces in the head and then

131
00:04:22,230 --> 00:04:20,639
look for other places to go like along

132
00:04:23,590 --> 00:04:22,240
the optic nerve tracks

133
00:04:25,909 --> 00:04:23,600
wouldn't it be a good idea to see if we

134
00:04:28,390 --> 00:04:25,919
can reverse that with a device that uses

135
00:04:29,830 --> 00:04:28,400
lower body negative pressure well it

136
00:04:32,230 --> 00:04:29,840
just so happens the russians have one of

137
00:04:34,469 --> 00:04:32,240
those lbnp devices on the station it's

138
00:04:36,469 --> 00:04:34,479

called chibis it's part of their usual

139
00:04:38,070 --> 00:04:36,479
end of mission countermeasure

140
00:04:40,070 --> 00:04:38,080
so we have asked permission and actually

141
00:04:40,950 --> 00:04:40,080
have a joint study a joint u.s russian

142
00:04:43,990 --> 00:04:40,960
study

143
00:04:46,150 --> 00:04:44,000
to do chibus measurements on uh

144
00:04:47,670 --> 00:04:46,160
kornyenko and kelly three times in

145
00:04:49,590 --> 00:04:47,680
flight the first one was in june the

146
00:04:51,590 --> 00:04:49,600
second one was this week and then once

147
00:04:53,430 --> 00:04:51,600
more before landing to see if we can

148
00:04:54,790 --> 00:04:53,440
document with a change in the fluid

149
00:04:56,469 --> 00:04:54,800
distribution the change in the shape of

150
00:04:58,469 --> 00:04:56,479
the eye and a change in other parameters

151
00:05:00,710 --> 00:04:58,479
that indicate uh the fluid shifting in

152
00:05:03,430 --> 00:05:00,720
space so it's a very complex highly

153
00:05:05,189 --> 00:05:03,440
integrated uh probably the most complex

154
00:05:07,110 --> 00:05:05,199
biomedical investigation ever done on

155
00:05:08,390 --> 00:05:07,120
the station and i like to think it's one

156
00:05:10,310 --> 00:05:08,400
of the most complex of any

157
00:05:11,749 --> 00:05:10,320
investigations done in the station

158
00:05:13,430 --> 00:05:11,759
highly integrated between the us and

159
00:05:15,189 --> 00:05:13,440
russian sides and between the

160
00:05:17,189 --> 00:05:15,199
engineering and the scientific community

161
00:05:18,710 --> 00:05:17,199
so it's a a real challenge and our teams

162
00:05:20,070 --> 00:05:18,720
have been doing an excellent job on it

163
00:05:21,670 --> 00:05:20,080

so far

164
00:05:23,110 --> 00:05:21,680
in addition to the

165
00:05:24,550 --> 00:05:23,120
the changes in the vision and the

166
00:05:26,310 --> 00:05:24,560
physiological effects on the eye are

167
00:05:27,590 --> 00:05:26,320
there other physiological types of

168
00:05:28,629 --> 00:05:27,600
changes that you're looking for with the

169
00:05:30,310 --> 00:05:28,639
crew members

170
00:05:32,230 --> 00:05:30,320
well in fact there are i just heard a

171
00:05:34,230 --> 00:05:32,240
brief mention in your early report about

172
00:05:36,710 --> 00:05:34,240
sprint that's an exercise

173
00:05:38,390 --> 00:05:36,720
study to evaluate different ways more

174
00:05:39,830 --> 00:05:38,400
efficient ways to do exercise on

175
00:05:41,830 --> 00:05:39,840
astronauts so they don't spend quite so

176
00:05:43,110 --> 00:05:41,840
many hours a day treadmilling or

177
00:05:45,270 --> 00:05:43,120
exercising

178
00:05:47,670 --> 00:05:45,280
we have uh the usual set of of

179
00:05:49,350 --> 00:05:47,680
measurements of the blood components

180
00:05:51,110 --> 00:05:49,360
