
PAO
Brion Au
PLUTO Flight Controller
Pat Ryan
NASA Public Affairs

1
00:00:10,070 --> 00:00:08,310
well good morning i'm pat ryan with the

2
00:00:12,549 --> 00:00:10,080
nasa public affairs office here at the

3
00:00:14,470 --> 00:00:12,559
johnson space center in houston we're in

4
00:00:17,109 --> 00:00:14,480
the international space station flight

5
00:00:19,750 --> 00:00:17,119
control room joining me is a brian awe

6
00:00:22,230 --> 00:00:19,760
who is a pluto flight controller

7
00:00:24,950 --> 00:00:22,240
what is a pluto flight controller brian

8
00:00:27,589 --> 00:00:24,960
uh it's an acronym it stands for plug-in

9
00:00:30,070 --> 00:00:27,599
port utilization officer

10
00:00:31,910 --> 00:00:30,080
and we provide

11
00:00:33,430 --> 00:00:31,920
plug-in services to the crew to make

12
00:00:35,350 --> 00:00:33,440
sure the equipment that they use on a

13
00:00:38,069 --> 00:00:35,360

day-to-day basis is compatible with

14
00:00:40,790 --> 00:00:38,079
other equipment and we contrive a plan

15
00:00:43,270 --> 00:00:40,800
on where to plug that equipment in

16
00:00:46,229 --> 00:00:43,280
and in addition to that we provide

17
00:00:47,510 --> 00:00:46,239
it support for the crew the the network

18
00:00:50,150 --> 00:00:47,520
support

19
00:00:53,029 --> 00:00:50,160
for an operations local area network

20
00:00:54,150 --> 00:00:53,039
that the crew uses to get their

21
00:00:56,830 --> 00:00:54,160
warning

22
00:01:01,830 --> 00:00:59,189
procedures their daily plan and what

23
00:01:04,869 --> 00:01:01,840
they're supposed to do for the day

24
00:01:07,109 --> 00:01:04,879
and that's also how they

25
00:01:08,630 --> 00:01:07,119
contact home that we've got an ip phone

26
00:01:10,630 --> 00:01:08,640
that they can use through the network

27
00:01:12,230 --> 00:01:10,640
that they can call anybody in the world

28
00:01:14,070 --> 00:01:12,240
you're supporting pretty much everything

29
00:01:15,670 --> 00:01:14,080
that goes on on board the station

30
00:01:17,990 --> 00:01:15,680
operations

31
00:01:20,310 --> 00:01:18,000
we're not doing commanding of the ship

32
00:01:22,789 --> 00:01:20,320
just the operations support

33
00:01:28,390 --> 00:01:22,799
so that's who we are and uh we're ready

34
00:01:31,670 --> 00:01:30,149
so hi i'm cole nelson from stonewash

35
00:01:32,950 --> 00:01:31,680
high school and i was wondering what are

36
00:01:34,870 --> 00:01:32,960
some of your favorite and least favorite

37
00:01:37,670 --> 00:01:34,880
parts about working for nasa

38
00:01:39,350 --> 00:01:37,680

the probably the most favorite part is

39
00:01:41,510 --> 00:01:39,360
really it's the awesome people that

40
00:01:43,670 --> 00:01:41,520
we've got working here we've got some

41
00:01:46,469 --> 00:01:43,680
incredibly smart folks

42
00:01:50,469 --> 00:01:46,479
and the teamwork that goes into making

43
00:01:52,710 --> 00:01:50,479
space flight happen is is just amazing

44
00:01:55,030 --> 00:01:52,720
the least favorite of all my activities

45
00:01:57,350 --> 00:01:55,040
here is catching up all the paperwork we

46
00:01:59,270 --> 00:01:57,360
have to document what we do that's how

47
00:02:00,789 --> 00:01:59,280
we carry forward

48
00:02:03,510 --> 00:02:00,799
the the

49
00:02:04,870 --> 00:02:03,520
solutions to problems we've solved and

50
00:02:06,630 --> 00:02:04,880
also

51
00:02:08,949 --> 00:02:06,640
carry forward the information for the

52
00:02:11,910 --> 00:02:08,959
future generations to use so yeah

53
00:02:13,589 --> 00:02:11,920
that paperwork's necessary

54
00:02:16,309 --> 00:02:13,599
go ahead next

55
00:02:25,670 --> 00:02:17,910
hi

56
00:02:29,030 --> 00:02:25,680
is very stressful

57
00:02:31,589 --> 00:02:29,040
no not really uh not no more stressful

58
00:02:34,229 --> 00:02:31,599
than let's say taking your driving test

59
00:02:36,790 --> 00:02:34,239
uh you first of all you have to learn

60
00:02:39,110 --> 00:02:36,800
uh you know about your mission and and

61
00:02:42,390 --> 00:02:39,120
we study each mission each phase of that

62
00:02:45,110 --> 00:02:42,400
flight uh in great detail we practice it

63
00:02:46,309 --> 00:02:45,120

uh we go through uh simulation sims as

64
00:02:50,070 --> 00:02:46,319
we call them

65
00:02:52,150 --> 00:02:50,080
uh we review the results of those sims

66
00:02:55,350 --> 00:02:52,160
to get better

67
00:02:56,309 --> 00:02:55,360
it's a kind of a maricopa when when you

68
00:03:05,910 --> 00:02:56,319
you

69
00:03:08,949 --> 00:03:05,920
the mission

70
00:03:11,350 --> 00:03:08,959
