
PAO
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1
00:00:06,230 --> 00:00:05,030
good afternoon we're live here in the

2
00:00:07,909 --> 00:00:06,240
international space station flight

3
00:00:10,070 --> 00:00:07,919
control room and joining us here at the

4
00:00:11,509 --> 00:00:10,080
pao console is the international space

5
00:00:14,150 --> 00:00:11,519
station flight director mike lammers

6
00:00:15,829 --> 00:00:14,160
thanks for joining us oh glad to be here

7
00:00:17,430 --> 00:00:15,839
um one of the big activities last week

8
00:00:19,990 --> 00:00:17,440
that's continuing this week is the

9
00:00:22,390 --> 00:00:20,000
upgrades for the iss ku communications

10
00:00:24,310 --> 00:00:22,400
system can you fill us in a little bit

11
00:00:26,870 --> 00:00:24,320
about what was done last week that was a

12
00:00:29,109 --> 00:00:26,880
lot of activity sure sure um last week

13
00:00:31,509 --> 00:00:29,119

what we did is we installed what we call

14
00:00:33,190 --> 00:00:31,519
ku communications unit number two um

15
00:00:35,830 --> 00:00:33,200
you'll hear me call it the k-u-com unit

16
00:00:38,310 --> 00:00:35,840
but this was um the k-u system on board

17
00:00:40,229 --> 00:00:38,320
the space station is is really uh what

18
00:00:41,990 --> 00:00:40,239
allows us to utilize

19
00:00:45,270 --> 00:00:42,000
the space station we have another system

20
00:00:46,790 --> 00:00:45,280
called s-band that's um a radio system

21
00:00:47,990 --> 00:00:46,800
that we use to talk to the crew

22
00:00:51,189 --> 00:00:48,000
previously was the only way we could

23
00:00:52,869 --> 00:00:51,199
talk to the crew as well as uh issue

24
00:00:54,790 --> 00:00:52,879
commands to the vehicle and get kind of

25
00:00:56,150 --> 00:00:54,800
systems telemetry that basically allows

26
00:00:58,709 --> 00:00:56,160
us to keep

27
00:01:00,630 --> 00:00:58,719
space station running it's sort of like

28
00:01:03,029 --> 00:01:00,640
sort of like the city maintenance

29
00:01:05,590 --> 00:01:03,039
department if you would um the ku band

30
00:01:07,350 --> 00:01:05,600
is really the high rate um data where we

31
00:01:08,950 --> 00:01:07,360
have megabits of data coming down to

32
00:01:11,590 --> 00:01:08,960
bring down science and all the nice

33
00:01:13,270 --> 00:01:11,600
video that you see and and really as far

34
00:01:15,190 --> 00:01:13,280
as using the space station for what's

35
00:01:18,149 --> 00:01:15,200
what it's intended for that's that's all

36
00:01:19,990 --> 00:01:18,159
done with ku band um the ku band system

37
00:01:22,630 --> 00:01:20,000
that we had on board the vehicle is uh

38
00:01:25,109 --> 00:01:22,640

over a decade old um

39
00:01:27,270 --> 00:01:25,119
it uh when we're looking at uh end of

40
00:01:29,109 --> 00:01:27,280
life with the vehicle

41
00:01:31,670 --> 00:01:29,119
and maintaining

42
00:01:33,510 --> 00:01:31,680
ku-band systems over the next decade or

43
00:01:35,590 --> 00:01:33,520
so we had to determine whether we're

44
00:01:37,510 --> 00:01:35,600
just going to build new versions of what

45
00:01:39,429 --> 00:01:37,520
essentially is mid-90s technology or

46
00:01:41,109 --> 00:01:39,439
we're going to take the next step and

47
00:01:42,950 --> 00:01:41,119
kind of come up with more advanced

48
00:01:44,630 --> 00:01:42,960
communication systems and

49
00:01:46,950 --> 00:01:44,640
we chose to do more advanced

50
00:01:48,310 --> 00:01:46,960
communication systems and what we did

51
00:01:50,230 --> 00:01:48,320
last week

52
00:01:51,270 --> 00:01:50,240
was the tail end of about four years of

53
00:01:54,069 --> 00:01:51,280
work

54
00:01:55,749 --> 00:01:54,079
to upgrade both the system on board the

55
00:01:57,670 --> 00:01:55,759
vehicle which was this