trying to undertrack the the changes

181
00:05:54,070 --> 00:05:51,120
that happen in the body's metabolic

182
00:05:55,270 --> 00:05:54,080
pathways in space and it should be noted

183
00:05:57,270 --> 00:05:55,280
that the studies that we're doing on the

184
00:05:58,629 --> 00:05:57,280
one-year mission are the same as we do

185
00:06:00,309 --> 00:05:58,639
on six-month missions they're not a

186
00:06:02,070 --> 00:06:00,319
separate set of investigations for one

187
00:06:03,670 --> 00:06:02,080
year because we're looking for

188
00:06:05,189 --> 00:06:03,680

differences between six months and one

189
00:06:06,550 --> 00:06:05,199
year and you want to do the same

190
00:06:08,150 --> 00:06:06,560
measurements and then see if the data

191
00:06:11,029 --> 00:06:08,160
are the same or different

192
00:06:13,430 --> 00:06:11,039
but there are a whole set of of

193
00:06:15,670 --> 00:06:13,440
physiological studies psychological

194
00:06:17,110 --> 00:06:15,680
studies and space human factors kind of

195
00:06:18,230 --> 00:06:17,120
studies how well do the astronauts

196
00:06:20,550 --> 00:06:18,240
relate to their environment the

197
00:06:22,629 --> 00:06:20,560
spacecraft to give future spacecraft

198
00:06:24,390 --> 00:06:22,639
designers insights into how how to

199
00:06:26,390 --> 00:06:24,400
design spacecraft more suitable for

200
00:06:27,749 --> 00:06:26,400
long-duration flights in the future

201
00:06:29,350 --> 00:06:27,759
and i think there was a number of tasks

202
00:06:31,110 --> 00:06:29,360
along those lines planned for scott

203
00:06:33,590 --> 00:06:31,120
today specifically

204
00:06:35,189 --> 00:06:33,600
what about cognitive performance how how

205
00:06:36,870 --> 00:06:35,199
do you guys monitor monitor that for

206
00:06:38,230 --> 00:06:36,880
crew members we're of course very

207
00:06:41,189 --> 00:06:38,240
concerned and very interested in the

208
00:06:44,230 --> 00:06:41,199
astronauts cognition uh astronauts are

209
00:06:46,390 --> 00:06:44,240
are selected and flown because they have

210
00:06:48,390 --> 00:06:46,400
substantial brains and those brains have

211
00:06:51,350 --> 00:06:48,400
to interact with the environment so we

212
00:06:54,469 --> 00:06:51,360
are doing some very simple testing of

213
00:06:56,309 --> 00:06:54,479

of cognitive function essentially a a

214
00:06:57,110 --> 00:06:56,319
reaction time test which tells us a lot

215
00:06:58,710 --> 00:06:57,120
about

216
00:07:00,710 --> 00:06:58,720
cognitive function at the very basal

217
00:07:02,390 --> 00:07:00,720
level and some other studies which are

218
00:07:05,350 --> 00:07:02,400
largely pre and post-flight with some

219
00:07:07,749 --> 00:07:05,360
in-flight sampling in-flight of

220
00:07:10,230 --> 00:07:07,759
questionnaires and testing that look at

221
00:07:12,870 --> 00:07:10,240
changes in the actual structure of the

222
00:07:14,390 --> 00:07:12,880
brain using mri and we'll do those who

223
00:07:15,990 --> 00:07:14,400
can't do an mri in flight but we can do

224
00:07:17,830 --> 00:07:16,000
it pre-flight and post-flight and do the

225
00:07:19,350 --> 00:07:17,840
same kind of psychological tests in

226
00:07:22,150 --> 00:07:19,360
flight as we do pre and post-flight to

227
00:07:23,830 --> 00:07:22,160
see if we can correlate changes and the

228
00:07:25,749 --> 00:07:23,840
function on the test with changes in the

229