uh or watching a rocket launch it's it's

71
00:03:12,390 --> 00:03:11,360
just a matter of fact so you know that's

72
00:03:14,790 --> 00:03:12,400
you know when you go to take your

73
00:03:17,110 --> 00:03:14,800
driver's test now you got to show the

74
00:03:18,710 --> 00:03:17,120
the uh the evaluator that you you did a

75
00:03:26,630 --> 00:03:18,720
good job in learning what you were

76
00:03:31,030 --> 00:03:28,869
omar high school and my question is how

77
00:03:33,670 --> 00:03:31,040
often do you face emergencies and what

78
00:03:35,830 --> 00:03:33,680
are the most common types of emergencies

79
00:03:38,070 --> 00:03:35,840
well thankfully we don't encounter that

80
00:03:40,789 --> 00:03:38,080
many emergencies

81
00:03:43,509 --> 00:03:40,799
the the most frequent that we see on the

82
00:03:45,110 --> 00:03:43,519
space station itself are those involving

83
00:03:47,509 --> 00:03:45,120
smoke detection

84
00:03:49,190 --> 00:03:47,519
the smoke detectors are devices

85
00:03:50,710 --> 00:03:49,200
you have to pull air through them so

86
00:03:52,550 --> 00:03:50,720
they can detect the

87
00:03:55,750 --> 00:03:52,560
smoke particles

88
00:03:59,910 --> 00:03:55,760

and every once in a while we'll get a

89
00:04:02,309 --> 00:03:59,920
thankfully to now a false alarm

90
00:04:04,390 --> 00:04:02,319
but when when they do sound the alarm

91
00:04:06,149 --> 00:04:04,400
everybody stops what they're doing uh

92
00:04:07,110 --> 00:04:06,159
here in mission control and we help

93
00:04:09,509 --> 00:04:07,120
guide

94
00:04:12,149 --> 00:04:09,519
the crew through the uh

95
00:04:14,869 --> 00:04:12,159
isolating where the the

96
00:04:16,390 --> 00:04:14,879
signal is is being enunciated from which

97
00:04:18,629 --> 00:04:16,400
module

98
00:04:21,670 --> 00:04:18,639
the alarm is going off in and we also

99
00:04:25,030 --> 00:04:21,680
have information uh ready for the crew

100
00:04:28,230 --> 00:04:25,040
uh if to help them work through

101
00:04:30,390 --> 00:04:28,240
any extinguishing actions any actions

102
00:04:32,469 --> 00:04:30,400
they have to take to put out a fire if

103
00:04:34,230 --> 00:04:32,479
it were actual and we also have

104
00:04:36,550 --> 00:04:34,240
information ready for the crew so that

105
00:04:38,390 --> 00:04:36,560
if they have to evacuate the station

106
00:04:40,710 --> 00:04:38,400
they can do that safely

107
00:04:42,469 --> 00:04:40,720
but as you say it's it's not come to

108
00:04:43,670 --> 00:04:42,479
that although occasionally fire alarms

109
00:04:46,310 --> 00:04:43,680
do go off

110
00:04:48,710 --> 00:04:46,320
those alarms go off because some sort of

111
00:04:50,469 --> 00:04:48,720
particle has has come through them and

112
00:04:52,469 --> 00:04:50,479
other particles that are not part of

113
00:04:54,469 --> 00:04:52,479

smoke can sometimes set them off and

114
00:04:57,830 --> 00:04:54,479
that's usually what we see dust and and

115
00:05:00,150 --> 00:04:57,840
then uh human skin is the real tiny tiny

116
00:05:02,550 --> 00:05:00,160
flakes in micro g they tend to float

117
00:05:04,629 --> 00:05:02,560
there's they don't settle to the floor

118
00:05:06,230 --> 00:05:04,639
and as the air current pulls those

119
00:05:08,550 --> 00:05:06,240
through the the

120
00:05:11,270 --> 00:05:08,560
smoke detector

121
00:05:12,469 --> 00:05:11,280
they they sound a false alarm yeah

122
00:05:16,550 --> 00:05:12,479
okay

123
00:05:20,230 --> 00:05:18,469
hi i'm riley nelson from snohomish high

124
00:05:22,710 --> 00:05:20,240
school and my question is in your

125
00:05:24,150 --> 00:05:22,720
opinion what is the biggest uh challenge

126
00:05:26,710 --> 00:05:24,160
facing the future of american man's

127
00:05:28,550 --> 00:05:26,720
space flight oh riley unfortunately i

128
00:05:31,830 --> 00:05:28,560
don't think that's with inside the space

129
00:05:33,510 --> 00:05:31,840
program it's we've got a political and

130
00:05:34,790 --> 00:05:33,520
socio-economic

131
00:05:37,270 --> 00:05:34,800
uh

132
00:05:40,230 --> 00:05:37,280
issue that faced that the space

133
00:05:43,510 --> 00:05:40,240
administration is facing on on

134
00:05:47,189 --> 00:05:43,520
first of all identifying a a

135
00:05:49,270 --> 00:05:47,199
mission for nasa and then as we go about

136
00:05:51,270 --> 00:05:49,280
trying to satisfy that mission

137
00:05:54,310 --> 00:05:51,280
it's working uh

138
00:05:55,990 --> 00:05:54,320

to inform the the legislators that

139
00:05:57,430 --> 00:05:56,000
