1
00:00:04,950 --> 00:00:02,389
good morning and welcome to the mission

2
00:00:06,710 --> 00:00:04,960
control center we are about a year away

3
00:00:08,230 --> 00:00:06,720
now from the launch of scott kelly to

4
00:00:10,310 --> 00:00:08,240
the international space station for a

5
00:00:12,390 --> 00:00:10,320
year-long stay there that's going to let

6
00:00:14,390 --> 00:00:12,400
scientists here on the ground

7
00:00:16,550 --> 00:00:14,400
have the opportunity to gather more data

8
00:00:18,550 --> 00:00:16,560
on how the human body is affected by

9
00:00:20,070 --> 00:00:18,560
long stays in space and in this

10
00:00:21,990 --> 00:00:20,080
particular case they're going to have a

11
00:00:23,750 --> 00:00:22,000
special opportunity to compare that data

12
00:00:26,150 --> 00:00:23,760
here on the ground with someone

13
00:00:28,550 --> 00:00:26,160

particularly like scott kelly his twin

14
00:00:30,710 --> 00:00:28,560
brother former astronaut mark kelly we

15
00:00:33,430 --> 00:00:30,720
have with us here today uh dr craig

16
00:00:35,430 --> 00:00:33,440
kundratt who is the uh deputy chief

17
00:00:37,590 --> 00:00:35,440
scientist for nasa's human

18
00:00:39,350 --> 00:00:37,600
uh human research program and he's gonna

19
00:00:41,110 --> 00:00:39,360
tell us a little bit more about that uh

20
00:00:43,350 --> 00:00:41,120
that pro that program thanks so much for

21
00:00:45,910 --> 00:00:43,360
joining us my pleasure

22
00:00:47,990 --> 00:00:45,920
so back in november of 2012 the one-year

23
00:00:50,630 --> 00:00:48,000
mission had just been announced and

24
00:00:52,150 --> 00:00:50,640
scott kelly uh was announced to that

25
00:00:54,549 --> 00:00:52,160
mission and he was meeting with members

26
00:00:55,990 --> 00:00:54,559
of the human research program to learn

27
00:00:57,270 --> 00:00:56,000
what kind of investigations would be

28
00:00:58,470 --> 00:00:57,280
taking place during that one year

29
00:01:00,069 --> 00:00:58,480
mission

30
00:01:00,950 --> 00:01:00,079
in the course of that conversation he

31
00:01:02,790 --> 00:01:00,960
asked

32
00:01:04,469 --> 00:01:02,800
will this involve my twin brother mark

33
00:01:06,950 --> 00:01:04,479
at all and of course we hadn't

34
00:01:09,109 --> 00:01:06,960
anticipated necessarily a twin selection

35
00:01:10,950 --> 00:01:09,119
so they meet the first answer was

36
00:01:12,870 --> 00:01:10,960
no we don't have anything in the queue

37
00:01:14,630 --> 00:01:12,880
right now but let us go think about that

38
00:01:17,590 --> 00:01:14,640

so we reached out to the american

39
00:01:19,910 --> 00:01:17,600
scientific community and released a

40
00:01:21,109 --> 00:01:19,920
research announcement and received 40

41
00:01:24,149 --> 00:01:21,119
proposals

42
00:01:25,510 --> 00:01:24,159
oh nice 40 was that a good number yeah

43
00:01:28,710 --> 00:01:25,520
that was an excellent number we ended up

44
00:01:31,990 --> 00:01:28,720
selecting 10 and they range over a broad

45
00:01:33,749 --> 00:01:32,000
range of topics from molecular to

46
00:01:35,590 --> 00:01:33,759
mental function well tell us a little

47
00:01:36,870 --> 00:01:35,600
bit about why having a twin on the

48
00:01:38,149 --> 00:01:36,880
ground would be kind of a special

49
00:01:40,390 --> 00:01:38,159
circumstance and something that you

50
00:01:42,630 --> 00:01:40,400
would you would be interested in well a

51
00:01:43,590 --> 00:01:42,640
classic question is

52
00:01:45,830 --> 00:01:43,600
are

53
00:01:48,069 --> 00:01:45,840
our behaviors our traits due to nature

54
00:01:50,230 --> 00:01:48,079
or nurture what's the balance and in the

55
00:01:52,950 --> 00:01:50,240
case of scott and mark kelly we have a

56
00:01:55,270 --> 00:01:52,960
setup where we have identical twins so

57
00:01:57,749 --> 00:01:55,280
that factor the genetics

58
00:01:59,990 --> 00:01:57,759
the the nature part

59
00:02:02,630 --> 00:02:00,000
is controlled and so we can look at just

60
00:02:05,429 --> 00:02:02,640
