Public Lecture Series

Topic: The View from Mission Operations

Speaker: Courtney McManus,
Space Telescope Science Institute

1
00:00:12,700 --> 00:00:03,340
here tonight I'm dr. Frank summers from

2
00:00:18,620 --> 00:00:12,710
outreach Mic Check Mic Check it's out

3
00:00:21,560 --> 00:00:18,630
get my voice right other question do we

4
00:00:22,910 --> 00:00:21,570
have enough lithographs as we have we

5
00:00:26,720 --> 00:00:22,920
have a rather large audience because

6
00:00:28,130 --> 00:00:26,730
Kourtney is obviously famous do we need

7
00:00:32,030 --> 00:00:28,140
more lithographs do I need to go grab

8
00:00:34,100 --> 00:00:32,040
some at the halftime we seem to be okay

9
00:00:36,170 --> 00:00:34,110
or somebody saying yes we need more okay

10
00:00:39,880 --> 00:00:36,180
I'll get more all right all right Thomas

11
00:00:44,119 --> 00:00:42,170
good evening ladies and gentlemen I am

12
00:00:46,400 --> 00:00:44,129
dr. Frank summers from the office of

13
00:00:49,069 --> 00:00:46,410

public outreach and it is my pleasure to

14
00:00:52,459 --> 00:00:49,079
be your host for the public lecture

15
00:00:54,920 --> 00:00:52,469
series tonight when you came in there

16
00:00:57,529 --> 00:00:54,930
are images of the jovian planets over

17
00:01:00,740 --> 00:00:57,539
here and over here if you didn't get one

18
00:01:02,990 --> 00:01:00,750
grab one on the way out and if you don't

19
00:01:04,729 --> 00:01:03,000
know what jovian planets are well you

20
00:01:07,070 --> 00:01:04,739
didn't pay attention in school or they

21
00:01:08,840 --> 00:01:07,080
didn't use the term Jovian uh-huh but

22
00:01:12,649 --> 00:01:08,850
look on the back of the lithograph and

23
00:01:15,380 --> 00:01:12,659
they will explain it all to you tonight

24
00:01:17,749 --> 00:01:15,390
our speaker is Courtney McManus this is

25
00:01:19,730 --> 00:01:17,759
this is one of the fun things okay that

26
00:01:22,609 --> 00:01:19,740
we get to do here we get to tell you the

27
00:01:24,980 --> 00:01:22,619
inside story of what goes on behind the

28
00:01:26,840 --> 00:01:24,990
scenes of these amazing programs so this

29
00:01:29,120 --> 00:01:26,850
is the view from Mission Operations I

30
00:01:32,390 --> 00:01:29,130
know very little about it so I'm looking

31
00:01:33,520 --> 00:01:32,400
forward to hearing all this talk let's

32
00:01:38,030 --> 00:01:33,530
see next month

33
00:01:39,590 --> 00:01:38,040
Nolan Walborn will be talking on active

34
00:01:41,960 --> 00:01:39,600
luminous blue variables in the large

35
00:01:44,149 --> 00:01:41,970
magellanic cloud and if you want to know

36
00:01:46,940 --> 00:01:44,159
what that means show up he sent me his

37
00:01:50,319 --> 00:01:46,950
abstract today and it looks like it's a

38
00:01:53,600 --> 00:01:50,329

nice juicy science topic talking about

39
00:01:57,859 --> 00:01:53,610
some very very bright stars in a

40
00:01:59,660 --> 00:01:57,869
satellite galaxy in October oh we have a

41
00:02:01,730 --> 00:01:59,670
really another really special talk

42
00:02:06,740 --> 00:02:01,740
because because the Cassini mission has

43
00:02:08,930 --> 00:02:06,750
been at Saturn for over a decade amazing

44
00:02:10,430 --> 00:02:08,940
images and its grand finale is

45
00:02:13,370 --> 00:02:10,440
mid-september I think it's like

46
00:02:15,980 --> 00:02:13,380
September 15th all right and so on

47
00:02:19,280 --> 00:02:15,990
tober third bonny monkey our saturn

48
00:02:21,200 --> 00:02:19,290
specialist here it's based health scope

49
00:02:24,020 --> 00:02:21,210
we'll be telling you all about Cassini's

50
00:02:25,580 --> 00:02:24,030
grand finale and i don't know what

51
00:02:27,110 --> 00:02:25,590
she'll be talking about she doesn't know

52
00:02:29,090 --> 00:02:27,120
what she'll be talking about because it

53
00:02:31,130 --> 00:02:29,100
hasn't happened yet so she will be

54
00:02:34,220 --> 00:02:31,140
spending the last two weeks of of

55
00:02:36,230 --> 00:02:34,230
September creating this amazing talk for

56
00:02:37,340 --> 00:02:36,240
you of course there's always stuff that

57
00:02:39,350 --> 00:02:37,350
Cassini has done before

58
00:02:43,550 --> 00:02:39,360
all right November we have the famous

59
00:02:46,040 --> 00:02:43,560
TBA which means I need to get on email

60
00:02:47,810 --> 00:02:46,050
and start twisting people's arms if you

61
00:02:49,820 --> 00:02:47,820
want to find out whose arm I do twist

62
00:02:53,210 --> 00:02:49,830
you can check our public lecture series

63
00:02:54,740 --> 00:02:53,220

website if you just go to your favorite

64
00:02:56,840 --> 00:02:54,750
favorite search engine

65
00:02:59,000 --> 00:02:56,850
typing Hubbell public talks you will

66
00:03:01,220 --> 00:02:59,010
find this web page where we have the

67
00:03:04,430 --> 00:03:01,230
list of the upcoming lectures we have

68
00:03:07,190 --> 00:03:04,440
the links to watch the live streams on

69
00:03:09,800 --> 00:03:07,200
the first Tuesday of every month as well

70
00:03:12,800 --> 00:03:09,810
as the list for the archives of the past

71
00:03:14,270 --> 00:03:12,810
lectures also if you would like to sign

72
00:03:17,660 --> 00:03:14,280
up for our mailing list this is the

73
00:03:20,060 --> 00:03:17,670
easiest way to do so just enter your

74
00:03:24,650 --> 00:03:20,070
email here hit that subscribe button and

75
00:03:27,200 --> 00:03:24,660
it will sign you up for our emails the

76
00:03:28,520 --> 00:03:27,210
announcements if you don't want to sign

77
00:03:30,560 --> 00:03:28,530
up at the website you can just provide

78
00:03:33,200 --> 00:03:30,570
your email address to me somebody

79
00:03:36,020 --> 00:03:33,210
already did that this evening and I will

80
00:03:38,810 --> 00:03:36,030
do my best to get you on there okay and

81
00:03:42,560 --> 00:03:38,820
I think we've got a perfect record of no

82
00:03:44,690 --> 00:03:42,570
spam ever on that email list if you have

83
00:03:48,260 --> 00:03:44,700
comments or questions you can also send

84
00:03:53,630 --> 00:03:48,270
them to us at public lecture at STScI

85
00:03:56,120 --> 00:03:53,640
dot edu social media I updated this

86
00:03:58,310 --> 00:03:56,130
because we've got a new push on a social

87
00:04:00,560 --> 00:03:58,320
media you know we've been known as the

88
00:04:02,480 --> 00:04:00,570

home of hubble right but what's

89
00:04:04,850 --> 00:04:02,490
happening next year the James Webb Space

90
00:04:06,710 --> 00:04:04,860
Telescope is launching so we aren't just

91
00:04:09,200 --> 00:04:06,720
the Hubble place we're also going to be

92
00:04:10,940 --> 00:04:09,210
the James Webb place and well we're

93
00:04:12,860 --> 00:04:10,950
really the Space Telescope Science

94
00:04:14,990 --> 00:04:12,870
Institute so our social media is

95
00:04:17,000 --> 00:04:15,000
expanding from just Hubble to also

96
00:04:19,220 --> 00:04:17,010
including a STScI

97
00:04:23,480 --> 00:04:19,230
so on Facebook we have Hubble telescope

98
00:04:25,880 --> 00:04:23,490
we also have our stsci page on facebook

99
00:04:27,290 --> 00:04:25,890
twitter has Hubble telescope as well as

100
00:04:29,360 --> 00:04:27,300
Space Telescope

101
00:04:31,129 --> 00:04:29,370
you - we just have Hubble sight Channel

102
00:04:33,350 --> 00:04:31,139
and on Instagram we have Space

103
00:04:36,499 --> 00:04:33,360
Telescope's so I think you'll see our

104
00:04:38,360 --> 00:04:36,509
branding grow beyond just being Hubble

105
00:04:39,800 --> 00:04:38,370
Hubble and Webb and being Space

106
00:04:41,839 --> 00:04:39,810
Telescope's over the next couple years

107
00:04:44,809 --> 00:04:41,849
so that's something to look forward to

108
00:04:47,119 --> 00:04:44,819
for myself you can follow me on Facebook

109
00:04:49,010 --> 00:04:47,129
Google+ or Twitter I don't do a heck of

110
00:04:55,010 --> 00:04:49,020
a lot of it so it's not the most

111
00:04:58,670 --> 00:04:55,020
exciting exciting not a very very full

112
00:05:01,369 --> 00:04:58,680
feed how about that okay Observatory I

113
00:05:04,279 --> 00:05:01,379

did not get an email but it was raining

114
00:05:06,580 --> 00:05:04,289
at 6:00 p.m. did it clear up since then

115
00:05:09,170 --> 00:05:06,590
you guys coming in somebody saying yes

116
00:05:11,749 --> 00:05:09,180
okay a little bit all right so we're not

117
00:05:13,760 --> 00:05:11,759
sure whether there will be observing but

118
00:05:16,309 --> 00:05:13,770
that person will show up around 9:00

119
00:05:19,610 --> 00:05:16,319
9:15 and remind me at the end of the

120
00:05:22,070 --> 00:05:19,620
talk to ask if arena is here okay okay

121
00:05:24,879 --> 00:05:22,080
and now our news from the universe for

122
00:05:28,430 --> 00:05:24,889
August 2017

123
00:05:32,689 --> 00:05:28,440
our first story tonight giant arc

124
00:05:34,730 --> 00:05:32,699
reveals tiny details all right so we're

125
00:05:36,230 --> 00:05:34,740
talking about gravitational lensing and

126
00:05:38,749 --> 00:05:36,240
actually we've had a lot of stories

127
00:05:41,420 --> 00:05:38,759
lately about gravitational lensing this

128
00:05:43,279 --> 00:05:41,430
is gravitational lensing by a cluster of

129
00:05:45,260 --> 00:05:43,289
galaxies and so the configuration is

130
00:05:47,330 --> 00:05:45,270
Hubble's down here we've got this giant

131
00:05:50,330 --> 00:05:47,340
cluster of galaxies here and we've got

132
00:05:52,339 --> 00:05:50,340
this very distant galaxy here and the

133
00:05:56,809 --> 00:05:52,349
light from that very distant galaxy

134
00:05:58,309 --> 00:05:56,819
passes by this large cluster and due to

135
00:06:02,149 --> 00:05:58,319
an effect of general relativity actually

136
00:06:03,980 --> 00:06:02,159
gets bent because generality has

137
00:06:08,019 --> 00:06:03,990
everybody in the back of the room knows

138
00:06:12,439 --> 00:06:08,029

can be boiled down to three words mass

139
00:06:13,610 --> 00:06:12,449
warps space okay that's what you need to

140
00:06:16,850 --> 00:06:13,620
know about general relativity and the

141
00:06:20,119 --> 00:06:16,860
mass of this cluster warped space so

142
00:06:23,059 --> 00:06:20,129
much that the light bends as it goes

143
00:06:24,769 --> 00:06:23,069
past that cluster so the cluster of

144
00:06:27,700 --> 00:06:24,779
galaxies the mass of the cluster of

145
00:06:30,769 --> 00:06:27,710
galaxies acts as a gravitational lens

146
00:06:32,629 --> 00:06:30,779
all right and so when Hubble looks at

147
00:06:34,850 --> 00:06:32,639
these giant these big clusters of

148
00:06:38,149 --> 00:06:34,860
galaxies we can get lensing effects like

149
00:06:40,750 --> 00:06:38,159
this which is an arc and this is a

150
00:06:42,100 --> 00:06:40,760
distant galaxies whose light has passed

151
00:06:44,970 --> 00:06:42,110
through that cluster and become

152
00:06:47,710 --> 00:06:44,980
stretched out as it passes through

153
00:06:49,300 --> 00:06:47,720
alright and so this one is actually a

154
00:06:51,400 --> 00:06:49,310
very big arc there are actually a lot of

155
00:06:53,110 --> 00:06:51,410
smaller arcs like that one here and

156
00:06:55,840 --> 00:06:53,120
there are a couple other smaller arcs

157
00:07:00,190 --> 00:06:55,850
that you can see in this image but this

158
00:07:04,390 --> 00:07:00,200
is a giant arc and there was a survey by

159
00:07:07,420 --> 00:07:04,400
the Sloan Digital Sky Survey to look for

160
00:07:09,310 --> 00:07:07,430
these giant arcs in Sloan and which is a

161
00:07:10,840 --> 00:07:09,320
ground-based telescope and then do

162
00:07:13,390 --> 00:07:10,850
follow up with the Hubble Space

163
00:07:15,610 --> 00:07:13,400

Telescope and so we did follow up with

164
00:07:18,250 --> 00:07:15,620
Hubble of this one all right and let me

165
00:07:21,880 --> 00:07:18,260
blow it up for you and this giant arc is

166
00:07:24,190 --> 00:07:21,890
not one yeah well it is one galaxy but

167
00:07:27,100 --> 00:07:24,200
it's the same galaxies three different

168
00:07:29,890 --> 00:07:27,110
times it's a triple lens of the same

169
00:07:31,960 --> 00:07:29,900
galaxy so you can see one image of it

170
00:07:35,140 --> 00:07:31,970
here one image of it in the center and

171
00:07:36,850 --> 00:07:35,150
one image of it down here and that's one

172
00:07:41,710 --> 00:07:36,860
of the reason it makes this really long

173
00:07:46,630 --> 00:07:41,720
arc okay and this galaxy is observed

174
00:07:49,030 --> 00:07:46,640
from 11 billion light-years away right

175
00:07:52,300 --> 00:07:49,040
and we could not really see it very well

176
00:07:55,420 --> 00:07:52,310
at all if it wasn't for the cluster of

177
00:07:56,680 --> 00:07:55,430
galaxies lensing it it's magnified about

178
00:08:01,120 --> 00:07:56,690
30 times

179
00:08:02,770 --> 00:08:01,130
it's brightened up it's also expanded so

180
00:08:04,960 --> 00:08:02,780
what they did with this is they use

181
00:08:07,630 --> 00:08:04,970
their model of the mass of the cluster

182
00:08:10,090 --> 00:08:07,640
of galaxies to try and reconstruct what

183
00:08:11,470 --> 00:08:10,100
this galaxy originally look like before

184
00:08:13,240 --> 00:08:11,480
it went through the lensing because it's

185
00:08:15,580 --> 00:08:13,250
distorted a little bit alright and so

186
00:08:17,560 --> 00:08:15,590
they reconstructed what they thought

187
00:08:19,960 --> 00:08:17,570
think this galaxy actually looks like

188
00:08:22,750 --> 00:08:19,970

before it gets distorted by the

189
00:08:25,000 --> 00:08:22,760
gravitational lensing and what they

190
00:08:27,160 --> 00:08:25,010
measured was that due to the

191
00:08:30,940 --> 00:08:27,170
gravitational lensing they're able to

192
00:08:33,550 --> 00:08:30,950
get about ten times the resolution that

193
00:08:36,159 --> 00:08:33,560
Hubble would get normally all right with

194
00:08:38,920 --> 00:08:36,169
the lensing it's stretched out magnified

195
00:08:40,870 --> 00:08:38,930
enough they're able to see finer details

196
00:08:43,570 --> 00:08:40,880
than Hubble could without the

197
00:08:45,760 --> 00:08:43,580
gravitational lensing as I said this

198
00:08:50,590 --> 00:08:45,770
galaxy is 11 billion light-years away

199
00:08:54,040 --> 00:08:50,600
which means we're seeing it as it was 11

200
00:08:54,430 --> 00:08:54,050
billion years ago because it takes a

201
00:09:02,620 --> 00:08:54,440
billion

202
00:09:05,890 --> 00:09:02,630
years ago when galaxies were still

203
00:09:08,830 --> 00:09:05,900
developing and at that time these small

204
00:09:11,260 --> 00:09:08,840
galaxies were undergoing massive bursts

205
00:09:13,210 --> 00:09:11,270
of star formation and you can see in the

206
00:09:17,380 --> 00:09:13,220
reconstruction all these bright small

207
00:09:20,350 --> 00:09:17,390
dots right that is the Stars star

208
00:09:23,530 --> 00:09:20,360
formation regions bursting to life 11

209
00:09:25,750 --> 00:09:23,540
billion years ago and we have known from

210
00:09:27,430 --> 00:09:25,760
other observations that we'd get a lot

211
00:09:31,060 --> 00:09:27,440
of star formation we get these star

212
00:09:32,590 --> 00:09:31,070
bursts early on in the universe but with

213
00:09:35,500 --> 00:09:32,600

this we're able to see them in

214
00:09:37,240 --> 00:09:35,510
unprecedented detail because it's even

215
00:09:39,700 --> 00:09:37,250
higher resolution than Hubble can get

216
00:09:41,770 --> 00:09:39,710
due to the lensing we're able to see

217
00:09:43,440 --> 00:09:41,780
these small star forming regions that

218
00:09:45,610 --> 00:09:43,450
are only hundreds of light-years across

219
00:09:46,780 --> 00:09:45,620
whereas normally Hubble would only be

220
00:09:48,670 --> 00:09:46,790
able to see things thousands of

221
00:09:50,410 --> 00:09:48,680
light-years across and the sort of all