you know it's going to cost a little bit

140
00:05:59,350 --> 00:05:57,440
more than we thought because the

141
00:06:02,150 --> 00:05:59,360
problems are are

142
00:06:04,629 --> 00:06:02,160
greater than than we imagined

143
00:06:06,790 --> 00:06:04,639
so it it's the the funding now the

144
00:06:08,309 --> 00:06:06,800
technical stuff we've got really smart

145
00:06:12,230 --> 00:06:08,319
engineers some of the brightest people

146
00:06:14,790 --> 00:06:12,240
in in the world and and we also have a a

147
00:06:17,430 --> 00:06:14,800
knowledge bank of universities that we

148
00:06:19,590 --> 00:06:17,440
we pose problems to and let them work

149
00:06:22,710 --> 00:06:19,600
out issues so the technical stuff is

150
00:06:25,830 --> 00:06:22,720
actually easy it's the funding for

151
00:06:27,830 --> 00:06:25,840
nasa that is the the the biggest problem

152
00:06:33,990 --> 00:06:27,840
the biggest hurdle

153
00:06:38,550 --> 00:06:35,990
hi i'm sarah aldrich from lynn ritzville

154
00:06:40,309 --> 00:06:38,560
high school and my question is

155
00:06:42,629 --> 00:06:40,319
where do you see pluto going in the

156
00:06:44,150 --> 00:06:42,639
future are there any changes being made

157
00:06:46,830 --> 00:06:44,160
to it or

158
00:06:49,510 --> 00:06:46,840
oh sarah we're actually one of the the

159
00:06:51,430 --> 00:06:49,520
youngest flight controller disciplines

160
00:06:53,990 --> 00:06:51,440
here at nasa

161
00:06:56,870 --> 00:06:54,000
we started just a few years ago

162
00:06:59,029 --> 00:06:56,880
when the we migrated a network over that

163
00:07:01,909 --> 00:06:59,039

used to fly in the shuttle

164
00:07:03,110 --> 00:07:01,919
it was a little coax network and and

165
00:07:04,469 --> 00:07:03,120
it was

166
00:07:07,270 --> 00:07:04,479
strictly

167
00:07:09,270 --> 00:07:07,280
uh contained on board the station we'd

168
00:07:11,270 --> 00:07:09,280
get the crew their procedures and a

169
00:07:13,749 --> 00:07:11,280
morning message and and that was about

170
00:07:17,110 --> 00:07:13,759
it now the crew can dial anywhere around

171
00:07:19,670 --> 00:07:17,120
the world uh we've got a huge movie

172
00:07:22,309 --> 00:07:19,680
library that that

173
00:07:24,710 --> 00:07:22,319
is part of the network now

174
00:07:28,550 --> 00:07:24,720
we're looking for more and more ways to

175
00:07:30,790 --> 00:07:28,560
utilize the the i.t resources to offload

176
00:07:33,510 --> 00:07:30,800
the cruise so we can actually do some of

177
00:07:37,110 --> 00:07:33,520
their work uh down here on the ground

178
00:07:39,510 --> 00:07:37,120
so we the plutos are are looking forward

179
00:07:42,309 --> 00:07:39,520
to actually migrating to the long

180
00:07:44,790 --> 00:07:42,319
duration missions through orion and the

181
00:07:46,230 --> 00:07:44,800
other deep space missions

182
00:07:47,430 --> 00:07:46,240
probably one of the biggest problems

183
00:07:49,430 --> 00:07:47,440
that that

184
00:07:51,909 --> 00:07:49,440
we're faced with right now is increasing

185
00:07:54,869 --> 00:07:51,919
crew autonomy so we're looking at trying

186
00:07:58,950 --> 00:07:54,879
to enhance the programs that the crews

187
00:08:01,430 --> 00:07:58,960
use as a knowledge base so that they can

188
00:08:03,029 --> 00:08:01,440

become more autonomous to themselves

189
00:08:03,749 --> 00:08:03,039
they don't rely

190
00:08:05,670 --> 00:08:03,759
uh

191
00:08:08,070 --> 00:08:05,680
like the station guys do on mission

192
00:08:09,990 --> 00:08:08,080
control quite so much

193
00:08:13,430 --> 00:08:10,000
the more intelligence that they have

194
00:08:15,670 --> 00:08:13,440
tools that that are computer-based to

195
00:08:16,869 --> 00:08:15,680
help them work through problems uh

196
00:08:19,589 --> 00:08:16,879
without

197
00:08:22,710 --> 00:08:19,599
earth's call coming that's 20 minutes

198
00:08:24,629 --> 00:08:22,720
away to solve their problems is one of

199
00:08:26,469 --> 00:08:24,639
the big things we're studying right now

200
00:08:28,390 --> 00:08:26,479
yeah what you're referring to is that on

201
00:08:31,110 --> 00:08:28,400
future missions when we go to mars for

202
00:08:33,670 --> 00:08:31,120
example it takes about 20 minutes for a

203
00:08:35,909 --> 00:08:33,680
voice message to get from earth to mars

204
00:08:37,750 --> 00:08:35,919
so if houston called them it would take

205
00:08:38,550 --> 00:08:37,760
20 minutes to get there and then when

206
00:08:40,310 --> 00:08:38,560
they

207
00:08:41,990 --> 00:08:40,320
had an answer it would take 20 more

