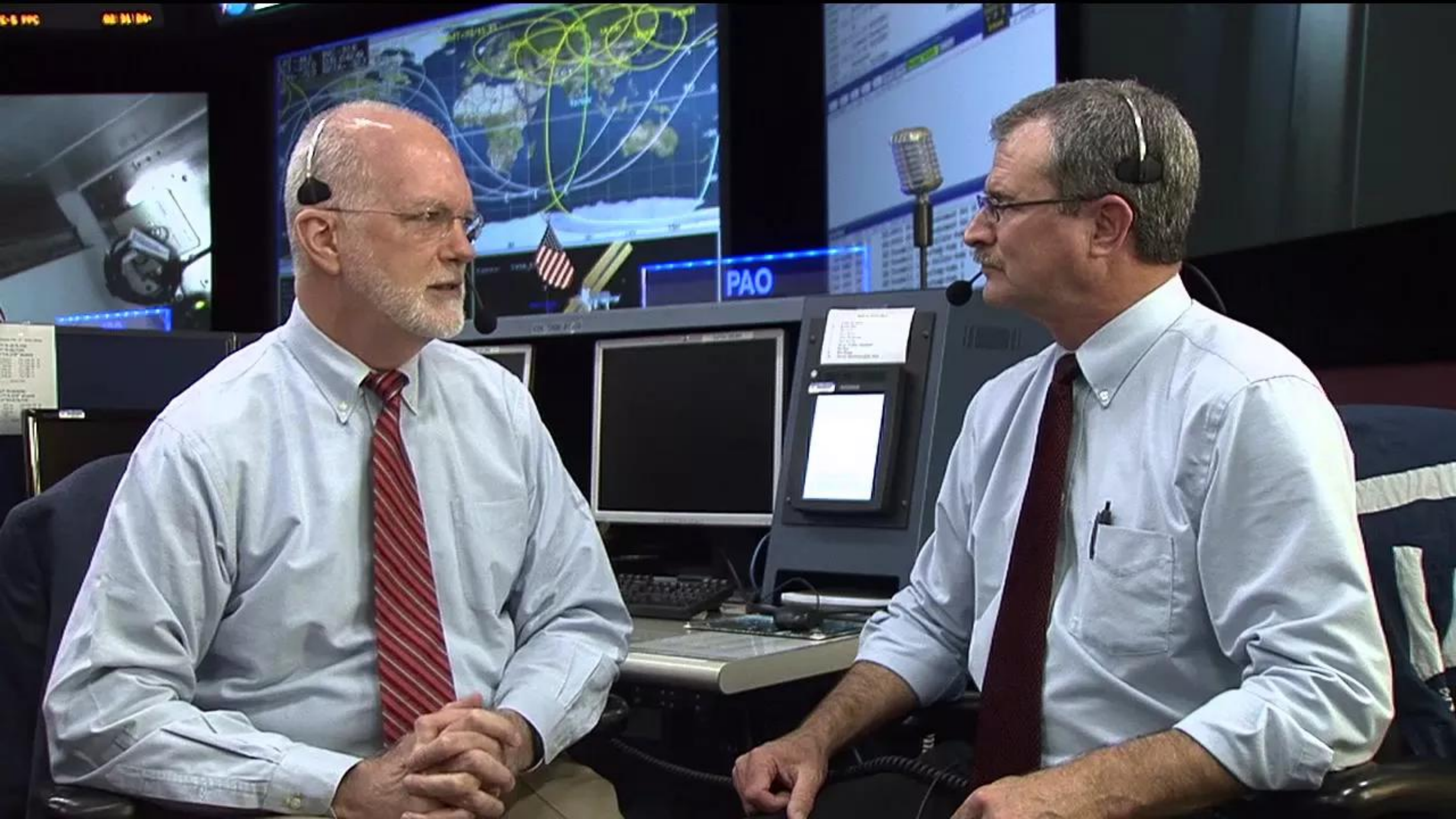
PAO

1
00:00:08,870 --> 00:00:06,950
recently my colleague pat ryan spoke

2
00:00:11,669 --> 00:00:08,880
with dr john charles the associate

3
00:00:14,310 --> 00:00:11,679
manager for the international science on

4
00:00:17,990 --> 00:00:14,320
nasa's human research program about the

5
00:00:19,590 --> 00:00:18,000
science plan for expeditions 43-46

6
00:00:21,910 --> 00:00:19,600
and asked him to identify the greatest

7
00:00:25,589 --> 00:00:21,920
concerns we have about how prolonged

8
00:00:28,070 --> 00:00:25,599
weightlessness affects a person

9
00:00:30,790 --> 00:00:28,080
the way weightlessness affects people

10
00:00:32,549 --> 00:00:30,800
after long periods in space is part of

11
00:00:34,229 --> 00:00:32,559
the problem and the rest of the problem

12
00:00:36,870 --> 00:00:34,239
of course is isolation and distance and

13
00:00:38,950 --> 00:00:36,880

things like that from family and support

14
00:00:40,310 --> 00:00:38,960
but the weightless problems are

15
00:00:41,270 --> 00:00:40,320
i think very interesting and they

16
00:00:43,190 --> 00:00:41,280
concern

17
00:00:45,510 --> 00:00:43,200
loss of bone mass that is the loss of

18
00:00:47,190 --> 00:00:45,520
bone structure and integrity because the

19
00:00:49,270 --> 00:00:47,200
bones are no longer hefting around our

20
00:00:51,110 --> 00:00:49,280
bodies and under one g

21
00:00:53,189 --> 00:00:51,120
the muscles that make those bones move

22
00:00:55,350 --> 00:00:53,199
also get weaker the cardiovascular

23
00:00:56,709 --> 00:00:55,360
system which doesn't have to pump blood

24
00:00:58,709 --> 00:00:56,719
uh from the lower body into the upper

25
00:01:00,389 --> 00:00:58,719
part of the body because of

26
00:01:03,110 --> 00:01:00,399
pooling because of gravity

27
00:01:05,030 --> 00:01:03,120
also has certain changes not so much in

28
00:01:06,230 --> 00:01:05,040
the force of the pumping but in the

29
00:01:09,510 --> 00:01:06,240
in the

30
00:01:15,670 --> 00:01:09,520
the

31
00:01:17,270 --> 00:01:15,680
effects of gravity of course notices

32
00:01:19,190 --> 00:01:17,280
right away that weightlessness doesn't

33
00:01:21,350 --> 00:01:19,200
happen anymore or weightlessness happens

34
00:01:23,590 --> 00:01:21,360
and gravity doesn't happen anymore

35
00:01:25,429 --> 00:01:23,600
all of these changes uh occur fairly

36
00:01:28,070 --> 00:01:25,439
quickly in flight but we're now looking

37
00:01:30,230 --> 00:01:28,080
at the long-term manifestations of these

38
00:01:32,230 --> 00:01:30,240

very very physical changes

39
00:01:34,390 --> 00:01:32,240
along with the psychological aspects and

40
00:01:36,069 --> 00:01:34,400
other aspects of just being in a

41
00:01:38,789 --> 00:01:36,079
confined environment in a great distance

42
00:01:41,030 --> 00:01:38,799
from from support and so forth do we

43
00:01:43,670 --> 00:01:41,040