56
00:01:58,630 --> 00:01:57,680
piece of avionics called the k-u-com

57
00:01:59,510 --> 00:01:58,640
unit

58
00:02:03,670 --> 00:01:59,520
that was

59
00:02:05,270 --> 00:02:03,680
but as well as a number of upgrades

60
00:02:07,030 --> 00:02:05,280
on the ground network

61
00:02:08,790 --> 00:02:07,040
both at johnson space center the

62
00:02:11,270 --> 00:02:08,800
marshall space flight center and out at

63
00:02:13,350 --> 00:02:11,280

white sands uh where where our tdrs

64
00:02:14,869 --> 00:02:13,360
downlink is and that

65
00:02:16,630 --> 00:02:14,879
that four years of planning all sort of

66
00:02:19,350 --> 00:02:16,640
came to a head last week where we had

67
00:02:20,390 --> 00:02:19,360
the crew essentially pull out um the old

68
00:02:25,910 --> 00:02:20,400
system

69
00:02:27,830 --> 00:02:25,920
and activate it um and we activated it

70
00:02:30,550 --> 00:02:27,840
from the ground and it actually went uh

71
00:02:32,949 --> 00:02:30,560
uh quite well for uh the number of of

72
00:02:34,790 --> 00:02:32,959
what i call moving parts going on

73
00:02:37,030 --> 00:02:34,800
um we

74
00:02:39,830 --> 00:02:37,040
we got the unit in um

75
00:02:42,150 --> 00:02:39,840
we took the crew all day both both

76
00:02:43,750 --> 00:02:42,160
both tom tom and chris hadfield spent

77
00:02:47,110 --> 00:02:43,760
the entire day doing it and when we were

78
00:02:49,430 --> 00:02:47,120
done we activated the system uh did a

79
00:02:51,589 --> 00:02:49,440
brief check out and uh

80
00:02:53,589 --> 00:02:51,599
rf systems and and essentially ended the

81
00:02:55,270 --> 00:02:53,599
day with uh with the fully functioning

82
00:02:56,710 --> 00:02:55,280
ku-band system

83
00:02:58,630 --> 00:02:56,720
both providing us

84
00:03:00,790 --> 00:02:58,640
payload data like like the old system

85
00:03:03,030 --> 00:03:00,800
did before but as well as we picked up

86
00:03:04,949 --> 00:03:03,040
two new space-to-ground voice channels

87
00:03:07,589 --> 00:03:04,959
space for ground three and four and we

88
00:03:09,509 --> 00:03:07,599

picked up two brand new video channels

89
00:03:10,550 --> 00:03:09,519
so we've gone from four video channels

90
00:03:12,070 --> 00:03:10,560
to six

91
00:03:13,670 --> 00:03:12,080
and if you ask me i think they look a

92
00:03:16,470 --> 00:03:13,680
little bit better

93
00:03:18,070 --> 00:03:16,480
but we'll see how that works and we also

94
00:03:19,670 --> 00:03:18,080
change the way we record a lot of our

95
00:03:23,990 --> 00:03:19,680
video on board we used to do it with

96
00:03:26,390 --> 00:03:24,000
tapes um which which uh has uh

97
00:03:28,309 --> 00:03:26,400
some artifacts and and and things it's

98
00:03:30,470 --> 00:03:28,319
it's sort of like going from a vcr to

99
00:03:32,630 --> 00:03:30,480
itunes i call it where where you go to a

100
00:03:34,149 --> 00:03:32,640
much more clear digital picture and

101
00:03:35,750 --> 00:03:34,159
we're able to bring down a lot more

102
00:03:38,470 --> 00:03:35,760
record a lot more video and bring down a

103
00:03:40,309 --> 00:03:38,480
lot more video um from the vehicle

104
00:03:42,949 --> 00:03:40,319
so all went quite well

105
00:03:45,030 --> 00:03:42,959
that's great to hear it was a big effort

106
00:03:46,550 --> 00:03:45,040
you kind of alluded to it some of the

107
00:03:47,990 --> 00:03:46,560
changes in the upgrades are visual

108
00:03:49,990 --> 00:03:48,000
things that we can see the new the new

109
00:03:51,910 --> 00:03:50,000
channels but some are not can you speak

110
00:03:54,309 --> 00:03:51,920
a little bit more about some of the sure

111
00:03:56,789 --> 00:03:54,319
benefits of this the single uh biggest

112
00:03:59,670 --> 00:03:56,799
change that we did is we brought the