208
00:08:43,829 --> 00:08:42,000
minutes to get back

209
00:08:44,550 --> 00:08:43,839
so crews can't

210
00:08:47,110 --> 00:08:44,560
be

211
00:08:48,710 --> 00:08:47,120
have to rely on people on the ground to

212
00:08:50,230 --> 00:08:48,720
do things for them right away they have

213
00:08:53,030 --> 00:08:50,240

to become more self-sufficient in the

214
00:08:55,190 --> 00:08:53,040
future yes yes especially in emergencies

215
00:08:57,430 --> 00:08:55,200
they need answers now so we'll have

216
00:08:58,630 --> 00:08:57,440
tools developed to help through that

217
00:09:00,389 --> 00:08:58,640
problem

218
00:09:01,750 --> 00:09:00,399
we're also looking into different ways

219
00:09:04,470 --> 00:09:01,760
of helping them

220
00:09:06,470 --> 00:09:04,480
for their experiment problems

221
00:09:09,269 --> 00:09:06,480
if something's not going exactly right

222
00:09:10,310 --> 00:09:09,279
they can they can hit up a knowledge

223
00:09:12,389 --> 00:09:10,320
base

224
00:09:14,470 --> 00:09:12,399
that will help them resolve the issue

225
00:09:15,750 --> 00:09:14,480
and and then get the the experiment back

226
00:09:17,910 --> 00:09:15,760
on track

227
00:09:22,150 --> 00:09:17,920
okay next question

228
00:09:26,630 --> 00:09:24,150
hello my name is hudo from inglemoor

229
00:09:28,630 --> 00:09:26,640
high school and if my understanding of

230
00:09:31,350 --> 00:09:28,640
pluto is correct then i have two

231
00:09:33,829 --> 00:09:31,360
different questions the first one is how

232
00:09:37,350 --> 00:09:33,839
is wiring in space different from

233
00:09:39,350 --> 00:09:37,360
writing from

234
00:09:41,430 --> 00:09:39,360
question is what kind of training like

235
00:09:43,269 --> 00:09:41,440
electrical engineering do you need to do

236
00:09:44,470 --> 00:09:43,279
your job

237
00:09:46,790 --> 00:09:44,480
the

238
00:09:49,829 --> 00:09:46,800

we we do have numerous electrical

239
00:09:51,750 --> 00:09:49,839
engineers that are pluto's we also have

240
00:09:54,150 --> 00:09:51,760
computer engineers and then computer

241
00:09:56,550 --> 00:09:54,160
science majors uh that are part of the

242
00:09:59,269 --> 00:09:56,560
pluto team and we kind of teach each

243
00:10:02,710 --> 00:09:59,279
other the side that we're we're not as

244
00:10:04,790 --> 00:10:02,720
strong in or where our undergrad work

245
00:10:08,150 --> 00:10:04,800
was not

246
00:10:10,630 --> 00:10:08,160
the wiring on board the space station is

247
00:10:12,389 --> 00:10:10,640
it's direct current uh so it's very

248
00:10:15,430 --> 00:10:12,399
simple circuits

249
00:10:16,829 --> 00:10:15,440
um it's no different it follows a very

250
00:10:19,509 --> 00:10:16,839
very strict

251
00:10:21,829 --> 00:10:19,519
code to use the term that they use in

252
00:10:24,550 --> 00:10:21,839
the construction industries

253
00:10:27,110 --> 00:10:24,560
so that the it's done correctly and it's

254
00:10:29,990 --> 00:10:27,120
verified and it's and it's very

255
00:10:32,389 --> 00:10:30,000
uh forgiving to

256
00:10:34,150 --> 00:10:32,399
faults that may may occur

257
00:10:36,710 --> 00:10:34,160
we try to keep it as safe as we can for

258
00:10:40,630 --> 00:10:36,720
the crew the big problem that we see

259
00:10:41,430 --> 00:10:40,640
with electrical current in microgravity

260
00:10:44,630 --> 00:10:41,440
is

261
00:10:45,509 --> 00:10:44,640
its ability to spark

262
00:10:49,110 --> 00:10:45,519
and

263
00:10:50,710 --> 00:10:49,120

voltage

264
00:10:53,750 --> 00:10:50,720
and the current that is

265
00:10:55,430 --> 00:10:53,760
passing through a wire

266
00:10:57,590 --> 00:10:55,440
at a certain level it will create a

267
00:10:59,990 --> 00:10:57,600
spark in space

268
00:11:01,430 --> 00:11:00,000
that's not good because those sparks

269
00:11:04,710 --> 00:11:01,440
usually contain

270
00:11:05,829 --> 00:11:04,720
very small particles of molten metal

271
00:11:07,110 --> 00:11:05,839
and

272
00:11:08,870 --> 00:11:07,120
with

273
00:11:11,350 --> 00:11:08,880
in micro g that that actually could

274
00:11:14,389 --> 00:11:11,360
float and get into the crew's eyes

275
00:11:15,430 --> 00:11:14,399
and because there's a lack of convection

276
00:11:17,829 --> 00:11:15,440
cooling

277
00:11:19,750 --> 00:11:17,839
the metal is going to stay hotter longer

278
00:11:21,350 --> 00:11:19,760
so it has the potential to burn the crew

279
00:11:22,870 --> 00:11:21,360
members so we have to understand that

280
00:11:24,630 --> 00:11:22,880
and and

281
00:11:26,829 --> 00:11:24,640