anticipate that all of these

44
00:01:45,670 --> 00:01:43,680
bad effects get worse the longer that

45
00:01:47,190 --> 00:01:45,680
you stay would it be worse in months

46
00:01:48,069 --> 00:01:47,200
seven or eight than it is in two or

47
00:01:49,270 --> 00:01:48,079
three

48
00:01:51,190 --> 00:01:49,280
well you know we're doing this one year

49
00:01:53,510 --> 00:01:51,200
mission and that the goal is to try and

50
00:01:55,429 --> 00:01:53,520
answer exactly that question we have

51
00:01:57,670 --> 00:01:55,439
always in the life sciences assumed that

52
00:01:59,590 --> 00:01:57,680
the next increment of duration is where

53
00:02:01,190 --> 00:01:59,600
the cliff is is where the brick wall is

54
00:02:02,870 --> 00:02:01,200
that we're going to run into and so far

55
00:02:04,550 --> 00:02:02,880
we've really not seen it so far the

56
00:02:06,789 --> 00:02:04,560
human body has proved remarkably

57
00:02:08,949 --> 00:02:06,799
adaptable to

58
00:02:10,869 --> 00:02:08,959
the most novel environmental situation

59
00:02:12,790 --> 00:02:10,879
that is possible to conceive of and that

60
00:02:14,949 --> 00:02:12,800
is the absence of gravity gravity has

61
00:02:17,510 --> 00:02:14,959
influenced everything on the earth in

62
00:02:18,630 --> 00:02:17,520
terms of biology from the very beginning

63
00:02:23,350 --> 00:02:18,640

of

64
00:02:25,270 --> 00:02:23,360
and now we're finding that the those

65
00:02:27,430 --> 00:02:25,280
resources that the body has to take care

66
00:02:28,550 --> 00:02:27,440
of itself in different attitudes

67
00:02:30,949 --> 00:02:28,560
different postures different

68
00:02:33,270 --> 00:02:30,959
environments on the ground are also

69
00:02:35,030 --> 00:02:33,280
pretty good for living in the absence of

70
00:02:36,949 --> 00:02:35,040
gravity as long as you maintain pressure

71
00:02:38,070 --> 00:02:36,959
and temperature and food and things like

72
00:02:40,869 --> 00:02:38,080
that

73
00:02:42,309 --> 00:02:40,879
so we're we're not yet encountering the

74
00:02:44,070 --> 00:02:42,319
the cliff you know there's no here be

75
00:02:45,990 --> 00:02:44,080
dragons on the map that we've

76
00:02:47,910 --> 00:02:46,000
encountered so far

77
00:02:50,309 --> 00:02:47,920
we're finding that many of the changes

78
00:02:52,070 --> 00:02:50,319
that occur in the human body

79
00:02:54,470 --> 00:02:52,080
physiologically occur

80
00:02:56,710 --> 00:02:54,480
fairly soon that is within days weeks

81
00:02:59,830 --> 00:02:56,720
even months of time and weightlessness

82
00:03:01,910 --> 00:02:59,840
but after three or four or five months

83
00:03:04,070 --> 00:03:01,920
our bodies would be pretty well

84
00:03:05,750 --> 00:03:04,080
accommodated to weightlessness as far as

85
00:03:08,149 --> 00:03:05,760
we know

86
00:03:10,309 --> 00:03:08,159
now that's a big caveat because

87