222
00:09:52,960 --> 00:09:50,420
the star bursting would be blurred

223
00:09:55,750 --> 00:09:52,970
together now we're able to see that

224
00:10:00,180 --> 00:09:55,760
individual star bursting in this galaxy

225
00:10:04,000 --> 00:10:00,190
due to the giant arc helping us to

226
00:10:08,950 --> 00:10:04,010
resolve very tiny details in this very

227
00:10:10,240 --> 00:10:08,960
distant galaxy that's really cool oh and

228
00:10:12,460 --> 00:10:10,250
by the way this is an artist's

229
00:10:14,260 --> 00:10:12,470
illustration of what's going on this is

230
00:10:16,300 --> 00:10:14,270
the galaxy seen mostly edge-on

231
00:10:18,370 --> 00:10:16,310
and you got all these wonderful star

232
00:10:19,810 --> 00:10:18,380
bursting things going on all right we

233
00:10:22,990 --> 00:10:19,820
like to add the pretty pictures because

234
00:10:25,270 --> 00:10:23,000
well that's only so pretty and this

235
00:10:26,620 --> 00:10:25,280
gives you an idea help your imagination

236
00:10:35,020 --> 00:10:26,630
look what it might have looked like

237
00:10:36,490 --> 00:10:35,030
eleven billion years ago question that's

238
00:10:38,470 --> 00:10:36,500

the view of the galaxy the galaxy is not

239
00:10:40,120 --> 00:10:38,480
distorted only the light is described no

240
00:10:51,970 --> 00:10:40,130
Alexei's were harmed in the creation of

241
00:10:53,790 --> 00:10:51,980
that all right so Mars and Earth go

242
00:10:56,050 --> 00:10:53,800
through what's called opposition every

243
00:10:56,860 --> 00:10:56,060
26 months I think it is every two years

244
00:10:59,260 --> 00:10:56,870
in two months

245
00:11:01,150 --> 00:10:59,270
okay and this is a diagram showing you

246
00:11:02,620 --> 00:11:01,160
all the some of the opposite and

247
00:11:04,750 --> 00:11:02,630
pictures Hubble has taken so whenever

248
00:11:06,700 --> 00:11:04,760
Earth and Mars are at their closest

249
00:11:08,200 --> 00:11:06,710
Hubble takes a picture and we put

250
00:11:11,530 --> 00:11:08,210
out there and the public loves it okay

251
00:11:14,860 --> 00:11:11,540
because sorry the public loves a solar

252
00:11:18,280 --> 00:11:14,870
system pictures so we did one in 1995

253
00:11:21,520 --> 00:11:18,290
and in 97 and 99 and 2000 one in 2003

254
00:11:24,280 --> 00:11:21,530
2005 and 2007 okay so this was you know

255
00:11:26,290 --> 00:11:24,290
a procession of all these to various

256
00:11:30,460 --> 00:11:26,300
opposition's so we've continued to do

257
00:11:33,100 --> 00:11:30,470
that over the years and last year 2016

258
00:11:36,070 --> 00:11:33,110
in May we also took a picture of Mars

259
00:11:37,990 --> 00:11:36,080
getting close to opposition and what we

260
00:11:39,430 --> 00:11:38,000
showed you about it this time cuz we've

261
00:11:41,560 --> 00:11:39,440
done this so many times we got to talk

262
00:11:43,180 --> 00:11:41,570
about new things each time well this

263
00:11:44,710 --> 00:11:43,190

time we talked about all the different

264
00:11:47,080 --> 00:11:44,720
features on the surface of Mars that

265
00:11:50,560 --> 00:11:47,090
Hubble could resolve the clouds above

266
00:11:53,520 --> 00:11:50,570
syrtis major chaparral a crater the

267
00:11:57,280 --> 00:11:53,530
North Pole and so on and so forth

268
00:11:59,650 --> 00:11:57,290
but we didn't tell you what we didn't

269
00:12:02,160 --> 00:11:59,660
tell you was during those observations

270
00:12:05,830 --> 00:12:02,170
we took a bunch of observations

271
00:12:08,410 --> 00:12:05,840
Mars's moon Phobos appeared in 13 of

272
00:12:09,910 --> 00:12:08,420
those observations alright and for those

273
00:12:11,830 --> 00:12:09,920
of you on the web you may not be able to

274
00:12:15,010 --> 00:12:11,840
see those dots so I'm gonna circle them

275
00:12:19,180 --> 00:12:15,020
all right alright this is a composite of

276
00:12:21,280 --> 00:12:19,190
13 observations including Phobos being

277
00:12:24,250 --> 00:12:21,290
along here alright so they actually

278
00:12:26,500 --> 00:12:24,260
timed it to try and see what they could

279
00:12:28,540 --> 00:12:26,510
see about this tiny moon because this is

280
00:12:30,490 --> 00:12:28,550
only you know tens kilometers across

281
00:12:33,070 --> 00:12:30,500
this is a this is a captured asteroid

282
00:12:34,840 --> 00:12:33,080
actually okay it's not it's not a moon

283
00:12:36,790 --> 00:12:34,850
that formed with Mars it's a moon that

284
00:12:39,310 --> 00:12:36,800
got captured by Mars both Phobos and

285
00:12:41,970 --> 00:12:39,320
Deimos are these tiny moons around Mars

286
00:12:45,730 --> 00:12:41,980
that are really almost assuredly

287
00:12:48,250 --> 00:12:45,740
captured asteroids all right and so here

288
00:12:51,730 --> 00:12:48,260

is the data sequence all right and you

289
00:12:54,340 --> 00:12:51,740
can see Phobos moving here you'll also

290
00:12:57,070 --> 00:12:54,350
see Mars flipping through it because we

291
00:12:59,170 --> 00:12:57,080
got different different observations

292
00:13:01,990 --> 00:12:59,180
during different Hubble orbits alright

293
00:13:04,870 --> 00:13:02,000
and so Mars goes through and this is the

294
00:13:06,940 --> 00:13:04,880
actual data okay but if you want to make

295
00:13:08,860 --> 00:13:06,950
a movie this kind of jumpiness doesn't

296
00:13:12,070 --> 00:13:08,870
work doesn't work so what we did is we

297
00:13:14,920 --> 00:13:12,080
had our video guy apply his special

298
00:13:19,090 --> 00:13:14,930
magic to it and now we have a smooth

299
00:13:20,579 --> 00:13:19,100
sequence that shows Phobos progressing

300
00:13:22,949 --> 00:13:20,589
through those 13 different sea

301
00:13:27,179 --> 00:13:22,959
and you'll notice Mars here turns

302
00:13:28,769 --> 00:13:27,189
relatively smoothly as well and we

303
00:13:30,749 --> 00:13:28,779
didn't come up with this name actually

304
00:13:34,259 --> 00:13:30,759
got her Space Flight Center use the

305
00:13:36,720 --> 00:13:34,269
phrase Phobos photobombing and it caught

306
00:13:38,340 --> 00:13:36,730
on really well on the internet and so I

307
00:13:41,850 --> 00:13:38,350
picked it up I'm sorry that's a cool

308
00:13:46,470 --> 00:13:41,860
name so this is Phobos photobombing our

309
00:13:48,900 --> 00:13:46,480
picture of Mars alright final thing

310
00:13:51,689 --> 00:13:48,910
where will you be when the light goes

311
00:13:53,309 --> 00:13:51,699
out I have to it's it's we've been

312
00:13:55,710 --> 00:13:53,319
waiting for this for how long

313
00:13:58,949 --> 00:13:55,720

alright it's finally 2017 it's finally

314
00:14:01,559 --> 00:13:58,959
August 2017 and the total solar eclipse

315
00:14:04,739 --> 00:14:01,569
that goes across America will come on

316
00:14:06,840 --> 00:14:04,749
August 21st so Monday August 21st there

317
00:14:09,869 --> 00:14:06,850
will be a tough you haven't paid any

318
00:14:12,059 --> 00:14:09,879
attention for the past five years there

319
00:14:15,989 --> 00:14:12,069
will be a total solar eclipse that

320
00:14:19,350 --> 00:14:15,999
starts around 10:15 a.m. out in Oregon

321
00:14:22,679 --> 00:14:19,360
and passes through South Carolina

322
00:14:26,939 --> 00:14:22,689
somewhere around of what is that 3:00

323
00:14:28,799 --> 00:14:26,949
p.m. okay and if you're in the path of

324
00:14:31,290 --> 00:14:28,809
totality you will see the total solar

325
00:14:33,749 --> 00:14:31,300
eclipse however if you are anywhere

326
00:14:38,280 --> 00:14:33,759
within North America you're pretty much

327
00:14:41,340 --> 00:14:38,290
going to get a 60 70 80 90 percent

328
00:14:43,199 --> 00:14:41,350
eclipse okay there are a lots of tools

329
00:14:45,269 --> 00:14:43,209
out there on the web I don't need to go

330
00:14:47,819 --> 00:14:45,279
through them we gave a complete talk on

331
00:14:49,530 --> 00:14:47,829
January go back and watch that talk and

332
00:14:52,319 --> 00:14:49,540
you'll have all the details if you want

333
00:14:53,610 --> 00:14:52,329
they are thing if you are not in the

334
00:14:55,740 --> 00:14:53,620
path note if you're in the path of

335
00:14:57,960 --> 00:14:55,750
totality there are these tools that will

336
00:15:00,389 --> 00:14:57,970
tell you you know when it starts when

337
00:15:02,069 --> 00:15:00,399
it's maximum when it ends alright and so

338
00:15:04,919 --> 00:15:02,079

in Salem Oregon they're gonna have them

339
00:15:07,189 --> 00:15:04,929
one minute and 55 second total solar

340
00:15:10,769 --> 00:15:07,199
eclipse if you stay here in Baltimore

341
00:15:13,290 --> 00:15:10,779
you will have not a total eclipse you'll

342
00:15:16,860 --> 00:15:13,300
have a partial eclipse about 80%

343
00:15:20,340 --> 00:15:16,870
obscured and its maximum will be at 243

344
00:15:23,189 --> 00:15:20,350
in the afternoon okay lots and lots of

345
00:15:25,290 --> 00:15:23,199
cool tools out there lots and lots of

346
00:15:27,869 --> 00:15:25,300
cool websites I advise you to take

347
00:15:30,240 --> 00:15:27,879
advantage of them before and alright the

348
00:15:34,290 --> 00:15:30,250
one thing that I always have to say for

349
00:15:38,430 --> 00:15:34,300
every audience is protect your

350
00:15:39,870 --> 00:15:38,440
okay do not use sunglasses do not use a

351
00:15:42,060 --> 00:15:39,880
mylar balloon

352
00:15:44,580 --> 00:15:42,070
do not lose something your uncle George

353
00:15:47,640 --> 00:15:44,590
told you all this is safe right no you

354
00:15:51,150 --> 00:15:47,650
want certified solar viewing glasses

355
00:15:53,280 --> 00:15:51,160
okay they must be certified to protect

356
00:15:54,750 --> 00:15:53,290
your eyes all right I was down at the

357
00:15:56,610 --> 00:15:54,760
beach this weekend talking with somebody

358
00:15:58,410 --> 00:15:56,620
about it I said take a look at the Sun

359
00:16:00,740 --> 00:15:58,420
right now how long can you look at that

360
00:16:03,060 --> 00:16:00,750
before it starts to hurt your eyes okay

361
00:16:04,950 --> 00:16:03,070
this is what you need to do if you want

362
00:16:06,780 --> 00:16:04,960
to stare at the Sun and watch that total

363
00:16:09,000 --> 00:16:06,790

solar eclipse or partial eclipse you

364
00:16:10,850 --> 00:16:09,010
need something that really blocks the

365
00:16:13,140 --> 00:16:10,860
light so that you don't hurt your eyes

366
00:16:14,670 --> 00:16:13,150
and after he stared the Sun for about

367
00:16:17,220 --> 00:16:14,680
four seconds he finally he got the

368
00:16:18,720 --> 00:16:17,230
picture oh yeah okay it's kept seeing

369
00:16:21,930 --> 00:16:18,730
the Sun for about three about thirty

370
00:16:25,350 --> 00:16:21,940
seconds afterwards right so you want

371
00:16:26,880 --> 00:16:25,360
Eclipse shades okay whenever any part of

372
00:16:28,800 --> 00:16:26,890
the Sun is visible you want to be

373
00:16:31,200 --> 00:16:28,810
wearing them if you will happen to get

374
00:16:33,570 --> 00:16:31,210
into totality and you and you and and

375
00:16:35,340 --> 00:16:33,580
during the few minutes of totality then

376
00:16:37,410 --> 00:16:35,350
you can take them off and look at the

377
00:16:38,670 --> 00:16:37,420
corona and actually I just suggest you

378
00:16:40,470 --> 00:16:38,680
do because you keep them on during

379
00:16:41,790 --> 00:16:40,480
totality you're not gonna see much all

380
00:16:44,640 --> 00:16:41,800
right you'll need to take them off

381
00:16:46,290 --> 00:16:44,650
during totality but once totality stops

382
00:16:49,230 --> 00:16:46,300
put them back on okay

383
00:16:51,210 --> 00:16:49,240
protect your eyes they are available

384
00:16:54,140 --> 00:16:51,220
online at lots of different places and

385
00:16:56,730 --> 00:16:54,150
they're only a couple bucks yes

386
00:17:00,390 --> 00:16:56,740
researchers the other day most of the

387
00:17:05,430 --> 00:17:00,400
sites are sold okay so it's too late

388
00:17:06,810 --> 00:17:05,440

forget it you're done 2024 because we're

389
00:17:09,390 --> 00:17:06,820
gonna have another total solar eclipse

390
00:17:10,829 --> 00:17:09,400
through America in 2024 this doesn't go

391
00:17:13,829 --> 00:17:10,839
coast-to-coast it comes up through

392
00:17:16,050 --> 00:17:13,839
Mexico goes across Cleveland and out

393
00:17:18,420 --> 00:17:16,060
through Nova Scotia I believe so alright

394
00:17:19,949 --> 00:17:18,430
so if you didn't buy them now buy the

395
00:17:21,090 --> 00:17:19,959
next year because you need them and

396
00:17:28,079 --> 00:17:21,100
you'll need them again in seven years

397
00:17:36,289 --> 00:17:28,089
okay kid they just get it something

398
00:17:41,789 --> 00:17:39,419
if you don't have Eclipse glasses you

399
00:17:44,310 --> 00:17:41,799
can't use a pinhole camera and you know

400
00:17:46,919 --> 00:17:44,320
project the project the image of it onto

401
00:17:49,499 --> 00:17:46,929
a piece of white paper okay and that

402
00:17:51,720 --> 00:17:49,509
worked extremely well too I remember I

403
00:17:53,609 --> 00:17:51,730
was up in Massachusetts when I was a kid

404
00:17:56,269 --> 00:17:53,619
and we did pinhole cameras we didn't

405
00:18:04,349 --> 00:18:01,529
I didn't know about that when I was a

406
00:18:06,629 --> 00:18:04,359
kid yes you can use pinhole projectors

407
00:18:08,999 --> 00:18:06,639
and there are other ways to project the

408
00:18:11,310 --> 00:18:09,009
image again lots of websites out there

409
00:18:11,940 --> 00:18:11,320
take advantage of it just to take care

410
00:18:15,539 --> 00:18:11,950
of your eyes

411
00:18:19,379 --> 00:18:15,549
all right so that is our news and now we

412
00:18:21,060 --> 00:18:19,389
go to our featured speaker tonight as I

413
00:18:24,570 --> 00:18:21,070

said I'm excited to hear this

414
00:18:26,580 --> 00:18:24,580
Courtney McManus is an expert at things

415
00:18:30,090 --> 00:18:26,590
that you don't see except for in movies

416
00:18:32,239 --> 00:18:30,100
I guess in Mission Control she got her

417
00:18:36,629 --> 00:18:32,249
degree in aeronautical and astronautical

418
00:18:38,489 --> 00:18:36,639
engineering from Purdue and then she

419
00:18:40,649 --> 00:18:38,499
went to one of the most famous places of

420
00:18:42,509 --> 00:18:40,659
all Johnson Space Center worked in

421
00:18:44,460 --> 00:18:42,519
Mission Control a little bit on the

422
00:18:47,639 --> 00:18:44,470
shuttle program but mostly on the

423
00:18:50,639 --> 00:18:47,649
International Space Station we are very

424
00:18:56,159 --> 00:18:50,649
lucky we stole her got her to come here

425
00:18:59,190 --> 00:18:56,169
three years ago where she is in a title

426
00:19:02,609 --> 00:18:59,200
that I can't remember systems

427
00:19:07,349 --> 00:19:02,619
integration and test engineer see I knew

428
00:19:08,700 --> 00:19:07,359
I'd remember and we one of the things

429
00:19:11,399 --> 00:19:08,710
I'm sure she'll tell you is that we have

430
00:19:13,619 --> 00:19:11,409
the missions Operations Center for the

431
00:19:16,289 --> 00:19:13,629
James Webb Space Telescope upstairs and

432
00:19:18,389 --> 00:19:16,299
so jst we run from here Hubble is being

433
00:19:20,759 --> 00:19:18,399
run from Goddard Space Flight Center so

434
00:19:24,180 --> 00:19:20,769
people like Courtney are incredibly

435
00:19:25,919 --> 00:19:24,190
important for our future missions and

436
00:19:28,409 --> 00:19:25,929
for Courtney that gentleman right there

437
00:19:30,029 --> 00:19:28,419
is important for her future mission

438
00:19:33,269 --> 00:19:30,039

because she tells me she's getting

439
00:19:35,399 --> 00:19:33,279
married in one month okay so ladies and

440
00:19:39,370 --> 00:19:35,409
gentlemen while she's still single let's

441
00:19:46,200 --> 00:19:39,380
hear for Courtney McManus

442
00:20:04,150 --> 00:19:46,210
[Applause]