how the environmental effects

61
00:02:07,270 --> 00:02:05,439
impact scott and mark and make a more

62
00:02:08,630 --> 00:02:07,280
careful comparison between the two than

63
00:02:10,229 --> 00:02:08,640

you could with

64
00:02:11,830 --> 00:02:10,239
people that aren't identical

65
00:02:13,750 --> 00:02:11,840
so what kind of ideas did you get for

66
00:02:15,910 --> 00:02:13,760
the for the twin studies

67
00:02:17,990 --> 00:02:15,920
well the topics fall into four areas the

68
00:02:19,510 --> 00:02:18,000
first is the molecular area

69
00:02:21,030 --> 00:02:19,520
and that uses

70
00:02:22,390 --> 00:02:21,040
things like blood and urine tests that

71
00:02:25,510 --> 00:02:22,400
you would have at your doctor's office

72
00:02:28,710 --> 00:02:25,520
so we're looking at dna rna protein

73
00:02:31,190 --> 00:02:28,720
metabolites and the like the next topic

74
00:02:32,630 --> 00:02:31,200
area is called the microbiome so it

75
00:02:35,910 --> 00:02:32,640
turns out that

76
00:02:38,630 --> 00:02:35,920
we are outnumbered about ten to one by

77
00:02:40,949 --> 00:02:38,640
bacteria on our surface of our skin and

78
00:02:42,630 --> 00:02:40,959
mostly in our gut which is what we're

79
00:02:44,390 --> 00:02:42,640
seeing here on the screen with the

80
00:02:45,430 --> 00:02:44,400
that's right

81
00:02:47,190 --> 00:02:45,440
and the

82
00:02:49,430 --> 00:02:47,200
the bacteria in our gut can have a

83
00:02:50,550 --> 00:02:49,440
profound impact on our health and our

84
00:02:52,550 --> 00:02:50,560
immune system

85
00:02:53,670 --> 00:02:52,560
and can change in response to stress to

86
00:02:55,830 --> 00:02:53,680
diet

87
00:02:57,430 --> 00:02:55,840
to disease to a number of factors so

88
00:02:59,030 --> 00:02:57,440

that's the second area

89
00:03:00,869 --> 00:02:59,040
the third is general

90
00:03:02,630 --> 00:03:00,879
overall human physiology so we're

91
00:03:05,589 --> 00:03:02,640
looking at the cardiovascular system for

92
00:03:07,750 --> 00:03:05,599
example and the fluid shifts that occur

93
00:03:09,830 --> 00:03:07,760
when we go into weightlessness and the

94
00:03:11,030 --> 00:03:09,840
fourth area is

95
00:03:12,710 --> 00:03:11,040
cognition

96
00:03:14,630 --> 00:03:12,720
so we have a battery of tests that are

97
00:03:15,830 --> 00:03:14,640
looking at things like

98
00:03:17,509 --> 00:03:15,840
alertness

99
00:03:19,509 --> 00:03:17,519
the ability to manipulate spatial

100
00:03:22,229 --> 00:03:19,519
objects in the mind

101
00:03:23,910 --> 00:03:22,239
and the like okay so you've got 10

102
00:03:25,670 --> 00:03:23,920
different studies that fall into those

103
00:03:26,789 --> 00:03:25,680
four categories that's correct can you

104
00:03:28,149 --> 00:03:26,799
tell us a little bit more about the

105
00:03:30,789 --> 00:03:28,159
individual studies

106
00:03:33,430 --> 00:03:30,799
sure for example on the molecular end

107
00:03:35,270 --> 00:03:33,440
we have one study that's looking at dna

108
00:03:38,070 --> 00:03:35,280
and more specifically the ends of the

109
00:03:40,550 --> 00:03:38,080
dna so our chromosomes are capped at the

110
00:03:43,110 --> 00:03:40,560
end by what are called telomeres special

111
00:03:45,990 --> 00:03:43,120
sequences and as we get older those

112
00:03:47,990 --> 00:03:46,000
sequences shorten and as we are exposed

113
00:03:49,910 --> 00:03:48,000

to stress they shorten

114
00:03:51,270 --> 00:03:49,920
so we're very interested to look at mark

115
00:03:53,110 --> 00:03:51,280
and scott at the beginning of the

116
00:03:55,350 --> 00:03:53,120
mission see what their telomere links

117
00:03:57,030 --> 00:03:55,360
are like and what scots will be like at

118
00:03:58,710 --> 00:03:57,040
the end of the mission and at the end of

119
00:04:01,110 --> 00:03:58,720
the mission scott will have accumulated

120
00:04:03,110 --> 00:04:01,120
540 days in space whereas mark will have

121
00:04:05,350 --> 00:04:03,120
had 54.