put in countermeasures to help the crew

282
00:11:29,350 --> 00:11:26,839
stay safe for when they're connecting

283
00:11:31,030 --> 00:11:29,360
disconnecting make sure you de-energize

284
00:11:32,550 --> 00:11:31,040
circuits and there's some some common

285
00:11:35,269 --> 00:11:32,560
sense stuff like that that the crew

286
00:11:37,190 --> 00:11:35,279
practices before they go and we also

287
00:11:39,030 --> 00:11:37,200
include

288
00:11:40,870 --> 00:11:39,040

messages inside the procedures when

289
00:11:43,110 --> 00:11:40,880
they're connecting disconnecting stuff

290
00:11:46,310 --> 00:11:43,120
to make sure that they follow the right

291
00:11:47,269 --> 00:11:46,320
steps to do that safely

292
00:11:52,629 --> 00:11:47,279
okay

293
00:11:58,550 --> 00:11:55,030
hello my name is ben beck from newport

294
00:12:00,870 --> 00:11:58,560
high school and so i'm wondering if um

295
00:12:03,430 --> 00:12:00,880
will there be less astronauts in space

296
00:12:05,990 --> 00:12:03,440
in the future as wireless instrumental

297
00:12:07,509 --> 00:12:06,000
instrumentation system technology grows

298
00:12:10,550 --> 00:12:07,519
in the future

299
00:12:12,230 --> 00:12:10,560
no we've got several projects right now

300
00:12:14,470 --> 00:12:12,240
that utilize the wireless

301
00:12:16,790 --> 00:12:14,480
instrumentation system even to go

302
00:12:17,910 --> 00:12:16,800
outside the station now

303
00:12:20,389 --> 00:12:17,920
we've got a

304
00:12:22,470 --> 00:12:20,399
the current system is is two phase we

305
00:12:24,389 --> 00:12:22,480
have an internal section

306
00:12:26,629 --> 00:12:24,399
and an external section that measures

307
00:12:31,110 --> 00:12:26,639
vibrations through the station we're

308
00:12:33,430 --> 00:12:31,120
extending that network now to include uh

309
00:12:36,150 --> 00:12:33,440
evas when the crew actually goes outside

310
00:12:38,069 --> 00:12:36,160
eva we can talk to them wireless

311
00:12:39,670 --> 00:12:38,079
we can see their video that comes back

312
00:12:42,069 --> 00:12:39,680
in wireless

313
00:12:44,949 --> 00:12:42,079

so actually what that's going to do is

314
00:12:47,350 --> 00:12:44,959
is make us able to assist the crew in

315
00:12:49,750 --> 00:12:47,360
more ways from the ground versus have

316
00:12:53,030 --> 00:12:49,760
cutting down the crew

317
00:12:55,269 --> 00:12:53,040
the uh to to get the crew more engaged

318
00:12:57,990 --> 00:12:55,279
in in different projects we're using our

319
00:13:00,150 --> 00:12:58,000
technology uh to offload the crew so

320
00:13:01,750 --> 00:13:00,160
that they can spend more time doing the

321
00:13:03,190 --> 00:13:01,760
actual science and

322
00:13:06,710 --> 00:13:03,200
and other actions that they need to

323
00:13:11,430 --> 00:13:06,720
onboard the station

324
00:13:16,790 --> 00:13:13,110
hi i'm jacob from view harbor high

325
00:13:19,829 --> 00:13:16,800
school and um my questions were uh what

326
00:13:21,829 --> 00:13:19,839
is being done to standardize like uh

327
00:13:24,710 --> 00:13:21,839
data and electrical connections with the

328
00:13:27,670 --> 00:13:24,720
international uh different devices

329
00:13:29,590 --> 00:13:27,680
and um my second question is uh what

330
00:13:32,230 --> 00:13:29,600
specific challenges do you face

331
00:13:35,670 --> 00:13:32,240
uh with uh earth to space communications

332
00:13:36,389 --> 00:13:35,680
versus long-range earth communications

333
00:13:40,870 --> 00:13:36,399
the

334
00:13:42,550 --> 00:13:40,880
we use actually are standard

335
00:13:45,030 --> 00:13:42,560
nasa has a

336
00:13:47,269 --> 00:13:45,040
a document that controls

337
00:13:49,350 --> 00:13:47,279
each connector how it is used which one

338
00:13:51,509 --> 00:13:49,360

is used for which purpose and the

339
00:13:54,150 --> 00:13:51,519
voltage and because we we're actually

340
00:13:56,230 --> 00:13:54,160
running two systems we've got a 28 volt

341
00:13:58,629 --> 00:13:56,240
system that operates and we have a 120

342
00:14:00,310 --> 00:13:58,639
volt dc system that operates

343
00:14:02,550 --> 00:14:00,320
so those are well defined there's an

344
00:14:04,069 --> 00:14:02,560
interface control document that's that's

345
00:14:07,269 --> 00:14:04,079
its title

346
00:14:08,790 --> 00:14:07,279
that specify what type of connectors and

347
00:14:11,990 --> 00:14:08,800
and

348
00:14:13,030 --> 00:14:12,000
get these to make sure that things do

349
00:14:16,710 --> 00:14:13,040
connect

350
00:14:19,189 --> 00:14:16,720