113
00:04:01,990 --> 00:03:59,680

downlink rate of the vehicle from 150

114
00:04:03,910 --> 00:04:02,000
megabits per second of data to uh 300

115
00:04:05,270 --> 00:04:03,920
megabits per second so the amount of

116
00:04:07,429 --> 00:04:05,280
payload data that we could bring down

117
00:04:09,429 --> 00:04:07,439
has doubled and just to give

118
00:04:10,710 --> 00:04:09,439
folks a comparison as

119
00:04:13,030 --> 00:04:10,720
a lot of us have

120
00:04:15,509 --> 00:04:13,040
broadband cable at home i know i do and

121
00:04:16,949 --> 00:04:15,519
mine um my cable company the basic

122
00:04:19,590 --> 00:04:16,959
broadband is six

123
00:04:21,110 --> 00:04:19,600
six megabits so uh you know multiply

124
00:04:23,510 --> 00:04:21,120
that by 50 and that's what you've got

125
00:04:25,430 --> 00:04:23,520
coming down from the vehicle which is um

126
00:04:27,749 --> 00:04:25,440
you know i grew up in a world working on

127
00:04:30,469 --> 00:04:27,759
some other satellites where we talked on

128
00:04:31,749 --> 00:04:30,479
kilobits of data so it's uh it's a

129
00:04:33,749 --> 00:04:31,759
tremendous amount of data that we can

130
00:04:35,830 --> 00:04:33,759
bring down from the vehicle

131
00:04:37,590 --> 00:04:35,840
and for folks who don't know like when

132
00:04:39,110 --> 00:04:37,600
we're looking at the timeline that both

133
00:04:40,790 --> 00:04:39,120
the ground team and the honorable crew

134
00:04:43,270 --> 00:04:40,800
use you're actually scheduling that

135
00:04:44,950 --> 00:04:43,280
bandwidth so this is a considerable

136
00:04:46,469 --> 00:04:44,960
enhancement to the operations and that's

137
00:04:48,870 --> 00:04:46,479
right and what we used to have to do is

138
00:04:50,310 --> 00:04:48,880

uh there's certain um payloads on board

139
00:04:51,110 --> 00:04:50,320
the vehicle especially ones that use a

140
00:04:53,110 --> 00:04:51,120
lot of

141
00:04:55,749 --> 00:04:53,120
video where we had to very carefully

142
00:04:57,110 --> 00:04:55,759
schedule them and uh and essentially we

143
00:04:59,030 --> 00:04:57,120
we couldn't run them all the time

144
00:05:00,950 --> 00:04:59,040
because we ran into uh

145
00:05:02,870 --> 00:05:00,960
bottlenecks on the bandwidth much much

146
00:05:04,310 --> 00:05:02,880
like you might at home with with

147
00:05:06,230 --> 00:05:04,320
internet if you have somebody that

148
00:05:07,990 --> 00:05:06,240
watches movies you may find that you

149
00:05:08,870 --> 00:05:08,000
can't do something useful

150
00:05:10,390 --> 00:05:08,880
um

151
00:05:13,350 --> 00:05:10,400
on your end on another computer and

152
00:05:14,950 --> 00:05:13,360
we're hoping to reduce a lot of those um

153
00:05:16,070 --> 00:05:14,960
bottlenecks as well as being able to

154
00:05:17,830 --> 00:05:16,080
support

155
00:05:19,110 --> 00:05:17,840
payloads that that use a lot more

156
00:05:20,950 --> 00:05:19,120
bandwidth

157
00:05:23,189 --> 00:05:20,960
so i know it's it's still new you're not

158
00:05:24,790 --> 00:05:23,199
even fully done yet um it's only been

159
00:05:26,550 --> 00:05:24,800
the weekend but what's been the initial

160
00:05:29,029 --> 00:05:26,560
feedback so far from the team um the

161
00:05:30,950 --> 00:05:29,039
initial feedback um has been great uh

162
00:05:34,150 --> 00:05:30,960
when we uh when we activated this last

163
00:05:36,390 --> 00:05:34,160

week uh it it went almost um by the book

164
00:05:38,550 --> 00:05:36,400
like we practiced it in testing um it

165
00:05:40,950 --> 00:05:38,560
was kind of funny we we uh we ran about

166
00:05:42,870 --> 00:05:40,960
an hour behind when we were

167
00:05:44,310 --> 00:05:42,880
configuring some settings that i like

168
00:05:46,230 --> 00:05:44,320