443
00:20:07,450 --> 00:20:04,160
hi everybody can you hear me okay haha

444
00:20:09,460 --> 00:20:07,460
success alright so as Frank said my name

445
00:20:12,820 --> 00:20:09,470
is Courtney McManus and I'm here to talk

446
00:20:14,710 --> 00:20:12,830
to you about what it takes to make space

447
00:20:17,610 --> 00:20:14,720
missions happen kind of the stuff behind

448
00:20:20,440 --> 00:20:17,620
the scenes so before I go into anything

449
00:20:21,990 --> 00:20:20,450
has anyone here seen the movie Apollo 13

450
00:20:24,040 --> 00:20:22,000
raise your hand

451
00:20:25,750 --> 00:20:24,050
excellent this will make it much easier

452
00:20:27,520 --> 00:20:25,760
for you guys to have a frame of

453
00:20:32,620 --> 00:20:27,530
reference if you haven't don't worry

454
00:20:35,290 --> 00:20:32,630
I'll guide you along so hi my name is

455
00:20:36,880 --> 00:20:35,300
Courtney like I said if you have any

456
00:20:38,980 --> 00:20:36,890
questions at any point feel free to ask

457
00:20:42,760 --> 00:20:38,990
otherwise hold them to the end and we'll

458
00:20:47,740 --> 00:20:42,770
we'll take them then I have a secret for

459
00:20:50,200 --> 00:20:47,750
you guys I'm not an astronomer so you

460
00:20:51,310 --> 00:20:50,210
guys might know more about astronomy

461
00:20:54,460 --> 00:20:51,320
stuff than I do

462
00:20:57,070 --> 00:20:54,470
having come to these lectures a lot the

463
00:20:59,860 --> 00:20:57,080

topic for the talk next month the blue

464
00:21:02,170 --> 00:20:59,870
variable stuff I don't really know any

465
00:21:05,470 --> 00:21:02,180
of that I know what a photon is for the

466
00:21:07,990 --> 00:21:05,480
most part and I know what it takes to

467
00:21:11,170 --> 00:21:08,000
make all of the stuff the astronomers

468
00:21:13,060 --> 00:21:11,180
want happen but I'm I'm not an

469
00:21:15,250 --> 00:21:13,070
astronomer at all

470
00:21:18,280 --> 00:21:15,260
right now I am a systems integration and

471
00:21:21,460 --> 00:21:18,290
test engineer for the James Webb Space

472
00:21:22,780 --> 00:21:21,470
Telescope so you guys probably know the

473
00:21:23,680 --> 00:21:22,790
James Webb Space Telescope's and

474
00:21:25,930 --> 00:21:23,690
development right now

475
00:21:27,670 --> 00:21:25,940
parts of it are down in Houston parts of

476
00:21:29,500 --> 00:21:27,680
it are out in California the Mission

477
00:21:31,180 --> 00:21:29,510
Operations Center is being developed and

478
00:21:34,390 --> 00:21:31,190
designed here

479
00:21:36,400 --> 00:21:34,400
my job as a test engineer is basically

480
00:21:39,160 --> 00:21:36,410
to take stuff that people work really

481
00:21:40,630 --> 00:21:39,170
really hard on and try to break it and I

482
00:21:42,070 --> 00:21:40,640
hope that I don't break it because

483
00:21:45,130 --> 00:21:42,080
they've usually done their job really

484
00:21:46,870 --> 00:21:45,140
well but sometimes we catch little

485
00:21:50,200 --> 00:21:46,880
errors that might happen and we try to

486
00:21:51,670 --> 00:21:50,210
do that before it gets into space so

487
00:21:52,460 --> 00:21:51,680
that we can fix everything before it

488
00:21:55,280 --> 00:21:52,470

goes up there

489
00:21:57,050 --> 00:21:55,290
so that's what I do right now but I'm

490
00:21:59,750 --> 00:21:57,060
going to talk to you about what I used

491
00:22:01,790 --> 00:21:59,760
to do when I was a flight controller

492
00:22:04,670 --> 00:22:01,800
with the International Space Station

493
00:22:07,550 --> 00:22:04,680
down in Houston this is actually a

494
00:22:11,540 --> 00:22:07,560
picture of me that's me that blur right

495
00:22:14,300 --> 00:22:11,550
there working on console and Mission

496
00:22:16,520 --> 00:22:14,310
Control this was on NASA television my

497
00:22:19,130 --> 00:22:16,530
mom took this screen shot to prove to my

498
00:22:20,420 --> 00:22:19,140
grandmother that I was in there it

499
00:22:23,570 --> 00:22:20,430
really could be anybody but that's

500
00:22:25,850 --> 00:22:23,580
definitely me and here's a picture of me

501
00:22:29,630 --> 00:22:25,860
really excited next to a Soyuz capsule

502
00:22:31,670 --> 00:22:29,640
which is what the Russians use to send a

503
00:22:33,410 --> 00:22:31,680
tour cosmonauts into space and we also

504
00:22:35,870 --> 00:22:33,420
hitch rides on there every now and then

505
00:22:37,790 --> 00:22:35,880
to send astronauts up into space too so

506
00:22:40,760 --> 00:22:37,800
I got to be next to one and it was

507
00:22:41,990 --> 00:22:40,770
really cool so I'm gonna talk to you

508
00:22:47,420 --> 00:22:42,000
about my time working as a flight

509
00:22:52,190 --> 00:22:47,430
controller with ISS this is the ISS this

510
00:22:55,250 --> 00:22:52,200
is Isis it is not the ISS this is the

511
00:22:57,920 --> 00:22:55,260
ISS sometimes people get confused when I

512
00:23:00,950 --> 00:22:57,930
talk quickly sounds like I'm saying one

513
00:23:02,420 --> 00:23:00,960

thing but I'm talking about the ISS so

514
00:23:05,630 --> 00:23:02,430
the International Space Station where

515
00:23:09,860 --> 00:23:05,640
the ISS is orbiting up in space about

516
00:23:11,810 --> 00:23:09,870
400 miles up there it kind of fluctuates

517
00:23:14,240 --> 00:23:11,820
a little bit right now we have six

518
00:23:15,620 --> 00:23:14,250
people I think on board the ISS they

519
00:23:18,350 --> 00:23:15,630
definitely should check that before I

520
00:23:19,940 --> 00:23:18,360
started talking but usually there's a

521
00:23:22,220 --> 00:23:19,950
crew of six people from various

522
00:23:24,620 --> 00:23:22,230
countries up on the ISS working and

523
00:23:26,810 --> 00:23:24,630
living in space all the time

524
00:23:28,820 --> 00:23:26,820
doing science experiments learning how

525
00:23:30,680 --> 00:23:28,830
our bodies adapt to space making it so

526
00:23:35,660 --> 00:23:30,690
we can do longer-term spaceflight

527
00:23:38,210 --> 00:23:35,670
missions out to Mars etc so does anyone

528
00:23:42,190 --> 00:23:38,220
know where Mission Control for the ISS

529
00:23:44,420 --> 00:23:42,200
is shout it out if you know I heard it

530
00:23:45,830 --> 00:23:44,430
Houston yes you probably have heard the

531
00:23:47,510 --> 00:23:45,840
line houston we have a problem

532
00:23:49,490 --> 00:23:47,520
that's because they were talking to

533
00:23:52,850 --> 00:23:49,500
Houston not just like some guy in in

534
00:23:55,340 --> 00:23:52,860
Houston it's the actual city so this is

535
00:23:57,560 --> 00:23:55,350
the very beautiful building where the

536
00:24:00,110 --> 00:23:57,570
Mission Control Center in Houston is

537
00:24:02,270 --> 00:24:00,120
located it's called the Christopher C

538
00:24:04,100 --> 00:24:02,280

Kraft jr. Mission Control Center named

539
00:24:05,570 --> 00:24:04,110
after Chris Kraft one of the

540
00:24:08,360 --> 00:24:05,580
names actually Christopher Columbus

541
00:24:10,490 --> 00:24:08,370
craft which is I don't know if I'd want

542
00:24:12,110 --> 00:24:10,500
that name but it's named after him he's

543
00:24:14,299 --> 00:24:12,120
one of the founders of Mission Control

544
00:24:16,280 --> 00:24:14,309
there's a whole theory out there that he

545
00:24:18,260 --> 00:24:16,290
helped to develop on what it takes to be

546
00:24:20,260 --> 00:24:18,270
a really solid Mission Control flight

547
00:24:22,460 --> 00:24:20,270
flight director and flight controller

548
00:24:24,770 --> 00:24:22,470
some really interesting stuff out him

549
00:24:28,010 --> 00:24:24,780
out there on him if you're interested in

550
00:24:30,890 --> 00:24:28,020
more detail after I finished my talk I

551
00:24:32,810 --> 00:24:30,900
suggest looking up Chris Craft anyway so

552
00:24:34,880 --> 00:24:32,820
this is a beautiful building there are

553
00:24:37,039 --> 00:24:34,890
no windows when you're inside it's very

554
00:24:39,049 --> 00:24:37,049
dark and very cold

555
00:24:41,960 --> 00:24:39,059
I was always freezing in Mission Control

556
00:24:43,370 --> 00:24:41,970
but that's it's actually better that

557
00:24:45,230 --> 00:24:43,380
there are no windows because then you

558
00:24:48,169 --> 00:24:45,240
can't tell that it's 3:00 in the morning

559
00:24:50,419 --> 00:24:48,179
and you're sitting at work because the

560
00:24:52,789 --> 00:24:50,429
Mission Control Center is staffed 24/7

561
00:24:56,270 --> 00:24:52,799
365 there's a person who has to see them

562
00:24:56,750 --> 00:24:56,280
they're on Thanksgiving and work at 3:00

563
00:24:58,940 --> 00:24:56,760

in the morning

564
00:25:00,500 --> 00:24:58,950
but usually people are nice and bring

565
00:25:02,600 --> 00:25:00,510
them food there's always food in Mission

566
00:25:04,850 --> 00:25:02,610
Control a fun fact about this building

567
00:25:06,770 --> 00:25:04,860
is anytime you see a flag flying out on

568
00:25:10,909 --> 00:25:06,780
the top it means there is someone in

569
00:25:12,440 --> 00:25:10,919
space it used to make more sense during

570
00:25:15,140 --> 00:25:12,450
times when we just had the shuttle

571
00:25:16,250 --> 00:25:15,150
flying because the shuttle wasn't up

572
00:25:17,870 --> 00:25:16,260
there all the time it would happen

573
00:25:19,190 --> 00:25:17,880
intermittently so you can look and say

574
00:25:20,510 --> 00:25:19,200
oh there's a shuttle mission cool

575
00:25:21,650 --> 00:25:20,520
someone's up there but now it's always

576
00:25:23,240 --> 00:25:21,660
flying because there's always someone

577
00:25:26,659 --> 00:25:23,250
Manning the International Space Station

578
00:25:28,909 --> 00:25:26,669
so once you go inside that building

579
00:25:31,100 --> 00:25:28,919
there are these really fancy looking

580
00:25:32,870 --> 00:25:31,110
doors that it's really hard to get

581
00:25:35,840 --> 00:25:32,880
through unless you're authorized so

582
00:25:37,880 --> 00:25:35,850
don't ever try it's really tough there's

583
00:25:40,130 --> 00:25:37,890
lots of sirens and guards and such but

584
00:25:42,049 --> 00:25:40,140
once you get through those doors you go

585
00:25:46,340 --> 00:25:42,059
through some catacombs a little ways and

586
00:25:47,930 --> 00:25:46,350
then you get to this room here in the

587
00:25:49,340 --> 00:25:47,940
Mission Control Building they're a

588
00:25:51,919 --> 00:25:49,350

handful of different Mission Control

589
00:25:52,850 --> 00:25:51,929
centers this one is for the it's the

590
00:25:54,500 --> 00:25:52,860
flight control room for the

591
00:25:56,030 --> 00:25:54,510
International Space Station and I'm

592
00:25:59,180 --> 00:25:56,040
going to talk to you about what all of

593
00:26:04,539 --> 00:25:59,190
this is who all these people are what

594
00:26:11,120 --> 00:26:08,270
but first I want to show you a little

595
00:26:13,250 --> 00:26:11,130
intro video for to get your head in the

596
00:26:15,200 --> 00:26:13,260
right space for what Mission Control is

597
00:26:17,750 --> 00:26:15,210
I thought about showing a clip from

598
00:26:19,760 --> 00:26:17,760
Apollo 13 and then I realized that there

599
00:26:22,520 --> 00:26:19,770
like actual stuff that happened and was

600
00:26:28,400 --> 00:26:22,530
filmed so be way better if I showed you

601
00:26:32,480 --> 00:26:28,410
a clip from an actual Apollo mission

602
00:26:34,010 --> 00:26:32,490
it's way better than Apollo 13 so in

603
00:26:36,740 --> 00:26:34,020
this video this is a really excellent

604
00:26:39,230 --> 00:26:36,750
video of a small snippet of when they

605
00:26:41,420 --> 00:26:39,240
were landing the Apollo 11 landing in

606
00:26:45,530 --> 00:26:41,430
this video you'll see Jean Krantz a

607
00:26:47,420 --> 00:26:45,540
flight director and you'll see a handful

608
00:26:49,460 --> 00:26:47,430
of other Mission Control people that are

609
00:26:51,200 --> 00:26:49,470
in there you'll also see oh gosh I don't

610
00:26:53,210 --> 00:26:51,210
remember what his name is but you'll see

611
00:26:56,000 --> 00:26:53,220
the Capcom or the capsule communicator

612
00:26:58,160 --> 00:26:56,010
who's the person who's talking to the

613
00:27:00,680 --> 00:26:58,170

capsule up in space

614
00:27:02,150 --> 00:27:00,690
you'll hear two different voice loops is

615
00:27:03,290 --> 00:27:02,160
what they're called in this in this film

616
00:27:05,090 --> 00:27:03,300
you'll hear what's called the flight

617
00:27:06,890 --> 00:27:05,100
loop which is where how the flight

618
00:27:09,290 --> 00:27:06,900
director talks to all the other flight

619
00:27:11,090 --> 00:27:09,300
controllers and you'll also hear the

620
00:27:13,370 --> 00:27:11,100
loop on which the capsule communicator

621
00:27:15,050 --> 00:27:13,380
talked to the spacecraft so you'll hear

622
00:27:17,510 --> 00:27:15,060
both of them so you're going to hear

623
00:27:20,080 --> 00:27:17,520
them go through a sequence of the flight

624
00:27:22,640 --> 00:27:20,090
director pulling all of the flight

625
00:27:25,310 --> 00:27:22,650
controllers as to whether or not the

626
00:27:29,090 --> 00:27:25,320
systems and the people are ready for at

627
00:27:37,610 --> 00:27:29,100
the actual moon landing so I hope this

628
00:27:38,990 --> 00:27:37,620
works it's gonna be really cool okay

629
00:27:43,660 --> 00:27:39,000
I'll fly controllers go/no-go for

630
00:27:46,960 --> 00:27:43,670
landing retro alright alright so control

631
00:28:03,070 --> 00:27:46,970
sir jet go Capcom work go for landing

632
00:28:15,530 --> 00:28:07,190
okay we're go we're go flight photo

633
00:28:18,880 --> 00:28:15,540
right on real watch agrees Roger it

634
00:28:22,310 --> 00:28:18,890
looks okay we're on hi Roger

635
00:28:24,140 --> 00:28:22,320
alright well so it the way they have the

636
00:28:25,790 --> 00:28:24,150
video set up is so that in the left

637
00:28:27,500 --> 00:28:25,800
audio channel you hear one in the right

638
00:28:29,570 --> 00:28:27,510

audio channel you hear the other so it

639
00:28:30,350 --> 00:28:29,580
must have not been both channels coming

640
00:28:35,420 --> 00:28:30,360
through but that's early

641
00:28:38,000 --> 00:28:35,430
fine you guys heard at least the flight

642
00:28:38,870 --> 00:28:38,010
director loop which was pretty cool but

643
00:28:43,250 --> 00:28:38,880
you could hear

644
00:28:45,500 --> 00:28:43,260
I suggest go look it up after this talk

645
00:28:53,870 --> 00:28:45,510
not during it probably but after the

646
00:28:55,070 --> 00:28:53,880
talk oh gosh sorry excusing I'll ask my

647
00:28:56,810 --> 00:28:55,080
train of thought because I was gonna

648
00:29:00,470 --> 00:28:56,820
talk about the two audio channels and

649
00:29:02,990 --> 00:29:00,480
then there's only one so you wouldn't

650
00:29:04,910 --> 00:29:03,000
you when the Apollo 11 landed was

651
00:29:06,920 --> 00:29:04,920
landing on the moon there was an alarm

652
00:29:09,920 --> 00:29:06,930
that sounded on the spacecraft and you

653
00:29:13,700 --> 00:29:09,930
can in that it's called the 1201 alarm

654
00:29:15,410 --> 00:29:13,710
in that video clip in the audio you

655
00:29:18,010 --> 00:29:15,420
could hear the astronauts calling out

656
00:29:20,990 --> 00:29:18,020
the 1201 alarm and then you can hear the

657
00:29:22,580 --> 00:29:21,000
flight controllers talking amongst

658
00:29:23,810 --> 00:29:22,590
themselves saying oh it's an alarm we've

659
00:29:25,310 --> 00:29:23,820
seen before everything's fine we're

660
00:29:27,860 --> 00:29:25,320
still go flight and then flight tells

661
00:29:29,300 --> 00:29:27,870
the Capcom to tell the crew that they're

662
00:29:30,770 --> 00:29:29,310
still go to land and then the crew can

663
00:29:33,610 --> 00:29:30,780

still go to land and then the crew lands

664
00:29:36,200 --> 00:29:33,620
and you all know what happens after that

665
00:29:38,450 --> 00:29:36,210
so so that kind of puts into perspective

666
00:29:40,370 --> 00:29:38,460
a little bit of what has to happen in

667
00:29:42,710 --> 00:29:40,380
Mission Control to get things to go on

668
00:29:44,360 --> 00:29:42,720
so now I want to orient you a little bit

669
00:29:46,430 --> 00:29:44,370
to the flight control room of the

670
00:29:48,410 --> 00:29:46,440
International Space Station so the

671
00:29:50,150 --> 00:29:48,420
flight director sits right here in the

672
00:29:53,600 --> 00:29:50,160
middle of the room and the Capcom is

673
00:29:55,100 --> 00:29:53,610
right next to him or her but up here we

674
00:29:56,360 --> 00:29:55,110
have a couple of different pretty nifty

675
00:29:58,850 --> 00:29:56,370
things that I want to point out to you

676
00:30:00,860 --> 00:29:58,860
guys we have this thing right here in

677
00:30:03,950 --> 00:30:00,870
the middle called the bird's eye view

678
00:30:07,610 --> 00:30:03,960
which is a map of the world that shows

679
00:30:10,340 --> 00:30:07,620
where the ISS ISS is at any point in

680
00:30:12,710 --> 00:30:10,350
time it's kind of hard sitting on the

681
00:30:14,120 --> 00:30:12,720
ground to visualize where in space it

682
00:30:16,340 --> 00:30:14,130
might be they just throw it up in the

683
00:30:18,110 --> 00:30:16,350
middle so everyone knows it also shows

684
00:30:19,880 --> 00:30:18,120
that you can't see very well in this

685
00:30:22,190 --> 00:30:19,890
picture but it also shows the dark and

686
00:30:23,540 --> 00:30:22,200
the light so it shows when the ISS is

687
00:30:26,630 --> 00:30:23,550
going into eclipse and when it's going

688
00:30:28,070 --> 00:30:26,640

to be in insulation or in sunshine it

689
00:30:29,660 --> 00:30:28,080
shows where some of the communications

690
00:30:31,790 --> 00:30:29,670
satellites are so we know which

691
00:30:34,670 --> 00:30:31,800
satellite the ISS is talking to at any

692
00:30:37,910 --> 00:30:34,680
given time it also can show things like

693
00:30:39,710 --> 00:30:37,920
the attitude and orientation of the ISS

694
00:30:41,390 --> 00:30:39,720
right here which is important when

695
00:30:43,820 --> 00:30:41,400
you're thinking about where your

696
00:30:44,380 --> 00:30:43,830
antennas are pointing or if you want to

697
00:30:46,510 --> 00:30:44,390
take an OP

698
00:30:47,740 --> 00:30:46,520
privation of a certain point on earth or

699
00:30:49,900 --> 00:30:47,750
you want the astronauts to go take a

700
00:30:51,720 --> 00:30:49,910
picture of a volcano erupting you need

701
00:30:54,520 --> 00:30:51,730
to know which window to go look out of

702
00:30:57,760 --> 00:30:54,530
then you have camera feeds coming from

703
00:30:59,500 --> 00:30:57,770
either inside or outside the ISS on

704
00:31:01,570 --> 00:30:59,510
these three screens here and on this one

705
00:31:04,120 --> 00:31:01,580
