



ENVIRONMENTAL  
(EECOM)



1  
00:00:42,570 --> 00:00:40,590  
it had been a great flight with a great

2  
00:00:44,310 --> 00:00:42,580  
entry in landing and the team was

3  
00:00:47,220 --> 00:00:44,320  
preparing to handover the vehicle to the

4  
00:00:48,810 --> 00:00:47,230  
KSC ground folks one of last orders of

5  
00:00:50,700 --> 00:00:48,820  
business in this process is to

6  
00:00:53,640 --> 00:00:50,710  
transition from internal vehicle cooling

7  
00:00:55,080 --> 00:00:53,650  
to ground cooling now in orbit cooling

8  
00:00:56,880 --> 00:00:55,090  
is accomplished through a combination of

9  
00:00:59,850 --> 00:00:56,890  
the radiators and flash evaporator

10  
00:01:01,530 --> 00:00:59,860  
system as shuttle equipment heats up the

11  
00:01:03,060 --> 00:01:01,540  
freon loops and water loops carry this

12  
00:01:06,000 --> 00:01:03,070  
heat to the flash evaporator and

13  
00:01:08,100 --> 00:01:06,010

radiators to be dispersed into space for

14

00:01:10,530 --> 00:01:08,110

entry the radiators are cold soaked and

15

00:01:12,840 --> 00:01:10,540

then bypassed so that that cooling can

16

00:01:15,210 --> 00:01:12,850

be used on the ground then post landing

17

00:01:17,130 --> 00:01:15,220

the shuttle uses its cold soaked

18

00:01:18,960 --> 00:01:17,140

radiators for a few minutes and then as

19

00:01:20,999 --> 00:01:18,970

they heat up the team activates the

20

00:01:22,850 --> 00:01:21,009

ammonia system which flashes ammonia

21

00:01:25,469 --> 00:01:22,860

onto the freon loops to provide cooling

22

00:01:27,359 --> 00:01:25,479

in order to have a safe transition to

23

00:01:29,310 --> 00:01:27,369

ground cooling the ammonia system has to

24

00:01:31,770 --> 00:01:29,320

be deactivated and confirmed to have no

25

00:01:33,450 --> 00:01:31,780

leaks and then a go is given so the

26  
00:01:35,490 --> 00:01:33,460  
ground team can activate ground cooling

27  
00:01:38,100 --> 00:01:35,500  
at least that's the way it's supposed to

28  
00:01:40,650 --> 00:01:38,110  
go now there are some critical elements

29  
00:01:42,029 --> 00:01:40,660  
to consider regarding cooling obviously

30  
00:01:44,160 --> 00:01:42,039  
you have to keep cooling going so

31  
00:01:46,109 --> 00:01:44,170  
nothing overheats but at the same time

32  
00:01:48,090 --> 00:01:46,119  
you can't get too cold or you could

33  
00:01:50,340 --> 00:01:48,100  
freeze the interchange the interchange

34  
00:01:52,469 --> 00:01:50,350  
er is the heat exchanger where the water

35  
00:01:54,930 --> 00:01:52,479  
loops dump the cabin heat onto the fan

36  
00:01:57,180 --> 00:01:54,940  
loops all the shuttle cooling loops meet

37  
00:01:59,010 --> 00:01:57,190  
there and since we're dealing with water

38  
00:02:00,809 --> 00:01:59,020

we can't let it get below 32 degrees

39

00:02:03,090 --> 00:02:00,819

Fahrenheit or the water loops could

40

00:02:05,490 --> 00:02:03,100

freeze and as you know when water

41

00:02:06,840 --> 00:02:05,500

freezes it expands and cracked

42

00:02:08,400 --> 00:02:06,850

you've just ruptured a piece of

43

00:02:10,740 --> 00:02:08,410

equipment that could cost over a million

44

00:02:12,270 --> 00:02:10,750

dollars to replace this is a very

45

00:02:14,820 --> 00:02:12,280

efficient heat exchanger so this would

46

00:02:17,070 --> 00:02:14,830

only take a matter of seconds on sts-27

47

00:02:20,210 --> 00:02:17,080

the e-comm team was faced with just this

48

00:02:38,720 --> 00:02:36,470

I was going to see the it's post-landing

49

00:02:40,850 --> 00:02:38,730

and everything's going normally you're

50

00:02:43,760 --> 00:02:40,860

on the ground you've made it right

51  
00:02:45,530 --> 00:02:43,770  
what could go wrong here the team is

52  
00:02:47,330 --> 00:02:45,540  
even starting the post-landing tradition

53  