00:03:12,149 --> 00:03:10,319
we don't have many other

88
00:03:14,390 --> 00:03:12,159

data points beyond those first few

89
00:03:15,830 --> 00:03:14,400
months but things seem to level off and

90
00:03:17,910 --> 00:03:15,840
we seem to be approaching something that

91
00:03:20,229 --> 00:03:17,920
some people call a space normal state

92
00:03:21,910 --> 00:03:20,239
that is you're through the the turmoil

93
00:03:23,670 --> 00:03:21,920
in the uproar of the adaptation and the

94
00:03:25,750 --> 00:03:23,680
accommodation process

95
00:03:27,270 --> 00:03:25,760
but there's always the what if you know

96
00:03:29,750 --> 00:03:27,280
if we're talking about two and a half

97
00:03:31,670 --> 00:03:29,760
year round trips to mars all of it in

98
00:03:33,670 --> 00:03:31,680
gravity less than earth's gravity

99
00:03:35,910 --> 00:03:33,680
weightlessness for the transits out and

100
00:03:37,990 --> 00:03:35,920
back and one third of a g while you're

101
00:03:39,270 --> 00:03:38,000
on the planet of mars

102
00:03:40,789 --> 00:03:39,280
wouldn't it be nice to know ahead of

103
00:03:43,430 --> 00:03:40,799
time before you embark on those missions

104
00:03:45,589 --> 00:03:43,440
whether gravity is whether there is a

105
00:03:47,750 --> 00:03:45,599
bugaboo out there that's gravity related

106
00:03:49,430 --> 00:03:47,760
so we're we're gradually expanding the

107
00:03:51,670 --> 00:03:49,440
the flight durations the space station

108
00:03:53,830 --> 00:03:51,680
has given us a huge database on roughly

109
00:03:56,550 --> 00:03:53,840
six month durations and so far like i

110
00:03:57,990 --> 00:03:56,560
say not many bugaboos but there was one

111
00:03:59,830 --> 00:03:58,000
and that is the visual problem that

112
00:04:01,990 --> 00:03:59,840
people have heard about before

113
00:04:04,149 --> 00:04:02,000

which seems to have manifested itself

114
00:04:06,470 --> 00:04:04,159
along about month three or four or five

115
00:04:09,429 --> 00:04:06,480
in these six-month missions

116
00:04:11,190 --> 00:04:09,439
and it was a bit of a surprise because

117
00:04:14,229 --> 00:04:11,200
people had not really reported that

118
00:04:15,509 --> 00:04:14,239
degree of visual change previously now

119
00:04:17,189 --> 00:04:15,519
we're trying now the human research

120
00:04:19,189 --> 00:04:17,199
program is trying to understand what is

121
00:04:20,949 --> 00:04:19,199
unique about the current situation about

122
00:04:22,950 --> 00:04:20,959
the crew members about the environment

123
00:04:25,510 --> 00:04:22,960
about whatever else may be causing a

124
00:04:27,749 --> 00:04:25,520
visual change so we can understand that

125
00:04:29,510 --> 00:04:27,759
problem and also so we can generalize to

126
00:04:31,830 --> 00:04:29,520
other problems what other problems have

127
00:04:32,790 --> 00:04:31,840
we missed that will manifest themselves

128