122
00:04:07,670 --> 00:04:05,360
yeah one tenth the amount so that's at

123
00:04:10,070 --> 00:04:07,680
the molecular level

124
00:04:11,670 --> 00:04:10,080
as i mentioned in the physiology realm

125
00:04:13,670 --> 00:04:11,680
we're looking at fluid shifts one of the

126
00:04:15,589 --> 00:04:13,680
concerns that we've noticed on the

127
00:04:17,430 --> 00:04:15,599
international space station with the

128
00:04:19,430 --> 00:04:17,440
number of astronauts we've been flying

129
00:04:21,110 --> 00:04:19,440
for six months is some have developed

130
00:04:22,310 --> 00:04:21,120
some vision problems

131
00:04:24,390 --> 00:04:22,320
and

132
00:04:25,749 --> 00:04:24,400
their visual acuity has changed a little

133
00:04:27,270 --> 00:04:25,759
bit and we see some changes in the

134
00:04:29,990 --> 00:04:27,280
structure of the eye

135
00:04:32,230 --> 00:04:30,000
the exact causes are not well understood

136
00:04:33,510 --> 00:04:32,240
there are several ideas and so we'll be

137
00:04:35,749 --> 00:04:33,520
studying mark

138
00:04:37,749 --> 00:04:35,759

um and scott both with a battery of

139
00:04:40,550 --> 00:04:37,759
tests that we're using on many

140
00:04:42,629 --> 00:04:40,560
astronauts in flight okay

141
00:04:44,870 --> 00:04:42,639
is that normally different in twins or

142
00:04:46,550 --> 00:04:44,880
their their their vision is that

143
00:04:48,710 --> 00:04:46,560
usually the same or is it i think it's

144
00:04:50,550 --> 00:04:48,720
usually the same but in this case you

145
00:04:52,790 --> 00:04:50,560
know what we've been able to

146
00:04:54,790 --> 00:04:52,800
do is study a series of astronauts in

147
00:04:57,350 --> 00:04:54,800
flight but here's a case where we can

148
00:04:59,510 --> 00:04:57,360
see when we compare to mark on the

149
00:05:01,830 --> 00:04:59,520
ground going through his daily life his

150
00:05:03,350 --> 00:05:01,840
yearly life with ups and with with

151
00:05:05,749 --> 00:05:03,360
various levels of activity different

152
00:05:07,990 --> 00:05:05,759
types of activity see how much how

153
00:05:10,710 --> 00:05:08,000
stable his readings are in these various

154
00:05:12,230 --> 00:05:10,720
measures compared to scott who's going

155
00:05:15,270 --> 00:05:12,240
through the weightlessness the confined

156
00:05:17,670 --> 00:05:15,280
environment the exercise regime etc okay

157
00:05:18,550 --> 00:05:17,680
what will they have to do you know

158
00:05:21,749 --> 00:05:18,560
versus

159
00:05:22,950 --> 00:05:21,759
to actually participate in the

160
00:05:25,189 --> 00:05:22,960
experiments

161
00:05:26,710 --> 00:05:25,199
well most of it or most of the

162
00:05:28,230 --> 00:05:26,720
research investigations most of the

163
00:05:29,909 --> 00:05:28,240

studies

164
00:05:33,189 --> 00:05:29,919
need either blood

165
00:05:35,350 --> 00:05:33,199