here and kind of on the right hand side

706
00:31:06,610 --> 00:31:04,130
is the caution and warning screen so at

707
00:31:07,930 --> 00:31:06,620
any time there might be a handful of

708
00:31:09,940 --> 00:31:07,940
things that aren't going the way they're

709
00:31:12,190 --> 00:31:09,950
supposed to on the different systems and

710
00:31:13,480 --> 00:31:12,200
the ifs and the various flight

711
00:31:16,270 --> 00:31:13,490
controllers need to be aware of it

712
00:31:17,860 --> 00:31:16,280
they're all aware of it in some degree

713
00:31:19,750 --> 00:31:17,870

for their own systems but you might need

714
00:31:23,050 --> 00:31:19,760
to know something about another system

715
00:31:24,730 --> 00:31:23,060
so that's thrown up here it's actually

716
00:31:27,760 --> 00:31:24,740
not great that there's red and yellow

717
00:31:29,140 --> 00:31:27,770
right here because that means something

718
00:31:31,900 --> 00:31:29,150
not good is happening so I don't know

719
00:31:34,900 --> 00:31:31,910
when this picture was taken but it's not

720
00:31:39,340 --> 00:31:34,910
good it's not good to see red in Mission

721
00:31:42,370 --> 00:31:39,350
Control just as a general rule so let's

722
00:31:44,680 --> 00:31:42,380
see this was a video I showed you so

723
00:31:46,720 --> 00:31:44,690
we'll switch back to this picture here

724
00:31:47,890 --> 00:31:46,730
so I want to jump in and I want to talk

725
00:31:51,100 --> 00:31:47,900
to you guys about what each one of these

726
00:31:52,750 --> 00:31:51,110
console positions do and then at the end

727
00:31:54,510 --> 00:31:52,760
of talking about ISS I'll jump in a

728
00:31:57,370 --> 00:31:54,520
little bit to what the different

729
00:31:59,590 --> 00:31:57,380
consoles and experts will be for the

730
00:32:01,810 --> 00:31:59,600
James Webb Space Telescope so first I

731
00:32:04,240 --> 00:32:01,820
want to talk about the flight director

732
00:32:06,130 --> 00:32:04,250
and Capcom that's who you guys saw in

733
00:32:07,800 --> 00:32:06,140
the video it's who you might be most

734
00:32:11,320 --> 00:32:07,810
familiar with from the movie Apollo 13

735
00:32:15,010 --> 00:32:11,330
things like that so the flight director

736
00:32:18,580 --> 00:32:15,020
is totally in charge of everything ever

737
00:32:20,020 --> 00:32:18,590
on the ISS period there are a handful of

738
00:32:21,220 --> 00:32:20,030

Mission Control centers I forgot to

739
00:32:23,140 --> 00:32:21,230
mention that there's a Mission Control

740
00:32:26,320 --> 00:32:23,150
Center in Moscow there's a Mission

741
00:32:29,830 --> 00:32:26,330
Control Center in Germany there's one in

742
00:32:31,810 --> 00:32:29,840
Japan there's one in Houston there's

743
00:32:33,580 --> 00:32:31,820
actually a payload control center in

744
00:32:35,350 --> 00:32:33,590
Alabama so there's a handful of

745
00:32:37,060 --> 00:32:35,360
different control centers all over the

746
00:32:38,740 --> 00:32:37,070
place and each one of those control

747
00:32:40,510 --> 00:32:38,750
centers has their own flight director

748
00:32:43,240 --> 00:32:40,520
but the flight director who's in Houston

749
00:32:45,490 --> 00:32:43,250
is the number one person in charge he or

750
00:32:48,670 --> 00:32:45,500
she makes the final call on everything

751
00:32:52,180 --> 00:32:48,680
that happens on the ISS so you may

752
00:32:53,560 --> 00:32:52,190
recognize Ed Harris from the movie

753
00:32:56,790 --> 00:32:53,570
Apollo 13 he was a flight director

754
00:32:58,860 --> 00:32:56,800
playing this guy Gene Kranz who you saw

755
00:33:01,020 --> 00:32:58,870
video before Jane Krantz is a really

756
00:33:03,270 --> 00:33:01,030
cool guy if you haven't heard about him

757
00:33:04,650 --> 00:33:03,280
before I definitely look him up I saw

758
00:33:07,470 --> 00:33:04,660
him once on an airplane and I got really

759
00:33:09,840 --> 00:33:07,480
excited flying back to Houston it was

760
00:33:12,420 --> 00:33:09,850
very cool for me but I was cool on the

761
00:33:14,610 --> 00:33:12,430
outside like oh hey how's it going on

762
00:33:18,840 --> 00:33:14,620
the inside I was like oh my god this is

763
00:33:21,360 --> 00:33:18,850

so cool um so the flight director like I

764
00:33:24,560 --> 00:33:21,370
said is in charge of everything they he

765
00:33:28,890 --> 00:33:24,570
he or she is the person in the room who

766
00:33:30,210 --> 00:33:28,900
has final say even if the president

767
00:33:32,190 --> 00:33:30,220
called and wanted something to happen on

768
00:33:33,720 --> 00:33:32,200
the ISS it couldn't happen unless the

769
00:33:38,400 --> 00:33:33,730
flight director said yes it can happen

770
00:33:41,220 --> 00:33:38,410
so kind of give you an idea so Capcom is

771
00:33:42,990 --> 00:33:41,230
the capsule communicator probably the

772
00:33:45,210 --> 00:33:43,000
most famous Capcom you guys have ever

773
00:33:49,440 --> 00:33:45,220
heard of is the actor commonly known as

774
00:33:53,250 --> 00:33:49,450
oh yeah that guy whose name I don't

775
00:33:54,180 --> 00:33:53,260
actually remember Garrett Gary that's

776
00:33:58,080 --> 00:33:54,190
right

777
00:34:00,600 --> 00:33:58,090
so he played like the Capcom in the

778
00:34:02,160 --> 00:34:00,610
movie Apollo 13 but a real-life Capcom

779
00:34:04,890 --> 00:34:02,170
can be seen here

780
00:34:07,230 --> 00:34:04,900
here this gentleman right here is the

781
00:34:08,790 --> 00:34:07,240
current Capcom not current like now but

782
00:34:10,080 --> 00:34:08,800
current when the picture was taken this

783
00:34:12,720 --> 00:34:10,090
is the current Capcom in the flight

784
00:34:13,980 --> 00:34:12,730
director sitting in Mission Control the

785
00:34:15,960 --> 00:34:13,990
Capcom and the flight director always

786
00:34:18,840 --> 00:34:15,970
sitting next to each other and the

787
00:34:22,919 --> 00:34:18,850
Capcom is for the most part the only

788
00:34:25,050 --> 00:34:22,929

person that can talk to the astronauts

789
00:34:28,800 --> 00:34:25,060
in space this was especially important

790
00:34:30,600 --> 00:34:28,810
in apollo gemini and the space shuttle

791
00:34:32,250 --> 00:34:30,610
it's a little less important now at the

792
00:34:33,800 --> 00:34:32,260
ISS since we have people up there all

793
00:34:35,790 --> 00:34:33,810
the time working on different

794
00:34:38,610 --> 00:34:35,800
experiments and stuff like that you want

795
00:34:41,100 --> 00:34:38,620
different specialists to be able to talk

796
00:34:43,080 --> 00:34:41,110
to them but anytime there is a dynamic

797
00:34:44,880 --> 00:34:43,090
operation happening and especially in

798
00:34:46,500 --> 00:34:44,890
the days of the shuttle Capcom was the

799
00:34:47,220 --> 00:34:46,510
only person who could talk to the two

800
00:34:49,770 --> 00:34:47,230
astronauts

801
00:34:51,690 --> 00:34:49,780
Capcom was generally a former astronaut

802
00:34:54,960 --> 00:34:51,700
themselves and the reason that this is

803
00:34:57,150 --> 00:34:54,970
is so there's only one voice that the

804
00:34:58,950 --> 00:34:57,160
astronauts hear and they're not hearing

805
00:34:59,550 --> 00:34:58,960
all of the craziness that's happening on

806
00:35:01,380 --> 00:34:59,560
the ground

807
00:35:03,570 --> 00:35:01,390
the reason it's a former astronaut is

808
00:35:05,670 --> 00:35:03,580
because they generally know in this

809
00:35:07,620 --> 00:35:05,680
situation that's happening these are the

810
00:35:09,210 --> 00:35:07,630
things that I would want to know up in

811
00:35:10,260 --> 00:35:09,220
space and these are the things I need to

812
00:35:14,760 --> 00:35:10,270
hear

813
00:35:17,130 --> 00:35:14,770

to react to the situation so now it's

814
00:35:18,450 --> 00:35:17,140
not just astronauts but different

815
00:35:20,430 --> 00:35:18,460
specialists and stuff who can talk to

816
00:35:28,800 --> 00:35:20,440
the astronauts and acting as Capcom

817
00:35:30,600 --> 00:35:28,810
anesthesia yeah so there is a play

818
00:35:32,640 --> 00:35:30,610
director office if you didn't get a

819
00:35:34,380 --> 00:35:32,650
question it is what happens with 24/7

820
00:35:36,660 --> 00:35:34,390
coverage are there multiple is there a

821
00:35:38,040 --> 00:35:36,670
deputy that sort of thing so there are

822
00:35:41,100 --> 00:35:38,050
there's a flight director office that

823
00:35:43,770 --> 00:35:41,110
has I don't know how many but a whole

824
00:35:45,390 --> 00:35:43,780
cadre of flight directors so the on

825
00:35:46,980 --> 00:35:45,400
console flight director is the person

826
00:35:48,870 --> 00:35:46,990
who has the final authority the person

827
00:35:51,840 --> 00:35:48,880
who's in the room at the time there's

828
00:35:55,170 --> 00:35:51,850
also for every increment on the ISS

829
00:35:58,830 --> 00:35:55,180
that's when a new crew of three people

830
00:36:00,270 --> 00:35:58,840
flies up on the Soyuz that new group of

831
00:36:01,800 --> 00:36:00,280
three people is called an increment so

832
00:36:03,450 --> 00:36:01,810
forever increment there's a lead flight

833
00:36:07,350 --> 00:36:03,460
director and they're kind of the ones

834
00:36:10,410 --> 00:36:07,360
who oversee the activities from start to

835
00:36:12,360 --> 00:36:10,420
finish of the increment but with 24/7

836
00:36:14,160 --> 00:36:12,370
ops the flight director console is one

837
00:36:16,350 --> 00:36:14,170
of the one of the consoles that's

838
00:36:17,940 --> 00:36:16,360

staffed all the time there's always a

839
00:36:20,400 --> 00:36:17,950
flight director there's not always a

840
00:36:22,350 --> 00:36:20,410
Capcom like when the astronauts are

841
00:36:23,760 --> 00:36:22,360
sleeping cuz even though they're in

842
00:36:25,770 --> 00:36:23,770
space we still let them sleep eight

843
00:36:27,690 --> 00:36:25,780
hours a day in fact it's planned into

844
00:36:29,520 --> 00:36:27,700
their day they have to sleep eight hours

845
00:36:31,770 --> 00:36:29,530
they even get free times if they want

846
00:36:33,240 --> 00:36:31,780
free time they do that sometimes you get

847
00:36:36,000 --> 00:36:33,250
an astronaut like Peggy Whitson

848
00:36:38,550 --> 00:36:36,010
who recently broke records for most days

849
00:36:40,790 --> 00:36:38,560
in space she's so cool in her free time

850
00:36:43,890 --> 00:36:40,800
she would just do more stuff like

851
00:36:45,510 --> 00:36:43,900
there's a it's called a task list that

852
00:36:47,460 --> 00:36:45,520
they have for the astronauts to do as

853
00:36:48,840 --> 00:36:47,470
while they're on orbit so if they have a

854
00:36:50,250 --> 00:36:48,850
little bit of free time and maybe want

855
00:36:52,080 --> 00:36:50,260
to advance science or something they

856
00:36:54,120 --> 00:36:52,090
could do that Peggy Whitson works in the

857
00:36:55,860 --> 00:36:54,130
whole task list and we had to pull stuff

858
00:36:58,260 --> 00:36:55,870
from other task lists just to give her

859
00:37:02,359 --> 00:36:58,270
because she was so cool I saw her in an

860
00:37:07,940 --> 00:37:05,900
anyways so the Capcom console is not

861
00:37:10,250 --> 00:37:07,950
staffed when the astronauts are asleep

862
00:37:11,960 --> 00:37:10,260
or maybe at some other times but the

863
00:37:16,010 --> 00:37:11,970

flight director console is always

864
00:37:20,480 --> 00:37:16,020
staffed so that brings me into the other

865
00:37:24,980 --> 00:37:20,490
consoles that are staffed 24/7 365 or

866
00:37:30,920 --> 00:37:24,990
366 we also staff on leap years we got

867
00:37:32,450 --> 00:37:30,930
ad Co Chronos ethos and Sparkman you

868
00:37:36,260 --> 00:37:32,460
should pay attention cuz there's gonna

869
00:37:38,060 --> 00:37:36,270
be a quiz and I'm going to talk about

870
00:37:39,740 --> 00:37:38,070
which each one of these do it won't

871
00:37:41,480 --> 00:37:39,750
surprise you to find out that each one

872
00:37:41,870 --> 00:37:41,490
of these names are acronyms because at

873
00:37:44,420 --> 00:37:41,880
NASA

874
00:37:46,099 --> 00:37:44,430
everyone loves acronyms even though some

875
00:37:47,380 --> 00:37:46,109
of them are a stretch and I'll show you

876
00:37:52,130 --> 00:37:47,390
in a second

877
00:37:54,410 --> 00:37:52,140
so ad Co is the attitude determination

878
00:37:57,740 --> 00:37:54,420
and control officer they are the people

879
00:37:59,839 --> 00:37:57,750
who determine and control the attitude

880
00:38:03,079 --> 00:37:59,849
for the International Space Station as

881
00:38:05,930 --> 00:38:03,089
you might guess so what does that mean

882
00:38:07,819 --> 00:38:05,940
much like an airplane can go this way in

883
00:38:09,500 --> 00:38:07,829
this way in this way the space station

884
00:38:11,900 --> 00:38:09,510
can also go this way in this way in this

885
00:38:15,589 --> 00:38:11,910
way but it also goes this way around the

886
00:38:17,420 --> 00:38:15,599
earth so the ADCO is the console in

887
00:38:20,240 --> 00:38:17,430
charge of making sure we know how the

888
00:38:26,300 --> 00:38:20,250

spacecraft is oriented and where they

889
00:38:27,530 --> 00:38:26,310
are in earth over Earth's orbit they you

890
00:38:29,930 --> 00:38:27,540
can think of them as kind of the ones

891
00:38:31,339 --> 00:38:29,940
who actually fly the ISS and that's what

892
00:38:33,140 --> 00:38:31,349
they'll tell you if you ever talk to an

893
00:38:37,280 --> 00:38:33,150
ad Co is that they're the ones who fly

894
00:38:40,370 --> 00:38:37,290
the ISS so we also have chromis and this

895
00:38:42,260 --> 00:38:40,380
is an example of one of the acronyms

896
00:38:44,720 --> 00:38:42,270
that's a little bit of a stretch they're

897
00:38:48,530 --> 00:38:44,730
the communications RF onboard network

898
00:38:52,819 --> 00:38:48,540
utilization specialist obviously and

899
00:38:55,849 --> 00:38:52,829
they utilize communications and RF

900
00:38:58,730 --> 00:38:55,859
onboard networks know they are in charge

901
00:39:01,370 --> 00:38:58,740
of the communication between the

902
00:39:04,520 --> 00:39:01,380
spacecraft and the ground there is a

903
00:39:05,300 --> 00:39:04,530
very video feed from the spacecraft on

904
00:39:07,280 --> 00:39:05,310
the ground let me out

905
00:39:09,140 --> 00:39:07,290
and the inside and they are in charge of

906
00:39:10,910 --> 00:39:09,150
the computers now this is a little bit

907
00:39:13,490 --> 00:39:10,920
of a misleading picture because they're

908
00:39:14,840 --> 00:39:13,500
not in charge of the computers such as

909
00:39:17,660 --> 00:39:14,850
laptops and stuff they're in charge of

910
00:39:22,040 --> 00:39:17,670
the computers that the ISS uses to talk

911
00:39:24,320 --> 00:39:22,050
to itself so all of the commands that we

912
00:39:25,550 --> 00:39:24,330
send up to the spacecraft get processed

913
00:39:27,230 --> 00:39:25,560

their computers and sent to the

914
00:39:31,100 --> 00:39:27,240
different subsystems like if you want to

915
00:39:33,170 --> 00:39:31,110
turn on a fan in one module you'd send

916
00:39:34,880 --> 00:39:33,180
up a command to turn on that fan these

917
00:39:38,180 --> 00:39:34,890
the computers that Chronos is in charge

918
00:39:39,800 --> 00:39:38,190
of is what take that command understands

919
00:39:44,770 --> 00:39:39,810
it and sends it to that fan to turn the

920
00:39:48,160 --> 00:39:44,780
fan on so that's how they utilize

921
00:39:50,740 --> 00:39:48,170
communications RF onboard and networks

922
00:39:53,000 --> 00:39:50,750
next we have ethos ethos the

923
00:39:54,860 --> 00:39:53,010
environmental and thermal operation

924
00:39:57,680 --> 00:39:54,870
system specialists they are the ones in

925
00:40:00,860 --> 00:39:57,690
charge of life support and climate

926
00:40:02,870 --> 00:40:00,870
control so they are in charge of

927
00:40:04,550 --> 00:40:02,880
basically the health and safety of the

928
00:40:07,220 --> 00:40:04,560
astronauts and making the International

929
00:40:10,430 --> 00:40:07,230
Space Station a livable place for us to

930
00:40:13,430 --> 00:40:10,440
send people they are in charge of

931
00:40:17,480 --> 00:40:13,440
ventilation not with a fan like this but

932
00:40:19,580 --> 00:40:17,490
with more fancy fans space fans if you

933
00:40:22,210 --> 00:40:19,590
will that are in the ducts for the space

934
00:40:26,150 --> 00:40:22,220
station because if you think about it in

935
00:40:29,120 --> 00:40:26,160
space there's no there's no gravity

936
00:40:35,810 --> 00:40:29,130
right here on earth if you have a pocket

937
00:40:37,310 --> 00:40:35,820
of hot air it rises high right so if you

938
00:40:40,070 --> 00:40:37,320

have a pocket of hot air rises and the

939
00:40:43,220 --> 00:40:40,080
cool air sinks but in space there isn't

940
00:40:45,620 --> 00:40:43,230
gravity to make those gradients happen

941
00:40:48,320 --> 00:40:45,630
so you can end up with kind of just a

942
00:40:51,550 --> 00:40:48,330
pocket of stagnant air just kind of

943
00:40:53,930 --> 00:40:51,560
there and it could smell bad or have a

944
00:40:55,400 --> 00:40:53,940
concentration of co2 in it or something

945
00:40:56,750 --> 00:40:55,410
like that so ventilation on the space

946
00:40:58,160 --> 00:40:56,760
station is really important you want to

947
00:41:00,850 --> 00:40:58,170
keep the air moving around so you don't

948
00:41:03,970 --> 00:41:00,860
end up with that stagnant pocket of air

949
00:41:08,660 --> 00:41:03,980
there also in charge of humidity control

950
00:41:10,580 --> 00:41:08,670
because again there is no gravity so

951
00:41:12,350 --> 00:41:10,590
things don't condense out of the air and

952
00:41:13,970 --> 00:41:12,360
fall to the ground it condenses out of

953
00:41:15,950 --> 00:41:13,980
the air and just kind of sticks to stuff

954
00:41:17,290 --> 00:41:15,960
you don't want that to happen so you

955
00:41:19,660 --> 00:41:17,300
want to keep really good control

956
00:41:22,900 --> 00:41:19,670
the humidity in the spacecraft also the

957
00:41:25,450 --> 00:41:22,910
temperature space is cold so they don't

958
00:41:27,270 --> 00:41:25,460
want the astronauts to be cold basically

959
00:41:30,250 --> 00:41:27,280
so they keep control of the temperature

960
00:41:31,840 --> 00:41:30,260
onboard the spacecraft to the ethos

961
00:41:33,940 --> 00:41:31,850
specialist is also in charge of

962
00:41:35,880 --> 00:41:33,950
emergencies on the spacecraft can anyone

963
00:41:42,370 --> 00:41:35,890

think of an emergency on a spacecraft

964
00:41:45,220 --> 00:41:42,380
hint yeah so on board the ISS there are

965
00:41:47,110 --> 00:41:45,230
three types of what you call an onboard

966
00:41:48,880 --> 00:41:47,120