into a lot like if you're trying to get

169
00:05:47,909 --> 00:05:46,240
a router to work at your house and and

170
00:05:50,390 --> 00:05:47,919
you can't get it working and and it was

171
00:05:52,230 --> 00:05:50,400
the same uh type of settings but we we

172
00:05:53,749 --> 00:05:52,240
got them corrected and it's been working

173
00:05:55,590 --> 00:05:53,759
really well ever since the feedback that

174
00:05:59,510 --> 00:05:55,600
i've gotten from folks is

175
00:06:01,670 --> 00:05:59,520
that uh that the video looks more clear

176
00:06:03,510 --> 00:06:01,680
we haven't yet taken full advantage of

177
00:06:05,029 --> 00:06:03,520
all the bandwidth that we're kind of

178
00:06:06,390 --> 00:06:05,039
ramping that in

179
00:06:08,870 --> 00:06:06,400
i will tell you that space to ground

180
00:06:11,350 --> 00:06:08,880
three um the crew got right on that and

181
00:06:12,950 --> 00:06:11,360
started using it right away which is uh

182
00:06:14,469 --> 00:06:12,960
made it actually rather challenging for

183
00:06:16,309 --> 00:06:14,479
our cap comps to keep track of all the

184
00:06:18,710 --> 00:06:16,319
conversations going on but it is kind of

185
00:06:20,629 --> 00:06:18,720
nice uh we used to with space to grounds

186
00:06:24,070 --> 00:06:20,639
one and two um with six people on board

187
00:06:25,590 --> 00:06:24,080
we used to uh run into um

188
00:06:27,510 --> 00:06:25,600

you know basically tie-ups on

189
00:06:29,270 --> 00:06:27,520
communications where um essentially the

190
00:06:30,790 --> 00:06:29,280
crew was waiting in line

191
00:06:32,629 --> 00:06:30,800
uh on um

192
00:06:34,230 --> 00:06:32,639
on space to ground and with with three

193
00:06:36,309 --> 00:06:34,240
available that hasn't happened in fact i

194
00:06:39,270 --> 00:06:36,319
was on console last week and there's a

195
00:06:40,390 --> 00:06:39,280
payload called um bass where the um

196
00:06:41,590 --> 00:06:40,400
where the uh

197
00:06:43,510 --> 00:06:41,600
the um

198
00:06:46,629 --> 00:06:43,520
the researcher actually talks directly

199
00:06:48,790 --> 00:06:46,639
to the crew as they manipulate um flames

200
00:06:50,390 --> 00:06:48,800
inside of the inside of the glove box

201
00:06:51,670 --> 00:06:50,400
and it was actually very nice because we

202
00:06:54,230 --> 00:06:51,680
could just give them space to ground

203
00:06:55,350 --> 00:06:54,240
three and they were able to just um talk

204
00:06:56,230 --> 00:06:55,360
and they didn't have to worry about

205
00:06:57,589 --> 00:06:56,240
interrupting some of the other

206
00:06:59,510 --> 00:06:57,599
conversations going on with the other

207
00:07:01,510 --> 00:06:59,520
five crew members so everyone was really

208
00:07:03,189 --> 00:07:01,520
happy to see that that's a great example

209
00:07:05,670 --> 00:07:03,199
of how this is going to really enable

210
00:07:07,909 --> 00:07:05,680
since um science experiment and research

211
00:07:09,830 --> 00:07:07,919
work has become such a

212
00:07:11,749 --> 00:07:09,840
dominant activity on board this is

213
00:07:13,110 --> 00:07:11,759

really going to enhance that right and

214
00:07:14,309 --> 00:07:13,120
that that's what we're all hoping for

215
00:07:15,189 --> 00:07:14,319
when we do this

216
00:07:16,710 --> 00:07:15,199
so

217
00:07:18,230 --> 00:07:16,720
now looking at the week ahead can you

218
00:07:20,870 --> 00:07:18,240
kind of step us through what what the

219
00:07:22,790 --> 00:07:20,880
plan what means sure um looking at the

220
00:07:25,110 --> 00:07:22,800
week ahead uh the main thing is we've

221
00:07:26,950 --> 00:07:25,120
gotten you know we've done the hard work

222
00:07:28,870 --> 00:07:26,960
we've gotten the first unit in we've

223
00:07:30,469 --> 00:07:28,880