00:02:48,710 --> 00:02:47,340  
of hanging the plaque in which one of

54  
00:02:51,320 --> 00:02:48,720  
the flight controllers is honored with

55  
00:02:53,780 --> 00:02:51,330  
special recognition however not

56  
00:02:55,370 --> 00:02:53,790  
everything is done handover to ground

57  
00:02:57,500 --> 00:02:55,380  
cooling hasn't been completed and the

58  
00:02:59,570 --> 00:02:57,510  
ecomp team is watching ammonia

59  
00:03:04,910 --> 00:02:59,580  
performance as suddenly the friendly

60  
00:03:06,320 --> 00:03:04,920  
temperatures start diving so I want you

61  
00:03:09,530 --> 00:03:06,330  
to tell me first of all we got Queen

62  
00:03:11,750 --> 00:03:09,540  
Caroline and Chuck dangle for sts-27 I

63  
00:03:13,430 --> 00:03:11,760

want you to tell me your positions for

64

00:03:15,860 --> 00:03:13,440

this flight and what the

65

00:03:18,050 --> 00:03:15,870

responsibilities those positions were so

66

00:03:20,180 --> 00:03:18,060

start with the leader chuck of the team

67

00:03:23,750 --> 00:03:20,190

okay so it's been a while but I think it

68

00:03:25,250 --> 00:03:23,760

was a son entry in orbit one II come for

69

00:03:27,470 --> 00:03:25,260

the flight so we were responsible for

70

00:03:29,509 --> 00:03:27,480

the life support thermal control and

71

00:03:32,930 --> 00:03:29,519

also at that time the electric power

72

00:03:34,640 --> 00:03:32,940

systems on onboard okay I was the acid

73

00:03:37,190 --> 00:03:34,650

entry thermal specifically responsible

74

00:03:38,990 --> 00:03:37,200

for the active cooling and passive

75

00:03:56,990 --> 00:03:39,000

cooling systems on the shuttle including

76  
00:04:02,340 --> 00:03:59,250  
okay so what were you looking at there

77  
00:04:03,990 --> 00:04:02,350  
that cued you into the fact hey I got a

78  
00:04:05,430 --> 00:04:04,000  
problem going on here was that that bill

79  
00:04:07,770 --> 00:04:05,440  
that went off the alarm that went off

80  
00:04:09,840 --> 00:04:07,780  
earlier probably actually what happened

81  
00:04:12,000 --> 00:04:09,850  
was the first thing I saw was we have an

82  
00:04:14,760 --> 00:04:12,010  
indication on the ammonia system the

83  
00:04:16,530 --> 00:04:14,770  
primary controller if something goes

84  
00:04:18,420 --> 00:04:16,540  
along with the logic or goes under temp

85  
00:04:20,970 --> 00:04:18,430  
it automatically switches to the

86  
00:04:22,170 --> 00:04:20,980  
secondary controller trying to go to a

87  
00:04:24,510 --> 00:04:22,180  
different controller to control the

88  
00:04:26,970 --> 00:04:24,520

system yet that was the first insight as

89

00:04:29,640 --> 00:04:26,980

I saw is this indication that we just

90

00:04:31,770 --> 00:04:29,650

switched from the primary controller to

91

00:04:33,690 --> 00:04:31,780

the secondary controller and generally

92

00:04:35,490 --> 00:04:33,700

means under tempo that is the only

93

00:04:37,170 --> 00:04:35,500

indication at the time was seeing a

94

00:04:39,210 --> 00:04:37,180

switch and having said that though it's

95

00:04:41,400 --> 00:04:39,220

upstream and we have a power T boosters

96

00:04:43,680 --> 00:04:41,410

so the temperatures hadn't arrived at

97

00:04:50,820 --> 00:04:43,690

yeah how many seconds is that from

98

00:04:54,390 --> 00:04:50,830

ammonia I forgot yeah it's about 45

99

00:04:56,040 --> 00:04:54,400

seconds or so yeah so you guys knew

100

00:04:57,720 --> 00:04:56,050

something something switched over but

101  
00:04:59,970 --> 00:04:57,730  
you probably didn't have an idea at that

102  
00:05:03,780 --> 00:04:59,980  
point it was an under tamp right okay

103  
00:05:06,180 --> 00:05:03,790  
okay and I think he may have just called

104  
00:05:24,300 --> 00:05:06,190  
hey I think he called it under Tim

105  
00:05:29,320 --> 00:05:26,830  
now the team has confirmed there's an