00:07:28,550 --> 00:07:25,759
structure in the brain it's an exciting

230
00:07:30,070 --> 00:07:28,560
it's exciting and it's the first time

231
00:07:31,909 --> 00:07:30,080
you know medical technology has allowed

232
00:07:35,029 --> 00:07:31,919
us to do this kind of really

233
00:07:37,029 --> 00:07:35,039
invasive non-invasive kind of work

234
00:07:38,870 --> 00:07:37,039
there was another really unique um

235
00:07:41,189 --> 00:07:38,880
opportunity with this crew in particular

236
00:07:42,790 --> 00:07:41,199
scott kelly being a twin so there's been

237
00:07:44,070 --> 00:07:42,800
a lot of talk about the twin studies in

238
00:07:46,230 --> 00:07:44,080

particular can you tell us how that's

239
00:07:47,909 --> 00:07:46,240
going the twin study is going very well

240
00:07:48,950 --> 00:07:47,919
in this case we

241
00:07:50,710 --> 00:07:48,960
actually

242
00:07:52,150 --> 00:07:50,720
had an experiment suggested by the

243
00:07:53,830 --> 00:07:52,160
astronauts that doesn't happen very

244
00:07:56,309 --> 00:07:53,840
often a biomedical experiment suggested

245
00:07:57,749 --> 00:07:56,319
by the astronauts scott and mark

246
00:07:59,430 --> 00:07:57,759
actually sort of came up with the idea

247
00:08:01,430 --> 00:07:59,440
themselves and we jumped on it as a

248
00:08:03,589 --> 00:08:01,440
chance to really take advantage of a

249
00:08:04,869 --> 00:08:03,599
once in a lifetime not just once in a

250
00:08:06,469 --> 00:08:04,879
career but a once in a lifetime

251
00:08:07,749 --> 00:08:06,479
opportunity to make coordinated

252
00:08:09,909 --> 00:08:07,759
measurements on

253
00:08:12,070 --> 00:08:09,919
identical twins one in flight and one on

254
00:08:14,710 --> 00:08:12,080
the ground scott or mark continues to

255
00:08:16,070 --> 00:08:14,720
live the free free range life in tucson

256
00:08:17,589 --> 00:08:16,080
he's not living in a space station

257
00:08:19,270 --> 00:08:17,599
mock-up he's not eating space station

258
00:08:21,510 --> 00:08:19,280
food he's not exercising on scott's

259
00:08:23,189 --> 00:08:21,520
schedule but he does visit with us

260
00:08:25,990 --> 00:08:23,199
periodically and allow us to collect

261
00:08:27,589 --> 00:08:26,000
body fluid samples and do other studies

262
00:08:29,270 --> 00:08:27,599
including the chiba study he is doing

263
00:08:31,189 --> 00:08:29,280

the the lower body negative pressure

264
00:08:33,269 --> 00:08:31,199
study himself as a comparison with his

265
00:08:34,550 --> 00:08:33,279
brother's function in flight he's also

266
00:08:36,630 --> 00:08:34,560
doing the cognition study and other

267
00:08:37,750 --> 00:08:36,640
studies like that so we've just

268
00:08:40,149 --> 00:08:37,760
collected

269
00:08:43,269 --> 00:08:40,159
saliva samples last week and next week

270
00:08:45,910 --> 00:08:43,279
we'll be doing the full panoply of of

271
00:08:48,070 --> 00:08:45,920
sample collection blood and urine and

272
00:08:50,630 --> 00:08:48,080
yes even fecal samples collected next

273
00:08:52,710 --> 00:08:50,640
week as well as a full suite of

274
00:08:55,030 --> 00:08:52,720
psychological psychological tests on

275
00:08:56,710 --> 00:08:55,040
scott and then in early october mark

276
00:08:58,790 --> 00:08:56,720
will come to houston and do the same

277
00:09:00,470 --> 00:08:58,800
studies for us again and then they will

278
00:09:01,829 --> 00:09:00,480