00:04:35,830 --> 00:04:32,800
on say

129
00:04:37,030 --> 00:04:35,840
month 13 or month 20 of a long duration

130
00:04:39,510 --> 00:04:37,040
flight we're trying to avoid those

131
00:04:41,990 --> 00:04:39,520
problems on this mission for for kelly

132
00:04:44,870 --> 00:04:42,000
and kornienko how do you take data about

133
00:04:47,270 --> 00:04:44,880
what's happening to them in order to

134
00:04:48,950 --> 00:04:47,280
to study later and

135
00:04:51,430 --> 00:04:48,960
learn what you need to learn

136
00:04:54,550 --> 00:04:51,440
we use all the techniques available in

137
00:04:56,550 --> 00:04:54,560
21st century medicine including nowadays

138
00:04:57,990 --> 00:04:56,560

genetic analysis you've heard of the

139
00:05:00,710 --> 00:04:58,000
twin study that craig kundra my

140
00:05:02,710 --> 00:05:00,720
colleague talked to you about recently

141
00:05:04,629 --> 00:05:02,720
that is really an application of

142
00:05:06,469 --> 00:05:04,639
individualized 21st century medicine to

143
00:05:07,909 --> 00:05:06,479
understand the effects of long-term

144
00:05:10,230 --> 00:05:07,919
space flight on

145
00:05:11,749 --> 00:05:10,240
very specific individuals but we also

146
00:05:13,110 --> 00:05:11,759
use the other techniques that many of us

147
00:05:14,629 --> 00:05:13,120
are familiar with from visits to the

148
00:05:17,670 --> 00:05:14,639
doctor's office the blood pressure the

149
00:05:19,590 --> 00:05:17,680
ecg the the stress testing we have

150
00:05:22,070 --> 00:05:19,600
treadmills and other ways to stress test

151
00:05:24,230 --> 00:05:22,080
individuals in flight we have

152
00:05:25,749 --> 00:05:24,240
blood draws nobody can forget the blood

153
00:05:27,189 --> 00:05:25,759
draws the astronauts absolutely the most

154
00:05:29,510 --> 00:05:27,199
favorite activity to do has to be

155
00:05:31,510 --> 00:05:29,520
punctured and have blood drawn in flight

156
00:05:33,510 --> 00:05:31,520
and those are going to be

157
00:05:35,749 --> 00:05:33,520
really well springs of of new and

158
00:05:38,150 --> 00:05:35,759
valuable information on the effects of

159
00:05:40,230 --> 00:05:38,160
long-duration flights on these uh these

160
00:05:41,909 --> 00:05:40,240
two crew members uh doing the one-year

161
00:05:43,590 --> 00:05:41,919
mission but they will allow us to to

162
00:05:45,830 --> 00:05:43,600
form a commonality with a large

163
00:05:47,670 --> 00:05:45,840

six-month database we also have but wait

164
00:05:50,150 --> 00:05:47,680
there's more we also have

165
00:05:50,870 --> 00:05:50,160
a large uh set of

166
00:05:52,550 --> 00:05:50,880
of

167
00:05:54,150 --> 00:05:52,560
psychological and psychosocial

168
00:05:55,590 --> 00:05:54,160
investigations because the human

169
00:05:57,749 --> 00:05:55,600
research program

170
00:05:59,749 --> 00:05:57,759
considers the psychological psychosocial

171