emergency there are a lots and lots of

967
00:41:50,620 --> 00:41:48,890
things that could go wrong but there are

968
00:41:52,540 --> 00:41:50,630
three things that will cause everybody

969
00:41:55,480 --> 00:41:52,550
to stop what they're doing and take care

970
00:41:57,910 --> 00:41:55,490
of the emergency one of them is fire can

971
00:42:01,510 --> 00:41:57,920
anyone think of another one thanks yeah

972
00:42:03,850 --> 00:42:01,520
a leak or a rapid depressurization so if

973
00:42:05,830 --> 00:42:03,860
a micrometeoroid hits something and it

974
00:42:08,620 --> 00:42:05,840
starts to depressurize that's really bad

975
00:42:10,510 --> 00:42:08,630
we have to take all of the air up there

976
00:42:13,600 --> 00:42:10,520
and we don't want to let it just go out

977
00:42:16,000 --> 00:42:13,610
into space so a rapid depressurization

978
00:42:17,800 --> 00:42:16,010
or a leak is another one the third one

979
00:42:24,970 --> 00:42:17,810
is kind of strange the third one is an

980
00:42:27,880 --> 00:42:24,980
ammonia leak yeah there is one very very

981
00:42:29,800 --> 00:42:27,890
not likely path through which ammonia

982
00:42:32,200 --> 00:42:29,810
could be introduced into the atmosphere

983
00:42:34,450 --> 00:42:32,210
of the space station it's never happened

984
00:42:36,520 --> 00:42:34,460
it probably will never happen but

985
00:42:38,710 --> 00:42:36,530
someone realized one day that through a

986
00:42:39,520 --> 00:42:38,720
series of very unfortunate events it

987
00:42:42,520 --> 00:42:39,530
could happen

988
00:42:44,470 --> 00:42:42,530

so there are a lot of detection zhh in

989
00:42:46,240 --> 00:42:44,480
place and a lot of different signs that

990
00:42:48,310 --> 00:42:46,250
the ethos looks forward to make sure

991
00:42:50,830 --> 00:42:48,320
that ammonia doesn't get introduced into

992
00:42:59,080 --> 00:42:50,840
the atmosphere because ammonia is really

993
00:43:00,610 --> 00:42:59,090
bad if you weren't sure yeah the

994
00:43:02,020 --> 00:43:00,620
question was how is it that the oxygen

995
00:43:03,760 --> 00:43:02,030
doesn't run out in the space station

996
00:43:06,010 --> 00:43:03,770
that is also something that the ethos

997
00:43:08,110 --> 00:43:06,020
specialist is in charge of so on board

998
00:43:10,720 --> 00:43:08,120
we have regenerative life support

999
00:43:14,380 --> 00:43:10,730
systems so we can take the water and

1000
00:43:17,260 --> 00:43:14,390
turn it into oxygen and hydrogen and we

1001
00:43:19,930 --> 00:43:17,270
can even take like pea and turn it into

1002
00:43:22,279 --> 00:43:19,940
drinkable water so if you're not into

1003
00:43:25,519 --> 00:43:22,289
that don't be an astronaut but

1004
00:43:30,229 --> 00:43:25,529
I I hear that it tastes just like water

1005
00:43:31,939 --> 00:43:30,239
and you would never know we also when

1006
00:43:34,880 --> 00:43:31,949
the shuttle was flying we also used to

1007
00:43:36,709 --> 00:43:34,890
take big tanks of oxygen up to the space

1008
00:43:38,900 --> 00:43:36,719
station to refill it that way but the

1009
00:43:40,459 --> 00:43:38,910
shuttle is not flying anymore so I'm not

1010
00:43:41,630 --> 00:43:40,469
sure if any of the other spacecraft do

1011
00:43:49,489 --> 00:43:41,640
that but that's a good question I'll

1012
00:43:51,229 --> 00:43:49,499
have to look into that yeah no they

1013
00:43:54,099 --> 00:43:51,239

don't cover when astronauts get sick but

1014
00:44:00,499 --> 00:43:54,109
I will tell you in a few slides who does

1015
00:44:01,939 --> 00:44:00,509
yes so the question was what sort of

1016
00:44:03,589 --> 00:44:01,949
fire protection systems that they have

1017
00:44:05,479 --> 00:44:03,599
on board they have a lot of different

1018
00:44:07,640 --> 00:44:05,489
fire protection protection systems on

1019
00:44:09,109 --> 00:44:07,650
board because fire is probably the

1020
00:44:12,219 --> 00:44:09,119
number one thing they are very most

1021
00:44:18,380 --> 00:44:16,279
there are everything from you don't

1022
00:44:20,390 --> 00:44:18,390
really want to loose a fire extinguisher

1023
00:44:22,309 --> 00:44:20,400
and the space station because all those

1024
00:44:24,620 --> 00:44:22,319
particles will just kind of float away

1025
00:44:26,209 --> 00:44:24,630
they won't necessarily stay right at the

1026
00:44:28,519 --> 00:44:26,219
fire so it's everything from like you

1027
00:44:31,069 --> 00:44:28,529
can smother it with blankets they have

1028
00:44:34,489 --> 00:44:31,079
special fire blankets too even closing

1029
00:44:36,109 --> 00:44:34,499
off the hatch and venting out a module

1030
00:44:38,479 --> 00:44:36,119
to get rid of all the oxygen so the fire

1031
00:44:39,649 --> 00:44:38,489
dies so there there's a lot of different

1032
00:44:41,749 --> 00:44:39,659
ways depending on the severity of the

1033
00:44:45,039 --> 00:44:41,759
fire and the location of the fire what

1034
00:44:47,380 --> 00:44:45,049
the approach would be and all of the

1035
00:44:50,779 --> 00:44:47,390
procedures for this are in a big

1036
00:44:52,849 --> 00:44:50,789
notebook about this big also probably on

1037
00:44:54,919 --> 00:44:52,859
the computer but there are hard copies

1038
00:44:56,209 --> 00:44:54,929

backed up right behind all of the flight

1039
00:44:58,099 --> 00:44:56,219
controllers they can grab the emergency

1040
00:45:00,769 --> 00:44:58,109
notebook and say ok this is what we do

1041
00:45:02,449 --> 00:45:00,779
next so it's very likely that most of

1042
00:45:04,579 --> 00:45:02,459
the scenarios have been thought through

1043
00:45:06,890 --> 00:45:04,589
and they're able to combat the fire the

1044
00:45:11,059 --> 00:45:06,900
way that they need to in order to keep

1045
00:45:14,479 --> 00:45:11,069
the crew and the vehicle healthy yes

1046
00:45:17,479 --> 00:45:14,489
does Chronos have control over all ISS

1047
00:45:19,339 --> 00:45:17,489
uplink and downlink so say say Capcom

1048
00:45:21,049 --> 00:45:19,349
was it something the astronauts that

1049
00:45:23,390 --> 00:45:21,059
they get from ethos does it have to go

1050
00:45:25,729 --> 00:45:23,400
through cretinous first that's a good

1051
00:45:26,380 --> 00:45:25,739
question so the question was all of the

1052
00:45:28,359 --> 00:45:26,390
up Lincoln

1053
00:45:30,309 --> 00:45:28,369
like go through Cronus crota said the

1054
00:45:33,160 --> 00:45:30,319
person that owns the systems that allow

1055
00:45:36,400 --> 00:45:33,170
the uplink and downlink to happen but

1056
00:45:38,740 --> 00:45:36,410
they don't have to talk to Kronos first

1057
00:45:40,180 --> 00:45:38,750
before they talk to the astronauts it's

1058
00:45:41,740 --> 00:45:40,190
not the only way you can talk to the

1059
00:45:43,839 --> 00:45:41,750
astronauts so there's also a ham radio

1060
00:45:46,359 --> 00:45:43,849
on the space station that the astronauts

1061
00:45:48,220 --> 00:45:46,369
use sometimes so when it's flying over

1062
00:45:51,430 --> 00:45:48,230
if any of the astronauts are on the ham

1063
00:45:55,000 --> 00:45:51,440

radio you can talk to them that way okay

1064
00:45:56,589 --> 00:45:55,010
but Kronos is just in charge of the

1065
00:45:58,779 --> 00:45:56,599
systems that allow it to happen

1066
00:46:01,210 --> 00:45:58,789
that's the cronuts doesn't directly

1067
00:46:04,210 --> 00:46:01,220
authorize communication correct cronuts

1068
00:46:06,519 --> 00:46:04,220
just enables communication to happen so

1069
00:46:09,870 --> 00:46:06,529
the next console position that staff

1070
00:46:12,309 --> 00:46:09,880
24/7 is called Spartan station power

1071
00:46:15,370 --> 00:46:12,319
articulation thermal and analysis it's

1072
00:46:17,829 --> 00:46:15,380
another stretch kind of acronym name but

1073
00:46:20,289 --> 00:46:17,839
I think it's pretty cool my parents went

1074
00:46:22,690 --> 00:46:20,299
to Michigan State so I like the console

1075
00:46:24,880 --> 00:46:22,700
named Spartan so Spartan is in charge of

1076
00:46:29,529 --> 00:46:24,890
the electrical power onboard the space

1077
00:46:31,990 --> 00:46:29,539
station and the external thermal excuse

1078
00:46:33,460 --> 00:46:32,000
me on the space station you guys

1079
00:46:36,609 --> 00:46:33,470
probably know that the space station is

1080
00:46:38,920 --> 00:46:36,619
powered from solar energy so as Spartan

1081
00:46:40,059 --> 00:46:38,930
is the one Spartan is the console that's

1082
00:46:42,220 --> 00:46:40,069
in charge of making sure the solar

1083
00:46:44,319 --> 00:46:42,230
arrays are pointed at the Sun so that

1084
00:46:46,269 --> 00:46:44,329
we're getting the most power we can out

1085
00:46:48,039 --> 00:46:46,279
of the solar arrays they are also in

1086
00:46:50,470 --> 00:46:48,049
charge of routing that power from the

1087
00:47:04,539 --> 00:46:50,480
solar arrays to the various components

1088
00:47:07,269 --> 00:47:04,549

that need it yeah that's an excellent

1089
00:47:09,309 --> 00:47:07,279
question so she asked how ADCO is in

1090
00:47:11,380 --> 00:47:09,319
charge of how the space station is

1091
00:47:13,839 --> 00:47:11,390
oriented but oriented in terms of what

1092
00:47:15,999 --> 00:47:13,849
there's actually different attitudes at

1093
00:47:17,589 --> 00:47:16,009
which the space station can fly but for

1094
00:47:20,079 --> 00:47:17,599
the most part the space station flies

1095
00:47:25,870 --> 00:47:20,089
like an airplane would around the world

1096
00:47:28,749 --> 00:47:25,880
so it has a forward it has a thank you

1097
00:47:30,910 --> 00:47:28,759
it has an aft it has a port it has a

1098
00:47:33,759 --> 00:47:30,920
starboard but it also has what's called

1099
00:47:35,829 --> 00:47:33,769
a zenith which is up so away from the

1100
00:47:38,620 --> 00:47:35,839
earth and a nadir which is down towards

1101
00:47:40,079 --> 00:47:38,630
the earth and it flies around at about a

1102
00:47:43,799 --> 00:47:40,089
4 degrees of

1103
00:47:45,900 --> 00:47:43,809
every minute I think so it just kind of

1104
00:47:49,829 --> 00:47:45,910
constantly pitches nose over so that it

1105
00:47:51,959 --> 00:47:49,839
can fly around the earth there's other

1106
00:47:56,579 --> 00:47:51,969
orientations once upon a time there was

1107
00:47:58,079 --> 00:47:56,589
a solar array that broke and we had we

1108
00:48:00,689 --> 00:47:58,089
weren't getting as much power as we

1109
00:48:02,880 --> 00:48:00,699
needed to so instead of flying like this

1110
00:48:06,660 --> 00:48:02,890
we kind of took the solar arrays and

1111
00:48:07,829 --> 00:48:06,670
flew like this so instead of around the

1112
00:48:12,269 --> 00:48:07,839
earth like this we kind of just like

1113
00:48:13,709 --> 00:48:12,279

went around the earth like like this so

1114
00:48:16,380 --> 00:48:13,719
there's different attitudes you can fly

1115
00:48:19,319 --> 00:48:16,390
at and it's always though determined

1116
00:48:21,529 --> 00:48:19,329
pretty much earth relative how you're

1117
00:48:24,689 --> 00:48:21,539
flying does that answer your question

1118
00:48:26,729 --> 00:48:24,699
cool all right I'm gonna move on because

1119
00:48:28,019 --> 00:48:26,739
there's lots of positions save your

1120
00:48:29,459 --> 00:48:28,029
question for the end there's lots of

1121
00:48:30,599 --> 00:48:29,469
positions I want to make sure I get to

1122
00:48:35,069 --> 00:48:30,609
all of them and then talk a little bit

1123
00:48:37,709 --> 00:48:35,079
about the articulation in Spartan is the

1124
00:48:39,239 --> 00:48:37,719
articulation of the solar arrays yeah

1125
00:48:41,579 --> 00:48:39,249
how the solar arrays are pointed so they

1126
00:48:44,009 --> 00:48:41,589
can articulate like this like this and

1127
00:48:46,890 --> 00:48:44,019
also like this there's lots of exercises

1128
00:48:50,519 --> 00:48:46,900
you could do as a Space Station flight

1129
00:48:52,259 --> 00:48:50,529
controller to talk about your job okay

1130
00:48:54,890 --> 00:48:52,269
so those are the stage those are the

1131
00:48:57,989 --> 00:48:54,900
positions that are staffed 24/7 365

1132
00:48:59,640 --> 00:48:57,999
there are four consoles that are staffed

1133
00:49:03,239 --> 00:48:59,650
for what's called dynamic operations

1134
00:49:04,949 --> 00:49:03,249
those are operations that aren't usual

1135
00:49:07,019 --> 00:49:04,959
on the space station so it's something

1136
00:49:09,059 --> 00:49:07,029
like the docking of a spacecraft or a

1137
00:49:12,089 --> 00:49:09,069
spacewalk or the undocking of a

1138
00:49:16,199 --> 00:49:12,099

spacecraft or a robotics operation

1139
00:49:20,039 --> 00:49:16,209
something like that so we have a VA Robo

1140
00:49:21,689 --> 00:49:20,049
vvo and ice I'm going to talk about each

1141
00:49:23,880 --> 00:49:21,699
one of those now first we'll start with

1142
00:49:25,979 --> 00:49:23,890
EPA EPA stands for extra vehicular

1143
00:49:28,229 --> 00:49:25,989
activity they are the people who are in

1144
00:49:30,359 --> 00:49:28,239
charge of the spacewalks so anytime an

1145
00:49:33,539 --> 00:49:30,369
astronaut or a cosmonaut goes outside of

1146
00:49:36,089 --> 00:49:33,549
the space station the EPA people are in

1147
00:49:37,380 --> 00:49:36,099
charge of what happens they are also in

1148
00:49:39,209 --> 00:49:37,390
charge of training the astronauts you

1149
00:49:40,799 --> 00:49:39,219
guys may have seen pictures of it's

1150
00:49:42,449 --> 00:49:40,809
called the neutral buoyancy lab down in

1151
00:49:44,069 --> 00:49:42,459
Houston it's this giant swimming pool

1152
00:49:44,789 --> 00:49:44,079
that has the mock-up of a space station

1153
00:49:46,140 --> 00:49:44,799
in it

1154
00:49:50,309 --> 00:49:46,150
it's where the astronauts can go

1155
00:49:52,140 --> 00:49:50,319
practice being essentially weightless to

1156
00:49:53,529 --> 00:49:52,150
practice all the spacewalks they're

1157
00:49:58,209 --> 00:49:53,539
going to do in space

1158
00:50:00,789 --> 00:49:58,219
in on earth before they go into space so

1159
00:50:03,759 --> 00:50:00,799
that's the EBA console there on dock

1160
00:50:06,789 --> 00:50:03,769
when EPA's happen we also have the

1161
00:50:08,889 --> 00:50:06,799
robotics officer or Robo they are in

1162
00:50:10,089 --> 00:50:08,899
charge of the different robotics

1163
00:50:12,249 --> 00:50:10,099

operations on board the space station

1164
00:50:15,069 --> 00:50:12,259
most notably the space station robotic

1165
00:50:17,620 --> 00:50:15,079
arm and I'll talk a little bit more

1166
00:50:19,599 --> 00:50:17,630
about the robotic arm in a second we

1167
00:50:24,819 --> 00:50:19,609
also have the visiting vehicle officer

1168
00:50:28,299 --> 00:50:24,829
who is in charge of the following

1169
00:50:31,449 --> 00:50:28,309
spacecraft the Soyuz which is the

1170
00:50:34,029 --> 00:50:31,459
Russian spacecraft that brings people up

1171
00:50:37,029 --> 00:50:34,039
to the space station the ATV which is

1172
00:50:39,219 --> 00:50:37,039
the European Space Agency's cargo

1173
00:50:40,870 --> 00:50:39,229
resupply vehicle and the progress which

1174
00:50:43,959 --> 00:50:40,880
is the Russians the Russian space

1175
00:50:46,870 --> 00:50:43,969
agency's cargo resupply vehicle fun fact

1176
00:50:50,139 --> 00:50:46,880
the Soyuz and the progress are almost

1177
00:50:52,359 --> 00:50:50,149
identical except this one says Soyuz and

1178
00:50:54,879 --> 00:50:52,369
this one says progress if you can read

1179
00:50:58,539 --> 00:50:54,889
Russian if you can't read Russian the

1180
00:51:00,219 --> 00:50:58,549
Soyuz has a periscope on it for the

1181
00:51:00,759 --> 00:51:00,229
astronauts and cosmonauts to be able to

1182
00:51:03,249 --> 00:51:00,769
see out of

1183
00:51:05,379 --> 00:51:03,259
because cargo doesn't need to see but

1184
00:51:09,549 --> 00:51:05,389
the astronauts do so this one has a

1185
00:51:11,289 --> 00:51:09,559
periscope this one also has a crew cabin

1186
00:51:13,359 --> 00:51:11,299
right here that's pressurized

1187
00:51:15,999 --> 00:51:13,369
this isn't pressurized because again

1188
00:51:18,519 --> 00:51:16,009

cargo we don't care I mean we care we

1189
00:51:21,189 --> 00:51:18,529
need it don't get me wrong but not as

1190
00:51:24,009 --> 00:51:21,199
much as we care about crew so then we

1191
00:51:26,139 --> 00:51:24,019
have the integration systems engineer or

1192
00:51:27,909 --> 00:51:26,149
ice they are in charge of the vehicles

1193
00:51:32,949 --> 00:51:27,919
that come to this fate to the space

1194
00:51:35,819 --> 00:51:32,959
station that are the Japanese HTV the

1195
00:51:40,059 --> 00:51:35,829
Cygnus the orbital Cygnus vehicle and

1196
00:51:42,939 --> 00:51:40,069
SpaceX's dragon vehicle can anyone spot

1197
00:51:44,469 --> 00:51:42,949
a difference between the vehicles videos

1198
00:51:47,429 --> 00:51:44,479
in charge of and the vehicles that ice

1199
00:51:51,999 --> 00:51:47,439
is in charge of just from these pictures

1200
00:51:55,139 --> 00:51:52,009
what yes so that is one difference these

1201
00:51:57,129 --> 00:51:55,149
are commercial vehicles here what about

1202
00:52:01,029 --> 00:51:57,139
there's something in these pictures

1203
00:52:02,620 --> 00:52:01,039
that's not in these pictures yeah so the

1204
00:52:05,519 --> 00:52:02,630
spacecraft don't have the arms that's

1205
00:52:06,880 --> 00:52:05,529
actually the space stations robotic arm

1206
00:52:09,089 --> 00:52:06,890
these V

1207
00:52:11,650 --> 00:52:09,099
people's here the Soyuz progress an ATV

1208
00:52:14,440 --> 00:52:11,660
dynamically duct to the space station so

1209
00:52:16,870 --> 00:52:14,450
they actually fly in and autonomously or

1210
00:52:20,200 --> 00:52:16,880
are piloted duck to the space station

1211
00:52:22,089 --> 00:52:20,210
these vehicles here we reach out and

1212
00:52:24,579 --> 00:52:22,099
grab them with the robotic arm and then

1213
00:52:26,829 --> 00:52:24,589

carefully bring them in to berth to the

1214
00:52:30,240 --> 00:52:26,839
space station that's the difference

1215
00:52:35,019 --> 00:52:30,250
between docking and berthing who knew

1216
00:52:37,210 --> 00:52:35,029
what I learned so ice is in charge of

1217
00:52:38,559 --> 00:52:37,220
those vehicles that berths and videos in

1218
00:52:40,120 --> 00:52:38,569
charge of the vehicles that dynamically

1219
00:52:44,710 --> 00:52:40,130
dock to the space station

1220
00:52:46,210 --> 00:52:44,720
yes it is the same arm that the robotics

1221
00:52:47,259 --> 00:52:46,220
officers in charge of oh that's why I

1222
00:52:50,339 --> 00:52:47,269
said I was going to talk about it again

1223
00:52:53,289 --> 00:52:50,349