or urine or fecal samples okay

166
00:05:37,510 --> 00:05:35,360
but in addition to that there will be

167
00:05:38,629 --> 00:05:37,520
some cognitive tests which are computer

168
00:05:39,670 --> 00:05:38,639
run

169
00:05:41,350 --> 00:05:39,680
and then there will be for the

170
00:05:45,189 --> 00:05:41,360
physiology there's a whole battery of

171
00:05:47,670 --> 00:05:45,199
tests that range from ultrasound to mri

172
00:05:49,110 --> 00:05:47,680
to more blood measurements and and the

173
00:05:51,029 --> 00:05:49,120
like

174
00:05:53,590 --> 00:05:51,039
okay so it's all pretty standard stuff

175
00:05:55,270 --> 00:05:53,600
that they normally would do

176
00:05:56,710 --> 00:05:55,280
in space as far as the actual collection

177
00:05:59,749 --> 00:05:56,720
of the data that's correct there is

178
00:06:02,230 --> 00:05:59,759
nothing that is a completely new type of

179
00:06:03,830 --> 00:06:02,240
sample or measurement okay any of the

180
00:06:04,710 --> 00:06:03,840
particular experiments that you are

181
00:06:06,150 --> 00:06:04,720
really

182
00:06:07,510 --> 00:06:06,160
looking forward to seeing or most

183
00:06:09,670 --> 00:06:07,520
interested in what you're going to

184
00:06:10,629 --> 00:06:09,680
gather well the most interesting thing

185
00:06:11,990 --> 00:06:10,639
to me

186
00:06:14,710 --> 00:06:12,000
is that

187
00:06:17,110 --> 00:06:14,720
for the first time we're we're doing

188
00:06:18,550 --> 00:06:17,120

what is called olmics type of research

189
00:06:21,350 --> 00:06:18,560
where we're looking at

190
00:06:23,670 --> 00:06:21,360
dna changes in the dna there's chemical

191
00:06:25,189 --> 00:06:23,680
changes that can occur and to help

192
00:06:28,309 --> 00:06:25,199
regulate genes

193
00:06:30,870 --> 00:06:28,319
rna protein metabolites looking at all

194
00:06:33,430 --> 00:06:30,880
of these in a coordinated fashion and

195
00:06:35,270 --> 00:06:33,440
looking at physiological and mental

196
00:06:37,350 --> 00:06:35,280
changes as well now with only two

197
00:06:40,230 --> 00:06:37,360
subjects we don't expect any

198
00:06:42,230 --> 00:06:40,240
great great grand conclusion to emerge

199
00:06:44,070 --> 00:06:42,240
but we are in a good position to see

200
00:06:46,070 --> 00:06:44,080
some subtle changes that we might not be

201
00:06:48,230 --> 00:06:46,080
able to detect if they were not

202
00:06:49,350 --> 00:06:48,240
identical twins so what's really novel

203
00:06:51,510 --> 00:06:49,360
about this

204
00:06:53,909 --> 00:06:51,520
is bringing all 10 investigations

205
00:06:55,189 --> 00:06:53,919
together and in a comprehensive way and

206
00:06:57,350 --> 00:06:55,199
looking for correlations at the

207
00:06:59,589 --> 00:06:57,360
different levels as we look at space

208
00:07:00,230 --> 00:06:59,599
flight versus ground okay well speaking