now for the communications question

351
00:14:21,110 --> 00:14:19,199
even today we have a

352
00:14:22,230 --> 00:14:21,120
about a two to two and a half second

353
00:14:25,269 --> 00:14:22,240
delay

354
00:14:27,509 --> 00:14:25,279
in the time it takes communications to

355
00:14:29,189 --> 00:14:27,519
reach from here let's say at mission

356
00:14:31,350 --> 00:14:29,199
control in houston

357
00:14:33,829 --> 00:14:31,360
up to the tdrs satellites and then over

358
00:14:36,470 --> 00:14:33,839
to the space station

359
00:14:37,670 --> 00:14:36,480
so even with that delay it it does cause

360
00:14:41,189 --> 00:14:37,680
problems

361
00:14:44,150 --> 00:14:41,199
pluto's

362
00:14:47,189 --> 00:14:44,160
with the crew using software that may be

363
00:14:49,829 --> 00:14:47,199

communicating via this tdrs network to

364
00:14:52,069 --> 00:14:49,839
the ground through the ku system

365
00:14:55,030 --> 00:14:52,079
that the software doesn't tolerate those

366
00:14:56,870 --> 00:14:55,040
delays so we've we've got to

367
00:15:01,030 --> 00:14:56,880
work through

368
00:15:02,790 --> 00:15:01,040
a delay tolerant network issue

369
00:15:04,069 --> 00:15:02,800
the network is delay tolerant we know

370
00:15:05,430 --> 00:15:04,079
that and that's that's the way it was

371
00:15:07,990 --> 00:15:05,440
developed but some of the software that

372
00:15:10,230 --> 00:15:08,000
we're actually using

373
00:15:12,870 --> 00:15:10,240
does not tolerate that two two and a

374
00:15:15,509 --> 00:15:12,880
half second delay from when it sends

375
00:15:17,269 --> 00:15:15,519
a call for data out and it needs an

376
00:15:19,350 --> 00:15:17,279
answer back usually those are in

377
00:15:20,870 --> 00:15:19,360
milliseconds so do you have to rewrite

378
00:15:23,509 --> 00:15:20,880
the software

379
00:15:25,030 --> 00:15:23,519
um we've we've actually rewritten

380
00:15:26,949 --> 00:15:25,040
software

381
00:15:27,990 --> 00:15:26,959
we've got a team that does that we've

382
00:15:30,150 --> 00:15:28,000
also

383
00:15:32,310 --> 00:15:30,160
created hardware

384
00:15:34,069 --> 00:15:32,320
that will

385
00:15:37,350 --> 00:15:34,079
literally and i don't want to use the

386
00:15:38,389 --> 00:15:37,360
term fake out but it accounts for that

387
00:15:41,590 --> 00:15:38,399
time

388
00:15:44,389 --> 00:15:41,600

delay and the software doesn't crash

389
00:15:45,910 --> 00:15:44,399
because of that delay so yeah we will we

390
00:15:46,949 --> 00:15:45,920
have both software and hardware

391
00:15:49,749 --> 00:15:46,959
solutions

392
00:15:55,990 --> 00:15:49,759
to those problems

393
00:15:58,790 --> 00:15:57,829
hi i'm nick mcgill from bellevue high

394
00:16:00,389 --> 00:15:58,800
school

395
00:16:01,990 --> 00:16:00,399
what means of propulsion are you

396
00:16:03,829 --> 00:16:02,000
currently considering using on the

397
00:16:06,069 --> 00:16:03,839
manned mission of mars

398
00:16:09,430 --> 00:16:06,079
well right now to get off the earth we

399
00:16:10,790 --> 00:16:09,440
have to use chemical rockets uh there's

400
00:16:13,030 --> 00:16:10,800
several different

401
00:16:15,110 --> 00:16:13,040
schools of thought on you know

402
00:16:18,470 --> 00:16:15,120
which rocket engine should run on

403
00:16:22,470 --> 00:16:18,480
kerosene or liquid hydrogen and liquid

404
00:16:24,870 --> 00:16:22,480
oxygen and and others or even alcohol

405
00:16:26,470 --> 00:16:24,880
but we do have several different ion

406
00:16:29,189 --> 00:16:26,480
thrusters

407
00:16:32,470 --> 00:16:29,199
that folks have been working on

408
00:16:35,350 --> 00:16:32,480
and we just need to get funding so that

409
00:16:36,870 --> 00:16:35,360
we can push to get much larger ion

410
00:16:38,710 --> 00:16:36,880
thrusters

411
00:16:40,230 --> 00:16:38,720
and

412
00:16:43,509 --> 00:16:40,240
they're actually

413
00:16:46,230 --> 00:16:43,519

large enough to propel something from

414
00:16:49,110 --> 00:16:46,240
let's say a high earth orbit out to mars

415
00:16:51,670 --> 00:16:49,120
and then actually back

416
00:16:54,069 --> 00:16:51,680
so it's a combination chemical and then

417
00:16:58,949 --> 00:16:54,079
ion thrusters

418
00:17:02,790 --> 00:17:01,110
my name is eric peterson i am from

419
00:17:05,270 --> 00:17:02,800
charles right academy

420
00:17:08,470 --> 00:17:05,280
and i want us to know what is the most

421
00:17:10,949 --> 00:17:08,480
stressful mission you've participated in

422
00:17:12,710 --> 00:17:10,959
oh eric uh let's see

423