that's good so the robotics officer

1224
00:52:56,140 --> 00:52:53,299
works with ice to capture these vehicles

1225
00:52:57,910 --> 00:52:56,150
so ice is the system's expert on the

1226
00:52:59,980 --> 00:52:57,920
vehicles and they work closely with Robo

1227
00:53:05,500 --> 00:52:59,990
to reach out capture the vehicles and

1228
00:53:08,980 --> 00:53:05,510
berth them to the space station actually

1229
00:53:10,059 --> 00:53:08,990
they don't these these ones all dock to

1230
00:53:13,559 --> 00:53:10,069
the Russian side of the space station

1231
00:53:15,609 --> 00:53:13,569
and these all docked to the European

1232
00:53:17,470 --> 00:53:15,619
Japanese and American side of the space

1233
00:53:19,109 --> 00:53:17,480
station the space station is kind of

1234
00:53:22,089 --> 00:53:19,119
like two space stations stuck together

1235
00:53:24,279 --> 00:53:22,099
that's not the official NASA like

1236
00:53:24,849 --> 00:53:24,289
terminology but it's my official

1237
00:53:27,130 --> 00:53:24,859
terminology

1238
00:53:29,019 --> 00:53:27,140

you've got the Russian side and the US

1239
00:53:32,200 --> 00:53:29,029
side and they're kind of just like step

1240
00:53:34,720 --> 00:53:32,210
together and then on the US side we also

1241
00:53:37,079 --> 00:53:34,730
have a European module and a Japanese

1242
00:53:39,579 --> 00:53:37,089
module and a handful of other things but

1243
00:53:41,589 --> 00:53:39,589
International Cooperation it's a really

1244
00:53:44,499 --> 00:53:41,599
good thing we just kind of stick them

1245
00:53:47,400 --> 00:53:44,509
together well I'll talk a little bit

1246
00:53:50,799 --> 00:53:47,410
more about that in a second so we have

1247
00:53:54,549 --> 00:53:50,809
these are the dynamic operations console

1248
00:53:57,819 --> 00:53:54,559
positions so we also have four consoles

1249
00:53:59,499 --> 00:53:57,829
that support daily stuff I didn't think

1250
00:54:03,579 --> 00:53:59,509
of a better term for it so I call it

1251
00:54:06,390 --> 00:54:03,589
daily stuff so we have ops plan ISO Oso

1252
00:54:08,620 --> 00:54:06,400
and Pluto

1253
00:54:11,950 --> 00:54:08,630
they're all up there yeah we'll get

1254
00:54:14,830 --> 00:54:11,960
there so us plan is the operations

1255
00:54:18,610 --> 00:54:14,840
planner the space station is a very very

1256
00:54:20,560 --> 00:54:18,620
very very very very very complex thing

1257
00:54:22,030 --> 00:54:20,570
there is all sorts of systems that have

1258
00:54:24,130 --> 00:54:22,040
to operate in conjunction with each

1259
00:54:26,110 --> 00:54:24,140
other there are people that have to be

1260
00:54:28,600 --> 00:54:26,120
scheduled throughout the day astronauts

1261
00:54:31,210 --> 00:54:28,610
have to do things like eat and sleep and

1262
00:54:32,500 --> 00:54:31,220
stuff ops plan is the console that's in

1263
00:54:35,020 --> 00:54:32,510

charge of making the schedule for

1264
00:54:37,420 --> 00:54:35,030
everything this is a screenshot of a

1265
00:54:38,830 --> 00:54:37,430
thing called OST PV because we can't

1266
00:54:42,070 --> 00:54:38,840
just call it the schedule when we could

1267
00:54:44,230 --> 00:54:42,080
call it OST PV it stands for the onboard

1268
00:54:46,240 --> 00:54:44,240
short-term plan viewer and it is

1269
00:54:49,660 --> 00:54:46,250
literally everything that's happening on

1270
00:54:52,300 --> 00:54:49,670
the ISS at any given time so time goes

1271
00:54:55,210 --> 00:54:52,310
this way and then these different bands

1272
00:54:57,400 --> 00:54:55,220
are I don't know I am pointing when I

1273
00:55:01,840 --> 00:54:57,410
have a laser these different bands are

1274
00:55:04,750 --> 00:55:01,850
the crew here so this is the commander

1275
00:55:08,680 --> 00:55:04,760
all of his activities or her activities

1276
00:55:11,020 --> 00:55:08,690
are here this is when the ISS is in

1277
00:55:12,960 --> 00:55:11,030
Eclipse or in insulation this is when we

1278
00:55:15,790 --> 00:55:12,970
have different communications contacts

1279
00:55:18,760 --> 00:55:15,800
literally everything on the ISS is on

1280
00:55:21,160 --> 00:55:18,770
OST PV ops plan is the person who takes

1281
00:55:23,230 --> 00:55:21,170
all of that information not the person

1282
00:55:24,940 --> 00:55:23,240
the console it's not just one guy but

1283
00:55:27,100 --> 00:55:24,950
they take all of that information and

1284
00:55:30,130 --> 00:55:27,110
they condense it into this plan that

1285
00:55:34,600 --> 00:55:30,140
everybody follows here's a picture of a

1286
00:55:38,080 --> 00:55:34,610
real live astronaut using it has anyone

1287
00:55:40,300 --> 00:55:38,090
seen the movie gravity so in the movie

1288
00:55:42,160 --> 00:55:40,310

gravity not to spoil anything but

1289
00:55:44,290 --> 00:55:42,170
there's a scene that takes place inside

1290
00:55:50,320 --> 00:55:44,300
the space station and if you look at the

1291
00:55:52,060 --> 00:55:50,330
computers it has OST PV on it I think

1292
00:55:55,150 --> 00:55:52,070
that's really cool I got really excited

1293
00:55:58,540 --> 00:55:55,160
it was like oh look at the screen no one

1294
00:56:00,730 --> 00:55:58,550
no one cared so ok I'm next we have AI

1295
00:56:04,000 --> 00:56:00,740
so does the inventory and stowage

1296
00:56:06,580 --> 00:56:04,010
officer I want you all to picture taking

1297
00:56:10,930 --> 00:56:06,590
a basket of laundry and throwing it onto

1298
00:56:13,120 --> 00:56:10,940
a bed falls nicely onto the bed right

1299
00:56:14,920 --> 00:56:13,130
now picture being in space and taking

1300
00:56:18,370 --> 00:56:14,930
that basket of laundry and throwing it

1301
00:56:20,590 --> 00:56:18,380
onto a bed and it all floats away

1302
00:56:22,990 --> 00:56:20,600
that's pretty much what the inventory

1303
00:56:24,580 --> 00:56:23,000
stowage officer has to deal with they're

1304
00:56:25,720 --> 00:56:24,590
in charge of stowing everything on the

1305
00:56:28,030 --> 00:56:25,730
space station and knowing where

1306
00:56:29,590 --> 00:56:28,040
everything is it might seem like a

1307
00:56:32,260 --> 00:56:29,600
menial task but I can assure you that

1308
00:56:34,630 --> 00:56:32,270
it's not even the littlest things like

1309
00:56:36,250 --> 00:56:34,640
pens just kind of float away

1310
00:56:38,350 --> 00:56:36,260
remember those events I was talking

1311
00:56:40,360 --> 00:56:38,360
about earlier they have they have

1312
00:56:41,740 --> 00:56:40,370
filters on them that capture things like

1313
00:56:46,210 --> 00:56:41,750

this so every now and then just go like

1314
00:56:47,830 --> 00:56:46,220
get a pen off event and use it so I so I

1315
00:56:49,960 --> 00:56:47,840
was in charge of whenever we have our

1316
00:56:52,060 --> 00:56:49,970
cargo resupply vehicle they have to have

1317
00:56:53,920 --> 00:56:52,070
identified everything that's in the

1318
00:56:55,660 --> 00:56:53,930
vehicle and where it's going to go and

1319
00:56:57,430 --> 00:56:55,670
then they have to identify everything

1320
00:57:00,010 --> 00:56:57,440
that's already up there that can get

1321
00:57:02,440 --> 00:57:00,020
returned back to the earth or trashed

1322
00:57:06,010 --> 00:57:02,450
and burned up in space that's a very

1323
00:57:08,740 --> 00:57:06,020
green process on the space station so

1324
00:57:10,480 --> 00:57:08,750
next we have oh so the Operations

1325
00:57:14,610 --> 00:57:10,490
Support Officer and the best way to

1326
00:57:17,650 --> 00:57:14,620
describe what Oso is is like MacGyver or

1327
00:57:22,930 --> 00:57:17,660
if you were born after 2000

1328
00:57:24,760 --> 00:57:22,940
it's like MacGyver so basically they're

1329
00:57:26,200 --> 00:57:24,770
the ones who are in charge of helping

1330
00:57:28,750 --> 00:57:26,210
the astronauts fix things when it's

1331
00:57:30,610 --> 00:57:28,760
broken on the space station the thing

1332
00:57:34,200 --> 00:57:30,620
that they probably most commonly fix is

1333
00:57:38,830 --> 00:57:34,210
the toilet because you've got six people

1334
00:57:41,800 --> 00:57:38,840
using like two toilets and it's not like

1335
00:57:43,330 --> 00:57:41,810
a simple toilet because again the no

1336
00:57:44,770 --> 00:57:43,340
gravity thing makes it difficult so

1337
00:57:48,850 --> 00:57:44,780
there's lots of fans and moving parts

1338
00:57:50,560 --> 00:57:48,860

and bags and stuff so they actually

1339
00:57:52,750 --> 00:57:50,570
spend a lot of time fixing toilets

1340
00:57:54,970 --> 00:57:52,760
fixing a lot of the life-support

1341
00:57:56,440 --> 00:57:54,980
regeneration systems things like that

1342
00:57:58,540 --> 00:57:56,450
anything that breaks on board

1343
00:58:00,310 --> 00:57:58,550
oh so probably knows how to fix it you

1344
00:58:02,530 --> 00:58:00,320
also have to have really good hair to be

1345
00:58:07,110 --> 00:58:02,540
a know so

1346
00:58:10,330 --> 00:58:07,120
it's just like mandatory so next we have

1347
00:58:12,430 --> 00:58:10,340
whoops MacGyver again wrong way next we

1348
00:58:14,860 --> 00:58:12,440
have Pluto which is the plug-in port

1349
00:58:16,240 --> 00:58:14,870
utilization officer this is the console

1350
00:58:18,970 --> 00:58:16,250
that's literally in charge of making

1351
00:58:22,180 --> 00:58:18,980
sure things can get plugged in to have

1352
00:58:25,210 --> 00:58:22,190
power when they need it think about in

1353
00:58:28,090 --> 00:58:25,220
your house say you're running a hair

1354
00:58:30,100 --> 00:58:28,100
dryer and a heater and an air

1355
00:58:32,320 --> 00:58:30,110
conditioner for whatever reason and a

1356
00:58:33,790 --> 00:58:32,330
fuse blows in your house no big deal go

1357
00:58:35,920 --> 00:58:33,800
downstairs flip the fuse go back

1358
00:58:38,170 --> 00:58:35,930
upstairs resume your activities well

1359
00:58:40,210 --> 00:58:38,180
maybe not all of them but resume what

1360
00:58:41,920 --> 00:58:40,220
you're doing it's a really really bad

1361
00:58:45,060 --> 00:58:41,930
thing when a fuse blows on the space

1362
00:58:48,100 --> 00:58:45,070
station so the Pluto is in charge of

1363
00:58:49,960 --> 00:58:48,110

really just making sure if an astronaut

1364
00:58:51,760 --> 00:58:49,970
takes their computer over here and needs

1365
00:58:54,430 --> 00:58:51,770
to plug it in can they plug it into that

1366
00:58:56,350 --> 00:58:54,440
port will it cause a problem what else

1367
00:58:59,350 --> 00:58:56,360
is being powered off that line things

1368
00:59:03,610 --> 00:58:59,360
like that so it sounds kind of menial

1369
00:59:06,190 --> 00:59:03,620
but it's super important next we have

1370
00:59:07,810 --> 00:59:06,200
four consoles of other stuff the ones

1371
00:59:15,660 --> 00:59:07,820
before were the daily stuff this is the

1372
00:59:18,340 --> 00:59:15,670
other stuff we have BM e Rio topo and GC

1373
00:59:20,050 --> 00:59:18,350
first we'll talk about BM e BM e it was

1374
00:59:22,810 --> 00:59:20,060
the answer to your question previously

1375
00:59:24,820 --> 00:59:22,820
about the actual health of the

1376
00:59:27,340 --> 00:59:24,830
astronauts so they are the doctors who

1377
00:59:30,520 --> 00:59:27,350
are on call to help with the astronauts

1378
00:59:32,260 --> 00:59:30,530
so they don't staff all the time they're

1379
00:59:33,910 --> 00:59:32,270
there usually when a crew has a medical

1380
00:59:36,580 --> 00:59:33,920
conference or something like that crews

1381
00:59:38,680 --> 00:59:36,590
have medical conferences planned so that

1382
00:59:42,370 --> 00:59:38,690
we are always on top of the health of

1383
00:59:43,900 --> 00:59:42,380
the crew DME and their counterpart

1384
00:59:45,400 --> 00:59:43,910
surgeon are some of the only other

1385
00:59:46,960 --> 00:59:45,410
people who talk to the crew besides

1386
00:59:48,940 --> 00:59:46,970
Capcom because you wouldn't want

1387
00:59:51,400 --> 00:59:48,950
necessarily want like a medical

1388
00:59:54,520 --> 00:59:51,410

emergency being translated by some dude

1389
00:59:56,380 --> 00:59:54,530
on a console so they're the ones in

1390
00:59:59,020 --> 00:59:56,390
charge of making sure the crew is

1391
01:00:00,880 --> 00:59:59,030
healthy then we have Rio which is the

1392
01:00:02,290 --> 01:00:00,890
remote interface officer this is the

1393
01:00:05,920 --> 01:00:02,300
console I worked when I was at Mission

1394
01:00:07,480 --> 01:00:05,930
Control Rio is in charge of making sure

1395
01:00:09,700 --> 01:00:07,490
that all of the different systems and

1396
01:00:11,890 --> 01:00:09,710
international partners work together in

1397
01:00:13,390 --> 01:00:11,900
a nice fashion so the way I said before

1398
01:00:15,470 --> 01:00:13,400
there's kind of two space stations stuck

1399
01:00:17,150 --> 01:00:15,480
together everything here

1400
01:00:18,859 --> 01:00:17,160
this is an outdated picture so don't

1401
01:00:22,609 --> 01:00:18,869
look closely but everything here in

1402
01:00:25,460 --> 01:00:22,619
yellow belongs to the US everything in

1403
01:00:29,599 --> 01:00:25,470
red belongs to the Russians pink is

1404
01:00:34,599 --> 01:00:29,609
Japanese green is European this is the

1405
01:00:39,020 --> 01:00:34,609
Canadian arm right there in blue and

1406
01:00:40,970 --> 01:00:39,030
then some other stuff so as you can see

1407
01:00:43,790 --> 01:00:40,980
it is actually an International Space

1408
01:00:45,950 --> 01:00:43,800
Station you can also tell up here on the

1409
01:00:50,150 --> 01:00:45,960
Russian side up at the very top there

1410
01:00:52,280 --> 01:00:50,160
are some solar arrays up there we also

1411
01:00:54,290 --> 01:00:52,290
have solar arrays so that's a really

1412
01:00:56,030 --> 01:00:54,300
good example of how there are redundant

1413
01:00:57,740 --> 01:00:56,040

systems on the space station

1414
01:01:00,109 --> 01:00:57,750
the Russians have solar arrays that can

1415
01:01:02,780 --> 01:01:00,119
provide power we generally use our solar

1416
01:01:05,300 --> 01:01:02,790
arrays but every now and then we use

1417
01:01:07,460 --> 01:01:05,310
theirs sometimes most the time we give

1418
01:01:10,820 --> 01:01:07,470
power to the Russian side so that they

1419
01:01:14,720 --> 01:01:10,830
can do certain things the Russian side

1420
01:01:16,280 --> 01:01:14,730
of the spacecraft is in charge of they

1421
01:01:18,590 --> 01:01:16,290
have all the thrusters that actually

1422
01:01:20,270 --> 01:01:18,600
move the spacecraft dynamically out of

1423
01:01:22,460 --> 01:01:20,280
the way of say debris or something like

1424
01:01:24,290 --> 01:01:22,470
that so it really is an International

1425
01:01:26,210 --> 01:01:24,300
Space Station and the real console is in

1426
01:01:28,099 --> 01:01:26,220
charge of coordinating all of the

1427
01:01:31,310 --> 01:01:28,109
systems work between the international

1428
01:01:33,410 --> 01:01:31,320
partners we have a team of people who go

1429
01:01:35,660 --> 01:01:33,420
out to Mission Control Moscow and sit

1430
01:01:37,160 --> 01:01:35,670
out there for three months at a time but

1431
01:01:38,630 --> 01:01:37,170
don't just sit on console for three

1432
01:01:40,520 --> 01:01:38,640
months they go live in Moscow for three

1433
01:01:41,990 --> 01:01:40,530
months and then we have a contingent of

1434
01:01:43,910 --> 01:01:42,000
Russians who live in Houston for three

1435
01:01:45,320 --> 01:01:43,920
months so we always have kind of boots

1436
01:01:47,090 --> 01:01:45,330
on the ground presence in the other

1437
01:01:48,620 --> 01:01:47,100
Mission Control Center so that if

1438
01:01:50,480 --> 01:01:48,630

there's a problem we can just walk down

1439
01:01:53,599 --> 01:01:50,490
the hall and say hey Sergei what's going

1440
01:01:55,280 --> 01:01:53,609
on and they can say nothing and we'll go

1441
01:01:59,210 --> 01:01:55,290
blow them why does it look like there is

1442
01:02:02,530 --> 01:01:59,220
but yeah so that was a console I worked

1443
01:02:04,580 --> 01:02:02,540
when I was working in Mission Control

1444
01:02:06,890 --> 01:02:04,590
next we have topo which is the

1445
01:02:08,810 --> 01:02:06,900
trajectory Operations Officer they're in

1446
01:02:12,470 --> 01:02:08,820
charge of making sure that ISS doesn't

1447
01:02:20,540 --> 01:02:12,480
hit any of this stuff in space they work

1448
01:02:22,490 --> 01:02:20,550
directly with NORAD some of their cold I

1449
01:02:23,870 --> 01:02:22,500
don't remember but the the Air Force

1450
01:02:26,780 --> 01:02:23,880
people who know where all this stuff is

1451
01:02:28,930 --> 01:02:26,790
in space they they track all of the

1452
01:02:30,370 --> 01:02:28,940
space debris and topo

1453
01:02:32,319 --> 01:02:30,380
directly with them to make sure we don't

1454
01:02:35,800 --> 01:02:32,329
hit anything because again hitting

1455
01:02:37,510 --> 01:02:35,810
things in space is bad so every now and

1456
01:02:39,910 --> 01:02:37,520
then we have to do what's called a

1457
01:02:41,950 --> 01:02:39,920
debris avoidance maneuver or a dam which

1458
01:02:43,870 --> 01:02:41,960
i think is a very appropriate acronym

1459
01:02:45,550 --> 01:02:43,880
for what happens when you're about to

1460
01:02:48,430 --> 01:02:45,560
hit something you have to move out of

1461
01:02:50,849 --> 01:02:48,440
the way really quick so Tocco are the

1462
01:02:53,440 --> 01:02:50,859
people who coordinate that they

1463
01:02:55,059 --> 01:02:53,450

understand how much we have to move out

1464
01:02:56,829 --> 01:02:55,069
of the way and when we have to do it and

1465
01:02:58,720 --> 01:02:56,839
if it will put us in the path of other

1466
01:03:00,670 --> 01:02:58,730
things that could hit us it's very

1467
01:03:04,930 --> 01:03:00,680
crowded up there in space so topo has a

1468
01:03:06,940 --> 01:03:04,940
quite a job we also have GC which is

1469
01:03:10,390 --> 01:03:06,950
ground control ground control is in

1470
01:03:13,420 --> 01:03:10,400
charge of the actual facility of Mission

1471
01:03:15,849 --> 01:03:13,430
Control so even if it's too hot

1472
01:03:18,040 --> 01:03:15,859
ground control is the person who turns

1473
01:03:20,170 --> 01:03:18,050
the air conditioner on which never

1474
01:03:26,260 --> 01:03:20,180
happened it was always too cold ground

1475
01:03:28,710 --> 01:03:26,270
control as we learned from someone in

1476
01:03:31,540 --> 01:03:28,720
the song ground control to Major Tom

1477
01:03:34,210 --> 01:03:31,550
he erroneously says that ground control

1478
01:03:37,569 --> 01:03:34,220
talks to Major Tom but he doesn't we all

1479
01:03:40,930 --> 01:03:37,579
know that that is that talks the

1480
01:03:44,770 --> 01:03:40,940
astronauts very good so rock and roll is