209
00:07:03,510 --> 00:07:00,240
of

210
00:07:05,430 --> 00:07:03,520
have participating i know like you said

211
00:07:07,510 --> 00:07:05,440
that's a little different than usual so

212
00:07:08,870 --> 00:07:07,520
is it is there are there follow-ups that

213
00:07:11,830 --> 00:07:08,880

you can do are there ways that you can

214
00:07:13,990 --> 00:07:11,840
make it um you know more applicable or

215
00:07:15,430 --> 00:07:14,000
is it or is this going to be good enough

216
00:07:16,870 --> 00:07:15,440
well

217
00:07:18,230 --> 00:07:16,880
i don't think

218
00:07:19,830 --> 00:07:18,240
i can't speak for the astronaut

219
00:07:22,550 --> 00:07:19,840
selection process in future but i think

220
00:07:23,270 --> 00:07:22,560
it's unlikely this this will trigger a a

221
00:07:33,189 --> 00:07:23,280
a

222
00:07:35,350 --> 00:07:33,199
um

223
00:07:37,430 --> 00:07:35,360
uh it's more likely i mean the typical

224
00:07:39,270 --> 00:07:37,440
study that is done with twins is done

225
00:07:41,110 --> 00:07:39,280
with tens or even on the order of 100

226
00:07:42,390 --> 00:07:41,120
twins of course we just have the twin

227
00:07:45,350 --> 00:07:42,400
pair here

228
00:07:46,950 --> 00:07:45,360
so we're in a good position to identify

229
00:07:49,830 --> 00:07:46,960
some subtle changes that normally would

230
00:07:51,430 --> 00:07:49,840
be masked if we didn't have identical uh

231
00:07:52,629 --> 00:07:51,440
individuals genetically identical

232
00:07:54,710 --> 00:07:52,639
individuals

233
00:07:56,629 --> 00:07:54,720
and that will set up follow-up

234
00:07:58,150 --> 00:07:56,639
experiments or studies that will look at

235
00:07:59,189 --> 00:07:58,160
those things in more detail and see if

236
00:08:00,950 --> 00:07:59,199
they are

237
00:08:02,390 --> 00:08:00,960
broad conclusions to be made so this is

238
00:08:03,270 --> 00:08:02,400

really

239
00:08:05,510 --> 00:08:03,280
uh

240
00:08:06,469 --> 00:08:05,520
a set of studies that will give us clues

241
00:08:08,550 --> 00:08:06,479
but not

242
00:08:10,869 --> 00:08:08,560
unlikely to give us definitive outcomes

243
00:08:12,070 --> 00:08:10,879
or results okay that makes sense and i'm

244
00:08:13,990 --> 00:08:12,080
sorry i have to ask you said you're

245
00:08:16,309 --> 00:08:14,000
you're a twin yourself and and married

246
00:08:18,710 --> 00:08:16,319
to a twin uh i have twin sisters oh twin

247
00:08:20,629 --> 00:08:18,720
sisters and you're not twins yeah okay

248
00:08:22,950 --> 00:08:20,639
so they're females in both sets but i i

249
00:08:24,150 --> 00:08:22,960
so i understand female twin dynamics so

250
00:08:25,749 --> 00:08:24,160
pretty well all right

251
00:08:27,350 --> 00:08:25,759
all right then thanks so much for for

252
00:08:28,550 --> 00:08:27,360
visiting us with us we really appreciate