106  
00:05:30,999 --> 00:05:29,330  
under tint problem the cold slug has now

107  
00:05:32,980 --> 00:05:31,009  
shown up on the downstream temperature

108  
00:05:34,629 --> 00:05:32,990  
dosers and the extra cold freon is

109  
00:05:35,800 --> 00:05:34,639  
racing towards the inner changer which

110  
00:05:38,170 --> 00:05:35,810  
could crack a face with these

111  
00:05:40,600 --> 00:05:38,180  
temperatures how long does the team have

112  
00:05:43,900 --> 00:05:40,610  
to respond what is the correct course of

113  
00:05:46,480 --> 00:05:43,910

action to take okay so at this point you

114

00:05:50,559 --> 00:05:46,490

know that you've got the about too low

115

00:05:52,270 --> 00:05:50,569

and what are you thinking one of my

116

00:05:57,339 --> 00:05:52,280

thing at the time there was a hairy edge

117

00:05:58,749 --> 00:05:57,349

where you know as the I knew that it may

118

00:06:00,870 --> 00:05:58,759

be the initiated ground : there's some

119

00:06:03,790 --> 00:06:00,880

spec leakage to the ammonia boiler that

120

00:06:07,570 --> 00:06:03,800

it leaks ammonia so you're getting some

121

00:06:09,040 --> 00:06:07,580

cooling from it whether it's on or when

122

00:06:10,779 --> 00:06:09,050

it's on no matter what if it's not

123

00:06:11,680 --> 00:06:10,789

required on it so it's providing extra

124

00:06:14,980 --> 00:06:11,690

cooling to loop

125

00:06:17,800 --> 00:06:14,990

initial thought was okay we're down just

126  
00:06:21,070 --> 00:06:17,810  
broke 32 degrees maybe they're cool and

127  
00:06:21,580 --> 00:06:21,080  
they're cooling cards just to go low am

128  
00:06:23,560 --> 00:06:21,590  
i right now

129  
00:06:24,999 --> 00:06:23,570  
ready to take this drastic action yet or

130  
00:06:26,920 --> 00:06:25,009  
is this maybe we can take the ammonia

131  
00:06:28,990 --> 00:06:26,930  
boiler off and that would be sufficient

132  
00:06:31,899 --> 00:06:29,000  
to bring it above freezing again what's

133  
00:06:33,459 --> 00:06:31,909  
my initial thoughts it was not it was

134  
00:06:35,800 --> 00:06:33,469  
pretty getting pretty excited you can

135  
00:06:38,620 --> 00:06:35,810  
hear was the fact that you know we were

136  
00:06:40,810 --> 00:06:38,630  
actually below the freezing point of the

137  
00:06:41,529 --> 00:06:40,820  
water and we needed to do something

138  
00:06:43,300 --> 00:06:41,539

quick

139

00:06:44,860 --> 00:06:43,310

so that was an initial reaction let's

140

00:06:47,020 --> 00:06:44,870

get it off and see if that won't bring

141

00:06:49,300 --> 00:06:47,030

it to the trip back up above freezing so

142

00:06:51,520 --> 00:06:49,310

what's what is the issue here with

143

00:06:56,680 --> 00:06:51,530

getting too cold what's the what's the

144

00:06:58,809 --> 00:06:56,690

problem with doing that the interchange

145

00:07:01,510 --> 00:06:58,819

is a very efficient heat exchanger and

146

00:07:04,600 --> 00:07:01,520

it's got freon on one side and water on

147

00:07:07,330 --> 00:07:04,610

the other and if you put in freon below

148

00:07:09,879 --> 00:07:07,340

32 degrees in pretty short order you're

149

00:07:12,790 --> 00:07:09,889

going to end up freezing water turn the

150

00:07:15,129 --> 00:07:12,800

water into ice it expands and volume

151

00:07:17,200 --> 00:07:15,139

change in heat exchanger can break

152

00:07:19,779 --> 00:07:17,210

that'd be pretty expensive to try to

153

00:07:21,129 --> 00:07:19,789

replace that and one of the big things

154

00:07:23,649 --> 00:07:21,139

was that we have done that before and

155

00:07:26,800 --> 00:07:23,659

sts-3 it was a better place the big

156

00:07:29,080 --> 00:07:26,810

thing is I don't think they have any

157

00:07:31,360 --> 00:07:29,090

spares and I think the big thing is it

158

00:07:32,950 --> 00:07:31,370