1481
01:03:48,430 --> 01:03:44,780
not always accurate so that's what you

1482
01:03:50,680 --> 01:03:48,440
should take away from this so just to

1483
01:03:52,390 --> 01:03:50,690
recap a little bit we have flight

1484
01:03:53,859 --> 01:03:52,400
director and Capcom here in the middle

1485
01:03:54,430 --> 01:03:53,869
in charge of everything talking to the

1486
01:03:57,579 --> 01:03:54,440
astronauts

1487
01:04:00,910 --> 01:03:57,589
we have Kronos ADCO ethos and Spartan

1488
01:04:04,150 --> 01:04:00,920

who are staffed 24/7 365

1489
01:04:07,020 --> 01:04:04,160
we've got Robo ice VBO and EBA who are

1490
01:04:09,940 --> 01:04:07,030
in charge of the the dynamic operations

1491
01:04:13,240 --> 01:04:09,950
we've got I had a lot of fun with the

1492
01:04:15,579 --> 01:04:13,250
power point things so we have ISO Oso

1493
01:04:17,950 --> 01:04:15,589
ops plane and Pluto who are in charge of

1494
01:04:19,480 --> 01:04:17,960
the daily stuff and then we have like a

1495
01:04:22,750 --> 01:04:19,490
lot of fun with PowerPoint and then we

1496
01:04:25,030 --> 01:04:22,760
have BM a topo DC and Rio who are in

1497
01:04:29,240 --> 01:04:25,040
charge of just kind of the other random

1498
01:04:33,080 --> 01:04:29,250
stuff so yeah

1499
01:04:34,760 --> 01:04:33,090
I did it wasn't a requirement but it was

1500
01:04:36,110 --> 01:04:34,770
very useful to know Russian so when I

1501
01:04:38,510 --> 01:04:36,120
was in high school I studied abroad in

1502
01:04:40,670 --> 01:04:38,520
Russia for a year so I learned Russian

1503
01:04:43,130 --> 01:04:40,680
pretty well and then it was very useful

1504
01:04:46,070 --> 01:04:43,140
to know Russian when people don't think

1505
01:04:48,590 --> 01:04:46,080
that I know Russian when I was in Russia

1506
01:04:50,150 --> 01:04:48,600
so I learned a lot of fun things our

1507
01:04:53,120 --> 01:04:50,160
console worked with interpreters and

1508
01:04:54,230 --> 01:04:53,130
translators to do the actual work but

1509
01:04:56,270 --> 01:04:54,240
every now and then you know you could

1510
01:04:57,620 --> 01:04:56,280
overhear things you also got a lot more

1511
01:04:58,670 --> 01:04:57,630
respect when you could walk into their

1512
01:05:00,770 --> 01:04:58,680
office and talk to them without a

1513
01:05:04,490 --> 01:05:00,780

translator and say hey what's going on

1514
01:05:07,490 --> 01:05:04,500
let's figure this out so I to speak

1515
01:05:09,770 --> 01:05:07,500
Russian a lot better than I do my dog

1516
01:05:10,970 --> 01:05:09,780
speaks Russian a little bit so she's

1517
01:05:13,550 --> 01:05:10,980
really the only one I get to talk

1518
01:05:18,740 --> 01:05:13,560
Russian to anymore you have told us that

1519
01:05:20,720 --> 01:05:18,750
the point director makes all but you

1520
01:05:22,100 --> 01:05:20,730
told us that the Japanese have a flight

1521
01:05:24,920 --> 01:05:22,110
director the Russians in the flight

1522
01:05:27,050 --> 01:05:24,930
director in several others so how do you

1523
01:05:29,900 --> 01:05:27,060
coordinate all of those flight directors

1524
01:05:31,670 --> 01:05:29,910
each one which is the Czar well each one

1525
01:05:33,050 --> 01:05:31,680
isn't really a czar so the question was

1526
01:05:34,970 --> 01:05:33,060
how do you coordinate the different

1527
01:05:36,110 --> 01:05:34,980
flight directors the different

1528
01:05:38,480 --> 01:05:36,120
international flight directors so you

1529
01:05:40,400 --> 01:05:38,490
have the flight director in Houston the

1530
01:05:44,300 --> 01:05:40,410
flight director in Moscow the one in

1531
01:05:47,810 --> 01:05:44,310
Japan in Germany and then one in Canada

1532
01:05:49,490 --> 01:05:47,820
I believe so it's not a thing that has

1533
01:05:52,850 --> 01:05:49,500
to be coordinated in real time really

1534
01:05:55,570 --> 01:05:52,860
it's more an understanding that the

1535
01:05:58,760 --> 01:05:55,580
flight director in Houston has final say

1536
01:06:01,970 --> 01:05:58,770
period however if we're doing something

1537
01:06:02,900 --> 01:06:01,980
that is say a vehicle is docking to the

1538
01:06:05,240 --> 01:06:02,910

Russian side of the space station

1539
01:06:08,660 --> 01:06:05,250
something that's really more Russian

1540
01:06:10,490 --> 01:06:08,670
centric operation the flight director in

1541
01:06:12,020 --> 01:06:10,500
Houston will most likely defer to the

1542
01:06:14,660 --> 01:06:12,030
flight director in Russia for that but

1543
01:06:16,490 --> 01:06:14,670
if at that time an emergency were to

1544
01:06:18,560 --> 01:06:16,500
occur the flight director in Houston

1545
01:06:20,690 --> 01:06:18,570
would assume responsibility and worked

1546
01:06:23,000 --> 01:06:20,700
the emergency does that kind of make

1547
01:06:25,240 --> 01:06:23,010
sense so it's it's a it's kind of a

1548
01:06:28,100 --> 01:06:25,250
political game but it's one that is

1549
01:06:30,350 --> 01:06:28,110
thought out long before it actually has

1550
01:06:32,000 --> 01:06:30,360
to be into practice and it's just an

1551
01:06:34,970 --> 01:06:32,010
agreement amongst everyone there's no

1552
01:06:36,800 --> 01:06:34,980
law or international policy that governs

1553
01:06:38,600 --> 01:06:36,810
this it's more just oh we want the space

1554
01:06:42,900 --> 01:06:38,610
station to work and to continue working

1555
01:07:07,569 --> 01:07:05,319
any collusion it's kind of a mixture of

1556
01:07:10,079 --> 01:07:07,579
English and Russian I'm yeah English and

1557
01:07:12,789 --> 01:07:10,089
Russian most of the all of the Russian

1558
01:07:14,470 --> 01:07:12,799
cosmonauts speak English most of the

1559
01:07:16,359 --> 01:07:14,480
Russian most of the American and

1560
01:07:19,210 --> 01:07:16,369
European and everybody else

1561
01:07:21,640 --> 01:07:19,220
astronauts speak Russian or at least

1562
01:07:24,220 --> 01:07:21,650
have some Russian training the the

1563
01:07:26,140 --> 01:07:24,230

number one language that is spoken is

1564
01:07:27,759 --> 01:07:26,150
English so if an emergency were to occur

1565
01:07:31,960 --> 01:07:27,769
the dialogue would happened in English

1566
01:07:34,109 --> 01:07:31,970
but there are Russians when they talk to

1567
01:07:36,489 --> 01:07:34,119
Moscow Mission Control speak in Russian

1568
01:07:39,309 --> 01:07:36,499
but while that's happening there are

1569
01:07:40,900 --> 01:07:39,319
translators on the voice loops that

1570
01:07:43,120 --> 01:07:40,910
translate for the American flight

1571
01:07:45,519 --> 01:07:43,130
control team there are Russian

1572
01:07:47,890 --> 01:07:45,529
translators in Moscow who translate all

1573
01:07:50,799 --> 01:07:47,900
the English for the Russians so it's

1574
01:07:52,390 --> 01:07:50,809
primarily English in Russian and then

1575
01:07:53,920 --> 01:07:52,400
just depending on what other crew is up

1576
01:08:10,749 --> 01:07:53,930
there other things could happen in other

1577
01:08:12,009 --> 01:08:10,759
languages on the ground was about fixing

1578
01:08:14,170 --> 01:08:12,019
toilets is there's someone on the ground

1579
01:08:15,640 --> 01:08:14,180
who can fix it remotely or are they

1580
01:08:17,470 --> 01:08:15,650
working with the astronauts or will it

1581
01:08:18,519 --> 01:08:17,480
come back and get it fixed and the

1582
01:08:20,320 --> 01:08:18,529
answer is they're working with the

1583
01:08:21,849 --> 01:08:20,330
astronauts so part of the glourious

1584
01:08:24,189 --> 01:08:21,859
training of becoming an astronaut is

1585
01:08:26,140 --> 01:08:24,199
learning how to fix a space toilet and

1586
01:08:29,989 --> 01:08:26,150
learning how to use a space toilet which

1587
01:08:34,399 --> 01:08:33,019
some about it but so the how not to know

1588
01:08:37,039 --> 01:08:34,409

how to do it before they get up there

1589
01:08:39,289 --> 01:08:37,049
but the ants have learned a lot of

1590
01:08:41,359 --> 01:08:39,299
things before they go into space so they

1591
01:08:43,339 --> 01:08:41,369
work in conjunction with Oso to make

1592
01:08:45,649 --> 01:08:43,349
sure that they're putting the right

1593
01:08:48,649 --> 01:08:45,659
things in the right places and fixing

1594
01:08:50,089 --> 01:08:48,659
them the way it needs to be fixed I'm

1595
01:09:02,559 --> 01:08:50,099
gonna keep going because next I want to

1596
01:09:06,200 --> 01:09:02,569
talk about yes four things and supplies

1597
01:09:07,999 --> 01:09:06,210
so the question was about the invisible

1598
01:09:11,059 --> 01:09:08,009
planning for things like meals and

1599
01:09:12,410 --> 01:09:11,069
supplies what you need to send up at

1600
01:09:15,019 --> 01:09:12,420
what times where does that take place

1601
01:09:17,120 --> 01:09:15,029
that all takes place in a lot of the

1602
01:09:19,399 --> 01:09:17,130
rest of Johnson Space Center so there's

1603
01:09:21,890 --> 01:09:19,409
a place that develops a lot of the food

1604
01:09:23,660 --> 01:09:21,900
that the astronauts eat there is a whole

1605
01:09:25,879 --> 01:09:23,670
division that's devoted just to

1606
01:09:28,219 --> 01:09:25,889
understanding what resources are on the

1607
01:09:30,379 --> 01:09:28,229
space station when those resources are

1608
01:09:32,120 --> 01:09:30,389
going to deplete when we need to refill

1609
01:09:34,579 --> 01:09:32,130
them that's not something that happens

1610
01:09:36,349 --> 01:09:34,589
in real time in Mission Control it just

1611
01:09:40,359 --> 01:09:36,359
kind of excuse me happens behind the

1612
01:09:45,589 --> 01:09:40,369
scenes and other organizations at NASA

1613
01:09:47,239 --> 01:09:45,599

yes resources how often do they have to

1614
01:09:48,829 --> 01:09:47,249
restore the food there's a resupply

1615
01:09:51,620 --> 01:09:48,839
vehicle that gets sent to the Space

1616
01:09:53,299 --> 01:09:51,630
Station probably and the mirror these

1617
01:09:54,950 --> 01:09:53,309
once every three months but it's

1618
01:09:56,600 --> 01:09:54,960
happening more and more frequently now

1619
01:09:58,219 --> 01:09:56,610
because we're getting more vehicles like

1620
01:10:00,979 --> 01:09:58,229
the SpaceX missions that are going up

1621
01:10:03,770 --> 01:10:00,989
there Cygnus Blue Origin things like

1622
01:10:07,750 --> 01:10:03,780
that so frequently but it's not always

1623
01:10:10,790 --> 01:10:07,760
just food it's other stuff too yeah

1624
01:10:13,609 --> 01:10:10,800
that's that are up there at any time do

1625
01:10:15,379 --> 01:10:13,619
they consider I now have to sort of be

1626
01:10:18,319 --> 01:10:15,389
cross-trained I understand that that's

1627
01:10:21,350 --> 01:10:18,329
right but do they do we cooperate in

1628
01:10:24,290 --> 01:10:21,360
terms of the complement that's up there

1629
01:10:25,459 --> 01:10:24,300
at any given time that has complement

1630
01:10:28,160 --> 01:10:25,469
the other people that are

1631
01:10:30,740 --> 01:10:28,170
they're something were to go wrong we

1632
01:10:34,220 --> 01:10:30,750
need the right people to be able to

1633
01:10:38,840 --> 01:10:34,230
handle back tire guards of who's in the

1634
01:10:41,000 --> 01:10:38,850
rotation kind of distill it a little bit

1635
01:10:43,760 --> 01:10:41,010
what thought is given to the crew

1636
01:10:45,920 --> 01:10:43,770
compliment on the ISS and what skills

1637
01:10:48,500 --> 01:10:45,930
they have in any given time if something

1638
01:10:49,850 --> 01:10:48,510

were to go wrong the the best answer to

1639
01:10:51,439 --> 01:10:49,860
that question is if something were to go

1640
01:10:53,150 --> 01:10:51,449
wrong it's these people on the ground

1641
01:10:54,800 --> 01:10:53,160
here that are going to take care of it

1642
01:10:57,140 --> 01:10:54,810
the astronauts may be pushing some

1643
01:10:58,729 --> 01:10:57,150
buttons for them may be doing some

1644
01:10:59,209 --> 01:10:58,739
things that they have to do hands-on in

1645
01:11:02,120 --> 01:10:59,219
space

1646
01:11:03,590 --> 01:11:02,130
but these people here in in Houston and

1647
01:11:05,689 --> 01:11:03,600
in Moscow and in the Mission Control

1648
01:11:07,760 --> 01:11:05,699
centers are the experts they're the ones

1649
01:11:10,610 --> 01:11:07,770
who are going to be reacting in care of

1650
01:11:13,820 --> 01:11:10,620
emergency situations as far as the crew

1651
01:11:17,570 --> 01:11:13,830
complement onboard I don't know exactly

1652
01:11:20,570 --> 01:11:17,580
how the crew is selected but I do know

1653
01:11:24,560 --> 01:11:20,580
that there is always an equal number of

1654
01:11:26,660 --> 01:11:24,570
Russian and non-russian members of the

1655
01:11:28,640 --> 01:11:26,670
space station crew and they alternate

1656
01:11:31,910 --> 01:11:28,650
between a Russian commander and a non

1657
01:11:34,340 --> 01:11:31,920
Russian commander so not necessarily

1658
01:11:36,320 --> 01:11:34,350
talking about the skills and such but a

1659
01:12:01,010 --> 01:11:36,330
little bit of how the crew is selected

1660
01:12:02,780 --> 01:12:01,020
in general it's a political thing when

1661
01:12:04,850 --> 01:12:02,790
they go up into space but they are also

1662
01:12:07,100 --> 01:12:04,860
understand that they are not the experts

1663
01:12:09,380 --> 01:12:07,110

of what needs to happen with the system

1664
01:12:13,370 --> 01:12:09,390
they always defer to the folks in this

1665
01:12:14,600 --> 01:12:13,380
room to take care of stuff in general

1666
01:12:16,520 --> 01:12:14,610
that's the answer sometimes that's not

1667
01:12:18,860 --> 01:12:16,530
to know them from being very cocky sell

1668
01:12:20,930 --> 01:12:18,870
them short people so but in general

1669
01:12:22,520 --> 01:12:20,940
that's the answer and would it be true

1670
01:12:25,910 --> 01:12:22,530
that for the Russian portion of the

1671
01:12:28,340 --> 01:12:25,920
space station that it's the people

1672
01:12:30,560 --> 01:12:28,350
Russia who would be on the ground yes

1673
01:12:32,120 --> 01:12:30,570
yeah so it's the same thing for the

1674
01:12:33,620 --> 01:12:32,130
Russian person this portion of the space

1675
01:12:35,330 --> 01:12:33,630
station it's the Russian flight control

1676
01:12:38,060 --> 01:12:35,340
team that are the experts for those

1677
01:12:39,800 --> 01:12:38,070
systems ok I'm going to go through and

1678
01:12:42,050 --> 01:12:39,810
talk about James Webb because it's

1679
01:12:44,090 --> 01:12:42,060
happening here in various language so

1680
01:12:46,220 --> 01:12:44,100
lots of satellites have their own

1681
01:12:51,020 --> 01:12:46,230
Mission Control Center just like James

1682
01:12:52,310 --> 01:12:51,030
Webb if you I don't know if it's open to

1683
01:12:54,890 --> 01:12:52,320
the public but it's just right upstairs

1684
01:12:59,180 --> 01:12:54,900
probably not open to the public so don't

1685
01:13:02,300 --> 01:12:59,190
try to go out there this is a picture I

1686
01:13:04,250 --> 01:13:02,310
took from the internet so Serge JWST

1687
01:13:07,120 --> 01:13:04,260
Mission Operations Center in YouTube can

1688
01:13:09,350 --> 01:13:07,130

look at this picture and others like it

1689
01:13:11,359 --> 01:13:09,360
this is the Mission Operations Center

1690
01:13:13,399 --> 01:13:11,369
you notice one thing that's really cool

1691
01:13:14,180 --> 01:13:13,409
that I thought was awesome is all this

1692
01:13:16,760 --> 01:13:14,190
back here

1693
01:13:18,890 --> 01:13:16,770
those are windows that look out right

1694
01:13:21,430 --> 01:13:18,900
over Wyman Park it's really pretty

1695
01:13:23,810 --> 01:13:21,440
watch the trees change and the wind

1696
01:13:27,979 --> 01:13:23,820
awesome compared to the Mission Control

1697
01:13:30,740 --> 01:13:27,989
Center piece and there's no windows so

1698
01:13:33,320 --> 01:13:30,750
this is where the quiz part comes in I'm

1699
01:13:35,720 --> 01:13:33,330
going to relate the flight control

1700
01:13:36,770 --> 01:13:35,730
positions on the ISS to what we're doing

1701
01:13:41,260 --> 01:13:36,780
on James Webb

1702
01:13:43,490 --> 01:13:41,270
so who remembers what Spartan does our

1703
01:13:45,320 --> 01:13:43,500
good yeah so they're in charge of the

1704
01:13:48,530 --> 01:13:45,330
solar rates and the electrical power on

1705
01:13:52,280 --> 01:13:48,540
James Webb we have a similar position

1706
01:13:55,640 --> 01:13:52,290
called EPS and TCS not as cool in the

1707
01:13:57,950 --> 01:13:55,650
afternoon that means for electrical

1708
01:13:58,700 --> 01:13:57,960
power subsystem and thermal control

1709
01:14:00,229 --> 01:13:58,710
subsystem

1710
01:14:03,530 --> 01:14:00,239
so it's the same sort of job that

1711
01:14:06,430 --> 01:14:03,540
Spartan did only on James Webb we also

1712
01:14:09,020 --> 01:14:06,440
have ADCO what is Edco do on ISS

1713
01:14:10,609 --> 01:14:09,030

attitude good we have something similar

1714
01:14:13,129 --> 01:14:10,619
on James Webb called

1715
01:14:15,410 --> 01:14:13,139
ACS and proc it's the attitude control

1716
01:14:17,359 --> 01:14:15,420
system and propulsion so again they're

1717
01:14:19,189 --> 01:14:17,369
in charge of the attitude of the

1718
01:14:22,220 --> 01:14:19,199
spacecraft but also the thrusters that

1719
01:14:25,549 --> 01:14:22,230
keep it where we want it to be then we

1720
01:14:30,350 --> 01:14:27,350
mental control what do you think they do

1721
01:14:33,919 --> 01:14:30,360
for James Webb nothing because there's

1722
01:14:35,750 --> 01:14:33,929
no people in James way happy livable

1723
01:14:36,950 --> 01:14:35,760
environment so we don't have the

1724
01:14:43,430 --> 01:14:36,960
equivalent of an eNOS

1725
01:14:47,060 --> 01:14:43,440
we do have Chronos what a grimace do the

1726
01:14:49,339 --> 01:14:47,070
communications and the video and onboard

1727
01:14:50,930 --> 01:14:49,349
computers so on James man we've taken

1728
01:14:53,779 --> 01:14:50,940
all of those things and split them up

1729
01:14:55,459 --> 01:14:53,789
into two positions we have flight

1730
01:14:59,479 --> 01:14:55,469
software and command and data handling

1731
01:15:00,799 --> 01:14:59,489
which are again are the sending commands

1732
01:15:03,109 --> 01:15:00,809
to the spacecraft and how they get

1733
01:15:05,000 --> 01:15:03,119
handled within the spacecraft and then

1734
01:15:06,919 --> 01:15:05,010
the telemetry that comes back down from

1735
01:15:11,479 --> 01:15:06,929
the spacecraft and then communications

1736
01:15:14,600 --> 01:15:11,489
which is how that telemetry comes down

1737
01:15:17,270 --> 01:15:14,610
and how that those commands and get up

1738
01:15:20,029 --> 01:15:17,280

to the space station so those are those