00:17:15,510 --> 00:17:12,720
well i mean pluto's really don't get

424
00:17:18,309 --> 00:17:15,520
involved and and you know the things

425
00:17:19,029 --> 00:17:18,319
that go boom

426
00:17:21,350 --> 00:17:19,039
so

427
00:17:22,630 --> 00:17:21,360
actually the the most stressful i'll

428
00:17:24,309 --> 00:17:22,640
kind of break that down into two

429
00:17:26,630 --> 00:17:24,319
different ways

430
00:17:29,590 --> 00:17:26,640
the complexity of the the 12a and the

431
00:17:31,669 --> 00:17:29,600
12a.1 mission back in and i think march

432
00:17:33,110 --> 00:17:31,679
of 2006

433
00:17:35,990 --> 00:17:33,120
were just

434
00:17:38,310 --> 00:17:36,000
a ton of work for the pluto's the the

435
00:17:39,350 --> 00:17:38,320
crew was the shuttle mission was taking

436
00:17:42,470 --> 00:17:39,360
up

437
00:17:44,870 --> 00:17:42,480
a uh parts of the the truss the solar

438
00:17:46,870 --> 00:17:44,880

arrays and as they reconfigured and

439
00:17:48,870 --> 00:17:46,880
attached the new arrays

440
00:17:50,950 --> 00:17:48,880
the uh the power buses were actually

441
00:17:52,470 --> 00:17:50,960
being

442
00:17:54,470 --> 00:17:52,480
reconfigured

443
00:17:55,750 --> 00:17:54,480
so in order to make sure that the crew

444
00:17:58,549 --> 00:17:55,760
had

445
00:18:00,630 --> 00:17:58,559
their onboard services literally

446
00:18:03,350 --> 00:18:00,640
the power that they needed to

447
00:18:05,270 --> 00:18:03,360
to conduct all these activities uh we

448
00:18:06,070 --> 00:18:05,280
had to come up with a plan

449
00:18:11,430 --> 00:18:06,080
to

450
00:18:14,470 --> 00:18:11,440
different power channel and and then we

451
00:18:16,470 --> 00:18:14,480
literally managed that on an eva by eva

452
00:18:18,630 --> 00:18:16,480
basis when the crew was out

453
00:18:20,950 --> 00:18:18,640
literally switching these connections

454
00:18:23,990 --> 00:18:20,960
right so we we had to keep flight the

455
00:18:25,990 --> 00:18:24,000
flight director and appraised of what

456
00:18:28,310 --> 00:18:26,000
services he did have and what he didn't

457
00:18:29,270 --> 00:18:28,320
have

458
00:18:43,750 --> 00:18:29,280
the

459
00:18:46,390 --> 00:18:43,760
that mission was 16 days long

460
00:18:48,870 --> 00:18:46,400
and we had sliding shifts from launch

461
00:18:51,430 --> 00:18:48,880
until they landed

462
00:18:53,590 --> 00:18:51,440
and we extended that mission

463
00:18:57,110 --> 00:18:53,600

by another couple of days because we had

464
00:18:57,990 --> 00:18:57,120
to put in a a fourth eva

465
00:19:00,390 --> 00:18:58,000
and

466
00:19:02,950 --> 00:19:00,400
at the end of those 16 days

467
00:19:04,390 --> 00:19:02,960
with not being able to stay on the same

468
00:19:06,950 --> 00:19:04,400
sleep schedule

469
00:19:10,070 --> 00:19:06,960
i was both physically and mentally just

470
00:19:11,909 --> 00:19:10,080
fatigued that was a long time to spend

471
00:19:14,549 --> 00:19:11,919
nine hours a shift

472
00:19:16,950 --> 00:19:14,559
every day coming into mission control

473
00:19:18,230 --> 00:19:16,960
and then making sure nothing went wrong

474
00:19:21,750 --> 00:19:18,240
so yeah that

475
00:19:23,510 --> 00:19:21,760
two different kind of ways but yeah it's

476
00:19:34,789 --> 00:19:23,520
those are my most memorable missions

477
00:19:38,710 --> 00:19:36,950
lake stevens high school and my question

478
00:19:40,789 --> 00:19:38,720
was what are the greatest dangers that

479
00:19:43,190 --> 00:19:40,799
you have faced in missions and what are

480
00:19:46,150 --> 00:19:43,200
the greatest dangers nasa now faces in

481
00:19:48,310 --> 00:19:46,160
regard to space travel

482
00:19:49,909 --> 00:19:48,320
oh let's see for mission controllers my

483
00:19:53,510 --> 00:19:49,919
greatest danger is just getting in

484
00:19:54,950 --> 00:19:53,520
traffic and getting to work driving yes

485
00:19:57,590 --> 00:19:54,960
yeah the uh

486
00:19:59,990 --> 00:19:57,600
the crew unfortunately is faced with a

487
00:20:02,310 --> 00:20:00,000
very hostile and an unforgiving

488
00:20:03,750 --> 00:20:02,320

environment out in space that's why they

489
00:20:05,430 --> 00:20:03,760
have the controllers down here on the

490
00:20:06,950 --> 00:20:05,440
ground looking over their shoulder we

491
00:20:08,710 --> 00:20:06,960
actually do more

492
00:20:10,310 --> 00:20:08,720
to operate the space station than the

493
00:20:12,149 --> 00:20:10,320
crew actually does

494
00:20:14,390 --> 00:20:12,159
we keep track of all of the

495
00:20:16,470 --> 00:20:14,400