been working uh working with it and it's

224
00:07:32,309 --> 00:07:30,479
been working great both at the end of

225
00:07:35,270 --> 00:07:32,319
last week and through the weekend uh we

226
00:07:37,670 --> 00:07:35,280
have to put in a second um redundant uh

227
00:07:39,189 --> 00:07:37,680
unit which we call ku coming at one even

228
00:07:41,350 --> 00:07:39,199
though it's the second one going in it's

229
00:07:43,029 --> 00:07:41,360
it's number one but uh that's actually

230
00:07:44,710 --> 00:07:43,039
an an um

231
00:07:46,150 --> 00:07:44,720
an enhancement to the system because

232
00:07:47,589 --> 00:07:46,160
it's actually a redundant piece of

233
00:07:50,469 --> 00:07:47,599
equipment

234
00:07:52,790 --> 00:07:50,479
until this time our ku band system a

235
00:07:54,230 --> 00:07:52,800
single failure could take it out

236
00:07:57,110 --> 00:07:54,240
which was

237
00:08:00,550 --> 00:07:57,120
bit earlier in the program as we're

238
00:08:02,869 --> 00:08:00,560

assembling but we've become um so

239
00:08:04,150 --> 00:08:02,879
dependent upon ku band for for our

240
00:08:05,909 --> 00:08:04,160
science community that getting the

241
00:08:07,189 --> 00:08:05,919
redundancy in there is is going to be a

242
00:08:09,670 --> 00:08:07,199
real boon

243
00:08:12,309 --> 00:08:09,680
for us so on thursday what we plan to do

244
00:08:14,629 --> 00:08:12,319
is install that redundant unit and we

245
00:08:16,150 --> 00:08:14,639
hope to

246
00:08:17,589 --> 00:08:16,160
activate it as far as possible we're

247
00:08:20,150 --> 00:08:17,599
still kind of going through the process

248
00:08:21,830 --> 00:08:20,160
of of when we actually will

249
00:08:23,350 --> 00:08:21,840
fully turn that on and activate it and

250
00:08:25,510 --> 00:08:23,360
start using it for science because we're

251
00:08:28,070 --> 00:08:25,520
trying to balance um

252
00:08:30,150 --> 00:08:28,080
an outage of of ku band that we have to

253
00:08:32,630 --> 00:08:30,160
have to activate that with our science

254
00:08:34,149 --> 00:08:32,640
users who who have been continuing to to

255
00:08:35,589 --> 00:08:34,159
schedule and do science activities

256
00:08:37,350 --> 00:08:35,599
throughout this week

257
00:08:38,870 --> 00:08:37,360
which has been pretty challenging it's a

258
00:08:40,389 --> 00:08:38,880
lot like changing the

259
00:08:41,509 --> 00:08:40,399
tire on your car as you're as you're

260
00:08:43,509 --> 00:08:41,519
driving along you know you want to

261
00:08:45,829 --> 00:08:43,519
minimize those outages but yet do the up

262
00:08:47,350 --> 00:08:45,839
the upgrade

263
00:08:49,350 --> 00:08:47,360

you alluded to it a little bit earlier

264
00:08:51,269 --> 00:08:49,360
in this interview the the teams and the

265
00:08:54,630 --> 00:08:51,279
work that's gone into this it was

266
00:08:57,030 --> 00:08:54,640
described last week i think by the mmt

267
00:08:58,550 --> 00:08:57,040
management saying that these upgrades

268
00:09:00,870 --> 00:08:58,560
are accelerating the station

269
00:09:03,030 --> 00:09:00,880
communication systems about 10 years and

270
00:09:04,389 --> 00:09:03,040
it didn't happen overnight can you share

271
00:09:06,150 --> 00:09:04,399
with us a little bit more about what it

272
00:09:07,910 --> 00:09:06,160
took for those you know for those years

273
00:09:09,110 --> 00:09:07,920
of planning and testing should make this

274
00:09:12,550 --> 00:09:09,120
happen i know

275
00:09:14,790 --> 00:09:12,560
i know that we've had teams of folks

276
00:09:16,470 --> 00:09:14,800
really fairly

277
00:09:18,150 --> 00:09:16,480
involved teams at both johnson space

278
00:09:19,190 --> 00:09:18,160
center and mars space flight center in

279
00:09:21,269 --> 00:09:19,200
huntsville