they will both continue except for the

279
00:09:04,070 --> 00:09:01,839
chippets part they'll both continue in

280
00:09:05,430 --> 00:09:04,080
post flight the post flight parade for

281
00:09:07,269 --> 00:09:05,440
six months and maybe even longer to

282
00:09:09,990 --> 00:09:07,279
allow us to collect data on scott as he

283
00:09:13,670 --> 00:09:10,000
re-adapts and on mark as an example of

284
00:09:18,870 --> 00:09:16,230
so one final question we've had a number

285
00:09:21,590 --> 00:09:18,880
of individuals just a few who've stayed

286
00:09:23,910 --> 00:09:21,600
up there longer but on tuesday that was

287
00:09:26,470 --> 00:09:23,920
the midway point for scott and mikhail

288
00:09:29,030 --> 00:09:26,480

and now they're embarking on a new you

289
00:09:30,790 --> 00:09:29,040
know longer mission than typical what

290
00:09:31,509 --> 00:09:30,800
are the types of psychological aspects

291
00:09:33,110 --> 00:09:31,519
that

292
00:09:35,509 --> 00:09:33,120
you anticipate they'll be facing as they

293
00:09:37,990 --> 00:09:35,519
go into the second phase

294
00:09:39,990 --> 00:09:38,000
scott and mikhail are both extremely

295
00:09:42,630 --> 00:09:40,000
well grounded no pun intended

296
00:09:43,990 --> 00:09:42,640
individuals in space i expect we're

297
00:09:45,509 --> 00:09:44,000
going to see more of the same i think

298
00:09:47,190 --> 00:09:45,519
they're highly motivated extremely

299
00:09:49,430 --> 00:09:47,200
highly motivated they're both volunteers

300
00:09:50,710 --> 00:09:49,440
for this mission they'll do the very

301
00:09:53,190 --> 00:09:50,720
best anybody can do under these

302
00:09:54,870 --> 00:09:53,200
circumstances i think they have

303
00:09:56,470 --> 00:09:54,880
considerable support from the ground

304
00:09:58,150 --> 00:09:56,480
from from their crewmates from their

305
00:10:00,470 --> 00:09:58,160
family and friends from people here in

306
00:10:02,230 --> 00:10:00,480
mission control and others and the in

307
00:10:03,269 --> 00:10:02,240
the the infrastructure supporting this

308
00:10:04,389 --> 00:10:03,279
mission

309
00:10:06,550 --> 00:10:04,399
i think

310
00:10:08,949 --> 00:10:06,560
i would bet they're not going to have

311
00:10:10,230 --> 00:10:08,959
real psychological issues but one of the

312
00:10:11,990 --> 00:10:10,240
things we're doing in this extended

313
00:10:14,069 --> 00:10:12,000

mission is to see whether we can detect

314
00:10:15,910 --> 00:10:14,079
even subtle changes that might be

315
00:10:17,509 --> 00:10:15,920
harbingers of changes on other

316
00:10:19,110 --> 00:10:17,519
astronauts on even more challenging

317
00:10:21,430 --> 00:10:19,120
missions in the future so we'll continue

318
00:10:23,350 --> 00:10:21,440
to look at them very closely but i'll be

319
00:10:24,470 --> 00:10:23,360
surprised if we see anything that that's

320
00:10:27,350 --> 00:10:24,480
really

321
00:10:29,190 --> 00:10:27,360
warrants a continued investigation

322
00:10:31,110 --> 00:10:29,200
well thank you so much there's a lot of

323
00:10:32,470 --> 00:10:31,120
exciting science going on it's i can

324
00:10:35,030 --> 00:10:32,480
hear the excitement in your voice so we

325
00:10:36,870 --> 00:10:35,040
look forward to following along and

326
00:10:38,630 --> 00:10:36,880
as you said supporting them so thank you

327
00:10:40,630 --> 00:10:38,640
again for joining us dr john charles