environmental controls the power

496
00:20:18,630 --> 00:20:16,480
generation the thermal

497
00:20:21,190 --> 00:20:18,640
rejection the heat that's generated by

498
00:20:22,789 --> 00:20:21,200
all the electric equipment that's used

499
00:20:25,110 --> 00:20:22,799
and then all the stuff that the crew

500
00:20:26,390 --> 00:20:25,120
uses to to accomplish their tasks and

501
00:20:28,630 --> 00:20:26,400
and even

502
00:20:30,789 --> 00:20:28,640
monitoring uh some of the experiments

503
00:20:33,830 --> 00:20:30,799
which could be potentially very

504
00:20:34,630 --> 00:20:33,840
dangerous if if they they ran unchecked

505
00:20:37,430 --> 00:20:34,640
or

506
00:20:41,750 --> 00:20:39,669
and because of that again this go back

507
00:20:43,590 --> 00:20:41,760
to that crew autonomy stuff we're trying

508
00:20:44,950 --> 00:20:43,600
to work on programs that will help the

509
00:20:46,950 --> 00:20:44,960
crew

510
00:20:49,590 --> 00:20:46,960
to operate

511
00:20:51,430 --> 00:20:49,600
just among themselves uh instead of

512
00:20:53,190 --> 00:20:51,440
relying so much on mcc so we're

513
00:20:55,830 --> 00:20:53,200

developing a lot of those autonomy

514
00:20:58,070 --> 00:20:55,840
programs and we actually do experiments

515
00:20:59,669 --> 00:20:58,080
with the crew

516
00:21:02,310 --> 00:20:59,679
where we

517
00:21:05,270 --> 00:21:02,320
simulate not being able to talk to earth

518
00:21:06,870 --> 00:21:05,280
except maybe once five minutes for

519
00:21:09,270 --> 00:21:06,880
every hour

520
00:21:12,390 --> 00:21:09,280
on these experiment type days

521
00:21:14,549 --> 00:21:12,400
so it's it's pretty neat to see and get

522
00:21:17,830 --> 00:21:14,559
feedback from the crew on how things did

523
00:21:19,590 --> 00:21:17,840
or didn't work so that we can tailor you

524
00:21:21,350 --> 00:21:19,600
know our operations here on the ground

525
00:21:23,110 --> 00:21:21,360
to help them better

526
00:21:25,430 --> 00:21:23,120
clearly the environment for them there

527
00:21:27,830 --> 00:21:25,440
is dangerous but there are so many

528
00:21:29,430 --> 00:21:27,840
systems that are built into

529
00:21:32,149 --> 00:21:29,440
this vehicle

530
00:21:33,909 --> 00:21:32,159
along with the the backup for control

531
00:21:36,470 --> 00:21:33,919
that comes down here that on a

532
00:21:39,590 --> 00:21:36,480
day-to-day basis as they go about their

533
00:21:41,350 --> 00:21:39,600
jobs it's really not an issue but

534
00:21:43,110 --> 00:21:41,360
the crew members are also very well

535
00:21:45,590 --> 00:21:43,120
trained to respond to anything that does

536
00:21:47,669 --> 00:21:45,600
happen yes they they are well-versed in

537
00:21:49,510 --> 00:21:47,679
the emergency response to all of the

538
00:21:51,029 --> 00:21:49,520

systems on board

539
00:21:53,190 --> 00:21:51,039
and as a matter of fact the controllers

540
00:21:55,190 --> 00:21:53,200
here on the ground most often will know

541
00:21:57,110 --> 00:21:55,200
when something is going wrong before the

542
00:21:58,470 --> 00:21:57,120
crew will and and

543
00:22:01,270 --> 00:21:58,480
that's that's

544
00:22:04,230 --> 00:22:01,280
why we're here and for every person that

545
00:22:07,029 --> 00:22:04,240
you see sitting in mission control

546
00:22:10,149 --> 00:22:07,039
uh on the tv screen there's usually

547
00:22:12,630 --> 00:22:10,159
sometimes two three or even four people

548
00:22:16,070 --> 00:22:12,640
sitting in a what we call the back room

549
00:22:18,149 --> 00:22:16,080
uh supporting the the lead controller in

550
00:22:20,149 --> 00:22:18,159
in the the flight control room here with

551
00:22:22,950 --> 00:22:20,159
the flight director so there's there's

552
00:22:24,789 --> 00:22:22,960
definitely multiple sets of eyes uh

553
00:22:27,110 --> 00:22:24,799
watching over the crew and making sure

554
00:22:29,029 --> 00:22:27,120
that the vehicle is safe for them

555
00:22:30,310 --> 00:22:29,039
okay i think do we have time for one

556
00:22:32,070 --> 00:22:30,320
more

557
00:22:34,230 --> 00:22:32,080
no i think we're we don't have time for

558
00:22:35,990 --> 00:22:34,240
one more okay i'm told uh brian thanks

559
00:22:38,549 --> 00:22:36,000
very much it's really interesting

560
00:22:40,950 --> 00:22:38,559
information and uh and i hope that you

561
00:22:42,390 --> 00:22:40,960
guys in washington got the answers that

562
00:22:43,830 --> 00:22:42,400
you were looking for and we sure

563
00:22:45,830 --> 00:22:43,840

appreciate the questions thank you very