280
00:09:22,630 --> 00:09:21,279
working on this for about four years

281
00:09:25,509 --> 00:09:22,640
along with the engineering community

282
00:09:27,190 --> 00:09:25,519
he's been developing this and boeing

283
00:09:29,829 --> 00:09:27,200
i've been i've been involved for about a

284
00:09:32,389 --> 00:09:29,839
year as it came to uh fruition

285
00:09:33,750 --> 00:09:32,399
those uh folks just learning how the

286
00:09:36,070 --> 00:09:33,760
system works

287
00:09:38,070 --> 00:09:36,080
they they work together and they did

288
00:09:40,310 --> 00:09:38,080

testing almost every week with

289
00:09:41,990 --> 00:09:40,320
hardware that we have on the ground

290
00:09:44,150 --> 00:09:42,000
just to get ready for this one of the

291
00:09:45,750 --> 00:09:44,160
one of the kind of the challenges is in

292
00:09:47,590 --> 00:09:45,760
something that's sort of unique about

293
00:09:50,070 --> 00:09:47,600
this particular system is it's jointly

294
00:09:51,910 --> 00:09:50,080
run by flight controllers both in

295
00:09:54,150 --> 00:09:51,920
huntsville and at

296
00:09:55,590 --> 00:09:54,160
jsc and those guys have been working

297
00:09:57,110 --> 00:09:55,600
working really

298
00:09:59,110 --> 00:09:57,120
well together and kind of going through

299
00:10:00,630 --> 00:09:59,120
the challenge of not being able to walk

300
00:10:02,710 --> 00:10:00,640
next door and talk to your office mate

301
00:10:04,389 --> 00:10:02,720
about a problem and i've been you know

302
00:10:05,670 --> 00:10:04,399
just very impressed by the whole team

303
00:10:06,949 --> 00:10:05,680
and and how they've been working

304
00:10:08,389 --> 00:10:06,959
together

305
00:10:10,470 --> 00:10:08,399
and we should ask tell us a little bit

306
00:10:12,550 --> 00:10:10,480
about your role in this

307
00:10:14,470 --> 00:10:12,560
sure i'm the i'm the flight director

308
00:10:16,310 --> 00:10:14,480
that's been the lead for this and so

309
00:10:18,870 --> 00:10:16,320
i've been working the ops integration

310
00:10:21,509 --> 00:10:18,880
and the activation and so uh my teams

311
00:10:23,590 --> 00:10:21,519
both both myself and then of course a

312
00:10:26,310 --> 00:10:23,600
key group of flight controllers here in

313
00:10:28,949 --> 00:10:26,320

the room um have developed the the uh

314
00:10:30,710 --> 00:10:28,959
the uh plans and procedures for taking

315
00:10:32,870 --> 00:10:30,720
um what engineering has given us and

316
00:10:35,430 --> 00:10:32,880
then figuring out how to operationally

317
00:10:38,150 --> 00:10:35,440
utilize it and how to operationally

318
00:10:40,069 --> 00:10:38,160
install it and activate it and it's uh

319
00:10:41,509 --> 00:10:40,079
it's a really great team i have they all

320
00:10:42,949 --> 00:10:41,519
you know they're the ones doing all the

321
00:10:44,630 --> 00:10:42,959
work i just kind of

322
00:10:46,470 --> 00:10:44,640
my job is just to enable them to do

323
00:10:48,710 --> 00:10:46,480
their great things and

324
00:10:50,470 --> 00:10:48,720
it's it's been really a lot of fun to do

325
00:10:51,990 --> 00:10:50,480
this well congratulations on the

326
00:10:54,069 --> 00:10:52,000
progress so far i know there's been a

327
00:10:55,350 --> 00:10:54,079
lot of enthusiasm from the team on how

328
00:10:56,949 --> 00:10:55,360
it's gone so

329
00:10:58,550 --> 00:10:56,959
kudos to you and all the team and we'll

330
00:11:00,230 --> 00:10:58,560
stand by and continue to watch the

331
00:11:01,750 --> 00:11:00,240
activities unfold this week okay thank

332
00:11:03,350 --> 00:11:01,760
you thanks for joining us again that was

333
00:11:05,269 --> 00:11:03,360
mike lammers the international space

334
00:11:07,990 --> 00:11:05,279
station flight director overseeing some