1739
01:15:24,350 --> 01:15:20,039
are the subject matter experts that we

1740
01:15:34,040 --> 01:15:24,360
have for James Webb in the controller we

1741
01:15:35,299 --> 01:15:34,050
also have science instruments so you

1742
01:15:37,069 --> 01:15:35,309
guys have you come to these lectures

1743
01:15:38,770 --> 01:15:37,079
elect you probably are familiar with the

1744
01:15:41,060 --> 01:15:38,780
science instruments I'm James Webb I

1745
01:15:43,790 --> 01:15:41,070
pretended to have familiarity with them

1746
01:15:47,200 --> 01:15:43,800
by knowing the acronyms such as the near

1747
01:15:50,779 --> 01:15:47,210
infrared imager and slit list

1748
01:15:53,000 --> 01:15:50,789
spectrograph yeah mirror and grade

1749
01:16:06,970 --> 01:15:53,010
camera the near infrared spectrograph

1750
01:16:08,779 --> 01:16:06,980
the infrared sensor sensor those are the

1751
01:16:10,729 --> 01:16:08,789
science instruments that are onboard

1752
01:16:12,529 --> 01:16:10,739
James Webb then each one of those

1753
01:16:13,990 --> 01:16:12,539
science instruments has a team of people

1754
01:16:15,580 --> 01:16:14,000
throughout the world who are

1755
01:16:17,650 --> 01:16:15,590
charge and making sure the instrument is

1756
01:16:19,540 --> 01:16:17,660
calibrated making sure we can take the

1757
01:16:21,820 --> 01:16:19,550
best science that we can from it that

1758
01:16:23,830 --> 01:16:21,830
the astronomical community knows how to

1759
01:16:26,650 --> 01:16:23,840
use it a whole contingent of people

1760
01:16:30,580 --> 01:16:26,660
behind each one of those science

1761
01:16:34,800 --> 01:16:30,590
instruments we also have here at STScI

1762
01:16:37,930 --> 01:16:34,810
the people who are in charge of making

1763
01:16:40,420 --> 01:16:37,940

sure everything from the astronauts

1764
01:16:43,750 --> 01:16:40,430
telling us what they want to look at all

1765
01:16:46,360 --> 01:16:43,760
the way to sending those commands or

1766
01:16:48,580 --> 01:16:46,370
sending that information up to the state

1767
01:16:49,750 --> 01:16:48,590
up to the spacecraft making the

1768
01:16:52,990 --> 01:16:49,760
spacecraft point where we want it to

1769
01:16:54,970 --> 01:16:53,000
point taking the images gathering that

1770
01:16:57,700 --> 01:16:54,980
data sending it down and getting it back

1771
01:17:00,250 --> 01:16:57,710
out to the astronomical community those

1772
01:17:01,960 --> 01:17:00,260
people also work here will work here at

1773
01:17:04,060 --> 01:17:01,970
Space Telescope in the silent Operations

1774
01:17:08,170 --> 01:17:04,070
Center so we have the proposal planning

1775
01:17:09,970 --> 01:17:08,180
subsystem which is the suite of tools

1776
01:17:11,680 --> 01:17:09,980
that allow the astronomers to tell us

1777
01:17:13,510 --> 01:17:11,690
what they want to look at we take that

1778
01:17:16,240 --> 01:17:13,520
information we put it on a rough

1779
01:17:20,110 --> 01:17:16,250
schedule we take that rough schedule and

1780
01:17:23,410 --> 01:17:20,120
refine it a couple I think like 10 days

1781
01:17:25,840 --> 01:17:23,420
at a time we've refined the schedule to

1782
01:17:28,210 --> 01:17:25,850
make sure we're taking the observations

1783
01:17:31,120 --> 01:17:28,220
the astronauts want to look at and then

1784
01:17:32,830 --> 01:17:31,130
we package up that data and hand it off

1785
01:17:42,150 --> 01:17:32,840
to get sent up to the spacecraft where

1786
01:17:53,320 --> 01:17:45,070
oh well now I'm talking about it

1787
01:17:57,550 --> 01:17:53,330
stronger so so the see now you threw me

1788
01:17:59,200 --> 01:17:57,560

off the so the data gets sent up the the

1789
01:18:00,880 --> 01:17:59,210
observations we want to take get sent up

1790
01:18:03,340 --> 01:18:00,890
to the spacecraft it takes the

1791
01:18:05,410 --> 01:18:03,350
observations and they get sent back down

1792
01:18:07,870 --> 01:18:05,420
to the data management subsystem which

1793
01:18:09,790 --> 01:18:07,880
takes all those ones and zeroes that

1794
01:18:11,740 --> 01:18:09,800
come down from space and turns them into

1795
01:18:14,170 --> 01:18:11,750
the science that the app that the

1796
01:18:17,260 --> 01:18:14,180
astronomers haha but the astronomers

1797
01:18:18,910 --> 01:18:17,270
used to do all of it turns it into the

1798
01:18:21,250 --> 01:18:18,920
data that the astronomers use to do all

1799
01:18:23,170 --> 01:18:21,260
of their science we also have the

1800
01:18:25,990 --> 01:18:23,180
project reference database which is

1801
01:18:27,910 --> 01:18:26,000
basically just a database of information

1802
01:18:28,360 --> 01:18:27,920
that each of these subsystems pull from

1803
01:18:29,470 --> 01:18:28,370
to make

1804
01:18:31,330 --> 01:18:29,480
sure we're all using the same

1805
01:18:34,480 --> 01:18:31,340
information and then we have the

1806
01:18:37,960 --> 01:18:34,490
wavefront sensing and control subsystem

1807
01:18:40,930 --> 01:18:37,970
that basically makes sure the spacecraft

1808
01:18:43,210 --> 01:18:40,940
is in focus so each one of the mirrors

1809
01:18:45,490 --> 01:18:43,220
on James Webb can articulate on its own

1810
01:18:47,410 --> 01:18:45,500
to make sure that the spacecraft is

1811
01:18:49,210 --> 01:18:47,420
always in focus so we don't run into

1812
01:18:52,390 --> 01:18:49,220
focus issues that I hear sometimes

1813
01:18:55,960 --> 01:18:52,400

happen on spacecraft sometimes so these

1814
01:18:58,810 --> 01:18:55,970
are the kind of behind-the-scenes things

1815
01:19:01,600 --> 01:18:58,820
that happen here at Space Telescope to

1816
01:19:05,050 --> 01:19:01,610
make James Webb possible so we have the

1817
01:19:07,030 --> 01:19:05,060
onboard systems to operate the actual

1818
01:19:08,590 --> 01:19:07,040
spacecraft we have the teams that

1819
01:19:11,590 --> 01:19:08,600
operate the science instruments and then

1820
01:19:16,780 --> 01:19:11,600
the teams here at Ft that make all of

1821
01:19:29,950 --> 01:19:16,790
the science possible and that's it so

1822
01:19:35,300 --> 01:19:33,620
okay you guys had a lot of questions who

1823
01:19:38,060 --> 01:19:35,310
during her talk but I'm sure there are

1824
01:19:43,490 --> 01:19:38,070
more because that's just a body as you

1825
01:19:45,860 --> 01:19:43,500
are I'm finally accessed what is the

1826
01:19:49,520 --> 01:19:45,870
source of the object track information

1827
01:19:51,320 --> 01:19:49,530
that's used for that position it yeah I

1828
01:19:52,700 --> 01:19:51,330
assess what is the source of the object

1829
01:19:54,440 --> 01:19:52,710
tracking information that's used for

1830
01:19:57,740 --> 01:19:54,450
collision avoidance we work with the Air

1831
01:19:59,720 --> 01:19:57,750
Force there knows where lots and lots of

1832
01:20:01,820 --> 01:19:59,730
stuff in spaces so the trajectory

1833
01:20:03,560 --> 01:20:01,830
Operations Officer works in collection

1834
01:20:05,390 --> 01:20:03,570
with them and sometimes it's the Air

1835
01:20:06,950 --> 01:20:05,400
Force calling us and saying hey there's

1836
01:20:26,840 --> 01:20:06,960
a thing in the way you should think

1837
01:20:40,310 --> 01:20:26,850
about moving out of the way and then

1838
01:20:48,020 --> 01:20:40,320

they just give us the information way to

1839
01:20:50,080 --> 01:20:48,030
bring home something that's really acute

1840
01:20:53,210 --> 01:20:50,090
like appendicitis I don't know for sure

1841
01:20:56,060 --> 01:20:53,220
is really kind of critical thing it

1842
01:20:59,150 --> 01:20:56,070
takes a finite amount of time to get the

1843
01:21:00,920 --> 01:20:59,160
astronauts down I think why well I'd I'm

1844
01:21:02,690 --> 01:21:00,930
not sure what the fastest amount of time

1845
01:21:04,400 --> 01:21:02,700
is but usually when they leave the space

1846
01:21:06,560 --> 01:21:04,410
station they can get home and about they

1847
01:21:08,960 --> 01:21:06,570
usually get home in three days it can be

1848
01:21:10,310 --> 01:21:08,970
expedited I'm not sure how fast and

1849
01:21:11,060 --> 01:21:10,320
there's only a mini huge like

1850
01:21:14,420 --> 01:21:11,070
appendicitis

1851
01:21:16,700 --> 01:21:14,430
I'm actually really sure what they would

1852
01:21:21,519 --> 01:21:16,710
do probably something very theatrical

1853
01:21:25,819 --> 01:21:23,569
but something that was less

1854
01:21:27,889 --> 01:21:25,829
time-sensitive they can absolutely send

1855
01:21:32,899 --> 01:21:27,899
the crew back at any time they are sent

1856
01:21:35,419 --> 01:21:32,909
a medical doctor roughly yeah I know for

1857
01:21:37,699 --> 01:21:35,429
sure for the space shuttle crews I don't

1858
01:21:39,259 --> 01:21:37,709
know I would imagine there have been

1859
01:21:53,569 --> 01:21:39,269
medical doctors that have been sent to

1860
01:21:57,349 --> 01:21:53,579
ISS but I don't know for a fact what

1861
01:21:59,509 --> 01:21:57,359
would that look like so this part of the

1862
01:22:27,019 --> 01:21:59,519
games lab is about the size of a tennis

1863
01:22:33,979 --> 01:22:27,029

court and the redundancy is there in the

1864
01:22:35,719 --> 01:22:33,989
web I don't know how many levels of

1865
01:22:39,039 --> 01:22:35,729
redundancy there are in James Webb my

1866
01:22:40,159 --> 01:22:39,049
guess is that it's probably two

1867
01:22:41,779 --> 01:22:40,169
fault-tolerant

1868
01:22:47,449 --> 01:22:41,789
for the systems which means it can

1869
01:22:50,089 --> 01:22:47,459
handle two things happening wrong to the

1870
01:22:50,559 --> 01:22:50,099
same component I don't know that for a

1871
01:22:54,619 --> 01:22:50,569
fact

1872
01:22:55,609 --> 01:22:54,629
that's my guess don't work with the

1873
01:22:58,039 --> 01:22:55,619
Hubble Space Telescope

1874
01:22:59,449 --> 01:22:58,049
we of course have two sides to the Tron

1875
01:23:01,729 --> 01:22:59,459
tree of an a side to each side of the

1876
01:23:06,830 --> 01:23:01,739
DSi it shorts out we can switch over the

1877
01:23:11,750 --> 01:23:10,100
you know the both sides failed on the

1878
01:23:14,770 --> 01:23:11,760
whole space telescope then we had to

1879
01:23:18,860 --> 01:23:14,780
repair them during servicing missions

1880
01:23:20,950 --> 01:23:18,870
like for example this I CDH failed for

1881
01:23:23,300 --> 01:23:20,960
its very first time after what 18 years

1882
01:23:26,690 --> 01:23:23,310
and we actually delayed servicing

1883
01:23:28,670 --> 01:23:26,700
mission 4 so you could replace placed

1884
01:23:30,710 --> 01:23:28,680
that and so we would have redundancy in

1885
01:23:32,660 --> 01:23:30,720
there so I mean they're very careful

1886
01:23:39,260 --> 01:23:32,670
about having a certain level of

1887
01:23:40,580 --> 01:23:39,270
redundancy but it's common practice when

1888
01:23:44,330 --> 01:23:40,590

you make a spacecraft to at least have

1889
01:23:46,100 --> 01:23:44,340
one level of redundancy and four really

1890
01:23:47,420 --> 01:23:46,110
important systems like your power system

1891
01:23:55,970 --> 01:23:47,430
of your communication system is

1892
01:24:00,920 --> 01:23:55,980
generally 2 or 3 radiation hazard in

1893
01:24:04,370 --> 01:24:00,930
terms of itself the radiation hazards

1894
01:24:05,990 --> 01:24:04,380
for the equipment on web itself I did

1895
01:24:12,490 --> 01:24:06,000
not talk about it because I don't know

1896
01:24:20,290 --> 01:24:18,340
I'm not sure I do political events here

1897
01:24:22,270 --> 01:24:20,300
on the surface of the earth affect the

1898
01:24:28,870 --> 01:24:22,280
decision-making process for what happens

1899
01:24:31,810 --> 01:24:28,880
on Space Station's process for the space

1900
01:24:34,480 --> 01:24:31,820
station it's interesting because the

1901
01:24:36,190 --> 01:24:34,490
politics on earth the ISS is sort of

1902
01:24:38,350 --> 01:24:36,200
immune to politics suckers like right

1903
01:24:41,410 --> 01:24:38,360
now there's a lot of let's say

1904
01:24:44,080 --> 01:24:41,420
contention between Russia and the US on

1905
01:24:45,880 --> 01:24:44,090
a political scale but the onboard

1906
01:24:48,220 --> 01:24:45,890
operations of the ISS are progressing

1907
01:24:49,510 --> 01:24:48,230
normally I know for a fact that the

1908
01:24:51,460 --> 01:24:49,520
Mission Control centers are still

1909
01:24:53,590 --> 01:24:51,470
working in tandem I have friends who are

1910
01:24:54,940 --> 01:24:53,600
over there right now who are perfectly

1911
01:25:02,680 --> 01:24:54,950
happy at work and then a little weary

1912
01:25:04,830 --> 01:25:02,690
when they do I assess has been up there

1913
01:25:07,600 --> 01:25:04,840

for quite some time and and a lot of

1914
01:25:09,700 --> 01:25:07,610
turbulent things have happened during

1915
01:25:12,220 --> 01:25:09,710
that time span and it never had an

1916
01:25:14,500 --> 01:25:12,230
effect really on the decision-making

1917
01:25:16,630 --> 01:25:14,510
process the number one most important

1918
01:25:17,740 --> 01:25:16,640
thing on the ISS is the crew the second

1919
01:25:19,570 --> 01:25:17,750
most important thing is the vehicle

1920
01:25:22,390 --> 01:25:19,580
itself and that's just a tenant that's

1921
01:25:24,820 --> 01:25:22,400
hold that's held true regardless of who

1922
01:25:27,640 --> 01:25:24,830
happens to be the president or what an

1923
01:25:29,830 --> 01:25:27,650
embassy happens to be doing so it's it's

1924
01:25:43,230 --> 01:25:29,840
blissfully immuned does it have its own

1925
01:25:46,730 --> 01:25:45,610
it's actually think it's a really cool

1926
01:25:48,320 --> 01:25:46,740
thing it's an

1927
01:25:50,480 --> 01:25:48,330
it truly is an international endeavor

1928
01:25:53,330 --> 01:25:50,490
and it couldn't be done if one if even

1929
01:25:56,060 --> 01:25:53,340
is one country pulled out of the ISS it

1930
01:26:00,620 --> 01:25:56,070
wouldn't survive anymore so I think it's

1931
01:26:04,060 --> 01:26:00,630
a really cool thing tell us but what

1932
01:26:06,500 --> 01:26:04,070
you're doing now I forgot the exact time

1933
01:26:08,780 --> 01:26:06,510
sure I'm the systems integration and

1934
01:26:10,460 --> 01:26:08,790
test engineer so on that last slide that

1935
01:26:12,230 --> 01:26:10,470
I was talking about those are all the

1936
01:26:15,130 --> 01:26:12,240
subsystems for the science and operation

1937
01:26:18,080 --> 01:26:15,140
center so my team and I make sure that

1938
01:26:20,210 --> 01:26:18,090

those subsystems are going to be fully

1939
01:26:23,240 --> 01:26:20,220
functional by the time James James one

1940
01:26:27,140 --> 01:26:23,250
of launches so we are making sure

1941
01:26:30,980 --> 01:26:27,150
everything from the software that the

1942
01:26:33,440 --> 01:26:30,990
advent of stronger put in the their data

1943
01:26:35,810 --> 01:26:33,450
into to the flight operation system that

1944
01:26:39,040 --> 01:26:35,820
actually commands the spacecraft my team

1945
01:26:41,290 --> 01:26:39,050
is responsible for making sure that it's

1946
01:26:44,560 --> 01:26:41,300
going to work

1947
01:26:47,090 --> 01:26:44,570
we just terrifying but that's what we do

1948
01:26:49,280 --> 01:26:47,100
and we work in tandem with the people

1949
01:26:50,900 --> 01:26:49,290
who are developing the systems to make

1950
01:26:53,780 --> 01:26:50,910
sure that they work the way we're

1951
01:27:02,810 --> 01:26:53,790
supposed to and just know we astronomers

1952
01:27:02,820 --> 01:27:08,979
[Music]

1953
01:27:18,200 --> 01:27:11,750
related to the question what was your

1954
01:27:21,770 --> 01:27:18,210
career packet Houston eventually so my

1955
01:27:24,080 --> 01:27:21,780
career path was I really wanted to be

1956
01:27:27,170 --> 01:27:24,090
that from when I was a kid I've never

1957
01:27:30,680 --> 01:27:27,180
really got over that but then got more

1958
01:27:31,400 --> 01:27:30,690
realistic about it and I like studied

1959
01:27:33,800 --> 01:27:31,410
aeronautical and astronautical

1960
01:27:37,520 --> 01:27:33,810
engineering at Purdue University and

1961
01:27:39,290 --> 01:27:37,530
while I was at Purdue I got at the time

1962
01:27:40,700 --> 01:27:39,300
it was called a co-op which it's kind of

1963
01:27:43,160 --> 01:27:40,710

like a work-study program where I would

1964
01:27:44,450 --> 01:27:43,170
alternate working one semester and then

1965
01:27:46,220 --> 01:27:44,460
going to school another semester and

1966
01:27:47,840 --> 01:27:46,230
then working and semester and going to

1967
01:27:50,900 --> 01:27:47,850
school and alternating until I graduated

1968
01:27:54,560 --> 01:27:50,910
and I got my co-op position with knack

1969
01:27:56,390 --> 01:27:54,570
side down in in Houston so starting my

1970
01:27:58,820 --> 01:27:56,400
sophomore year I would go work down in

1971
01:28:00,380 --> 01:27:58,830
Houston every other semester getting job

1972
01:28:02,240 --> 01:28:00,390
skills and training and kind of seeing

1973
01:28:04,430 --> 01:28:02,250
where I fit in in the mix of everything

1974
01:28:07,790 --> 01:28:04,440
so that by the time I graduated I had a

1975
01:28:10,340 --> 01:28:07,800
full-time job waiting for me down in

1976
01:28:13,240 --> 01:28:10,350
Houston I was there for about four years

1977
01:28:16,689 --> 01:28:13,250
and Mike hey Houston so I wanted to move

1978
01:28:18,920 --> 01:28:16,699
and I found a job up here I am a

1979
01:28:20,209 --> 01:28:18,930
aerospace engineer who doesn't

1980
01:28:22,160 --> 01:28:20,219
particularly want to work for a defense

1981
01:28:24,709 --> 01:28:22,170
contractor so it really limits my

1982
01:28:26,330 --> 01:28:24,719
options so I had been a civil servant

1983
01:28:28,970 --> 01:28:26,340
for the government down in Houston

1984
01:28:31,820 --> 01:28:28,980
I found this position here literally by

1985
01:28:33,140 --> 01:28:31,830
typing aerospace jobs state because I

1986
01:28:35,660 --> 01:28:33,150
just wanted to leave Houston because

1987
01:28:37,790 --> 01:28:35,670
it's not my favorite place awesome work

1988
01:28:40,959 --> 01:28:37,800

it loves my job I just didn't want to be

1989
01:28:43,400 --> 01:28:40,969
there anymore so I found this job I

1990
01:28:45,080 --> 01:28:43,410
applied they brought me up for an

1991
01:28:46,580 --> 01:28:45,090
interview I convinced him I vaguely know

1992
01:28:53,490 --> 01:28:46,590
what I'm talking about and then they

1993
01:28:58,680 --> 01:28:56,300
I have to cut off questions at 9:30

1994
01:29:02,070 --> 01:28:58,690
araignee is not in the building

1995
01:29:03,990 --> 01:29:02,080
so I presume there will be no observing

1996
01:29:07,230 --> 01:29:04,000
cat-themed aerospace ran observatories