00:06:02,629 --> 00:05:59,759
aspects of long-duration flights off

172
00:06:04,070 --> 00:06:02,639
beyond earth's orbit and off to mars as

173
00:06:07,350 --> 00:06:04,080
some of the most significant the most

174
00:06:09,350 --> 00:06:07,360
profound potential problems that that we

175
00:06:11,110 --> 00:06:09,360
might encounter and the funny thing

176
00:06:12,790 --> 00:06:11,120
about the psychological

177
00:06:14,070 --> 00:06:12,800
changes that may occur in flight is that

178
00:06:15,830 --> 00:06:14,080
you don't have them until suddenly

179
00:06:18,550 --> 00:06:15,840
you've got them in a big way so the

180
00:06:20,950 --> 00:06:18,560
trick is to develop techniques that will

181
00:06:22,710 --> 00:06:20,960
monitor crew members psychological

182
00:06:24,230 --> 00:06:22,720
states and their ability to form teams

183
00:06:25,749 --> 00:06:24,240
and their ability to sleep which is an

184
00:06:28,150 --> 00:06:25,759
important contributor to psychological

185
00:06:29,670 --> 00:06:28,160
health and then

186
00:06:31,270 --> 00:06:29,680
using those techniques that we may have

187
00:06:33,510 --> 00:06:31,280
developed on the ground and in isolation

188
00:06:35,350 --> 00:06:33,520

studies apply those to long-duration

189
00:06:37,510 --> 00:06:35,360
missions to validate them in the actual

190
00:06:39,909 --> 00:06:37,520
flight environment but part of the study

191
00:06:41,590 --> 00:06:39,919
now is to find out just exactly what

192
00:06:43,749 --> 00:06:41,600
they're capable of doing when they do

193
00:06:45,590 --> 00:06:43,759
return to earth at the end of the year

194
00:06:47,510 --> 00:06:45,600
yes pat the the goal of that

195
00:06:49,270 --> 00:06:47,520
investigation which is called field test

196
00:06:51,350 --> 00:06:49,280
is to understand the capabilities of

197
00:06:53,350 --> 00:06:51,360
astronauts immediately after landing

198
00:06:54,950 --> 00:06:53,360
from a long duration period in space

199
00:06:56,790 --> 00:06:54,960
flight which would mimic the transit

200
00:06:58,390 --> 00:06:56,800
time from the earth to mars

201
00:07:00,469 --> 00:06:58,400
to allow us to to help the the

202
00:07:01,909 --> 00:07:00,479
spacecraft designers for future mars

203
00:07:03,909 --> 00:07:01,919
vehicles understand what they have to

204
00:07:05,510 --> 00:07:03,919
build into the landing vehicle and how

205
00:07:07,749 --> 00:07:05,520
much they can expect the astronauts to

206
00:07:09,909 --> 00:07:07,759
do immediate after landing this is a

207
00:07:11,749 --> 00:07:09,919
very exciting and actually a very

208
00:07:13,270 --> 00:07:11,759
i want to say popular it's it's

209
00:07:15,350 --> 00:07:13,280
enthusiastically supported by the crew

210
00:07:17,029 --> 00:07:15,360
members the astronaut office as well as

211
00:07:19,189 --> 00:07:17,039
a scientific community because it's a

212
00:07:20,790 --> 00:07:19,199
good demonstration of what people can do

213
00:07:22,870 --> 00:07:20,800

immediately after landing and it has

214
00:07:24,469 --> 00:07:22,880
operational and scientific benefits and

215
00:07:26,390 --> 00:07:24,479
i think it's also interesting to note

216
00:07:28,870 --> 00:07:26,400
that in in this case in the one year

217
00:07:30,710 --> 00:07:28,880
crew a lot of these investigations are

218
00:07:32,629 --> 00:07:30,720
joint work by american and russian

219
00:07:34,469 --> 00:07:32,639
scientists in ways that

220
00:07:37,110 --> 00:07:34,479
hadn't happened on this project up to

221
00:07:39,830 --> 00:07:37,120
now that's exactly right in fact these

222
00:07:42,390 --> 00:07:39,840
were two separate ideas that were

223
00:07:44,230 --> 00:07:42,400
promoted by the the all of the uh space

224
00:07:46,629 --> 00:07:44,240
station program managers the u.s russian

225
00:07:48,070 --> 00:07:46,639
european japanese canadian they said we

226
00:07:49,589 --> 00:07:48,080
would like to understand what happens on

227
00:07:51,510 --> 00:07:49,599
a one year mission and we'd also like to

228
00:07:53,189 --> 00:07:51,520
see more joint activities between the

229
00:07:55,029 --> 00:07:53,199
partners taking advantage of the

230
00:07:57,589 --> 00:07:55,039
resources that each brings to the space

231
00:07:59,110 --> 00:07:57,599
station and breaking down any artificial

232
00:08:00,869 --> 00:07:59,120
barriers between

233
00:08:02,150 --> 00:08:00,879
the modules so we can move hardware back

234
00:08:04,150 --> 00:08:02,160
and forth crew members back and forth

235
00:08:05,430 --> 00:08:04,160
take advantage of of equipment that's in

236
00:08:07,909 --> 00:08:05,440
one and crew members that are in the

237
00:08:09,110 --> 00:08:07,919
other and so forth we quickly melded

238
00:08:11,430 --> 00:08:09,120

those two

239
00:08:13,510 --> 00:08:11,440
efforts into one so the one-year mission

240
00:08:15,830 --> 00:08:13,520
and the breaking down barriers became

241
00:08:17,589 --> 00:08:15,840
the same activity and we're using this

242
00:08:20,309 --> 00:08:17,599
one-year mission as a highly visible

243
00:08:22,230 --> 00:08:20,319
demonstration of how to do that

244
00:08:24,550 --> 00:08:22,240
once we get these techniques these

245
00:08:26,869 --> 00:08:24,560
lessons learned figured out we hope to

246
00:08:28,550 --> 00:08:26,879
be doing this on every iss mission

247
00:08:30,150 --> 00:08:28,560
beyond the one-year mission so that we

248
00:08:31,830 --> 00:08:30,160
take advantage as i say of the resources

249
00:08:34,070 --> 00:08:31,840
everybody brings and provide benefits to

250
00:08:37,269 --> 00:08:34,080
all the partners be very exciting to see

251
00:08:38,790 --> 00:08:37,279
how it goes thank you for uh letting us

252
00:08:41,750 --> 00:08:38,800
get a look into what's going to happen