just bits of not only the cost which

159

00:07:35,379 --> 00:07:32,960

they estimated 100 million dollars but

160

00:07:37,450 --> 00:07:35,389

getting a new one in installing it from

161

00:07:39,309 --> 00:07:37,460

the downtime of the vehicle was a big

162

00:07:40,899 --> 00:07:39,319

impact impact of schedule would have

163

00:07:42,700 --> 00:07:40,909

been pretty enormous right I mean

164

00:07:46,959 --> 00:07:42,710

basically can't power how vehicle what

165

00:07:50,019 --> 00:07:46,969

the real move or loosen on actors so

166

00:07:51,550 --> 00:07:50,029

knowing that why didn't she just go take

167

00:07:53,110 --> 00:07:51,560

the drastic it what is drastic about

168

00:07:54,399 --> 00:07:53,120

turning the friendly soft ones just say

169

00:07:56,350 --> 00:07:54,409

let's go ahead and turn them off what's

170

00:07:57,670 --> 00:07:56,360

what's the issue there you know so we

171

00:07:59,679 --> 00:07:57,680

got on one side we don't want to freeze

172

00:08:00,700 --> 00:07:59,689

the interchange er why don't we want to

173

00:08:09,129 --> 00:08:00,710

just turn the family piece off what's

174

00:08:10,920 --> 00:08:09,139

the issue there well I kind of had my

175

00:08:13,480 --> 00:08:10,930

way of saying who gets below 30 degrees

176

00:08:16,390 --> 00:08:13,490

that's what my land my saying we're not

177

00:08:18,369 --> 00:08:16,400

playing anymore and he's you're gonna

178

00:08:20,890 --> 00:08:18,379

hearing a little bit it happened quickly

179

00:08:23,980 --> 00:08:20,900

from drop down and it was very officer

180

00:08:25,390 --> 00:08:23,990

obvious that once it got to obstacle low

181

00:08:26,829 --> 00:08:25,400

of the deucer which was twenty four

182

00:08:30,939 --> 00:08:26,839

point nine you'll hear that several

183

00:08:36,670 --> 00:08:30,949

times repeated very obvious what we need

184

00:08:39,069 --> 00:08:36,680

to do but it was to me was a drastic I

185

00:08:51,600 --> 00:08:39,079

mean the fact that we potentially shut

186

00:08:51,610 --> 00:09:50,970

that's okay so basically you're okay

187

00:09:55,449 --> 00:09:53,259

sounds like nothing you made the call

188

00:09:58,809 --> 00:09:55,459

for the frame loops nothing happened

189

00:10:01,840 --> 00:09:58,819

right initially and and I'm still like

190

00:10:04,960 --> 00:10:01,850

they're you know they're actually the

191

00:10:06,670 --> 00:10:04,970

trawl team was basically and like I said

192

00:10:11,889 --> 00:10:06,680

the post mission mode where they're

193

00:10:13,960 --> 00:10:11,899

doing the post black hanging and stuff

194

00:10:16,720 --> 00:10:13,970

and I think even GC got to the point or

195

00:10:18,759 --> 00:10:16,730

actually we temporarily they shut down

196

00:10:21,100 --> 00:10:18,769

calm between the vehicles what I heard

197

00:10:23,380 --> 00:10:21,110

later for the infirm their first initial

198

00:10:25,240 --> 00:10:23,390

call to the vehicle to turn off both

199

00:10:26,500 --> 00:10:25,250

trailers and I don't think that we left

200

00:10:29,230 --> 00:10:26,510

the house they're probably thinking the

201  
00:10:31,809 --> 00:10:29,240  
rule the one point one hey the crews

202  
00:10:32,710 --> 00:10:31,819  
gone why should I keep calm up I mean

203  
00:10:34,930 --> 00:10:32,720  
we're already doing the plaque hanging

204  
00:10:38,230 --> 00:10:34,940  
right let's just let's just shut this

205  
00:10:39,880 --> 00:10:38,240  
thing down so okay I don't know what I

206  
00:10:44,019 --> 00:10:39,890  
don't know what all the factors were in

207  
00:10:50,060 --> 00:10:44,029  
that listening to that recording which I

208  
00:10:55,010 --> 00:10:52,460  
just being kind of stepping back as an

209  
00:10:56,870 --> 00:10:55,020  
observer to myself if I would have had

210  
00:10:59,870 --> 00:10:56,880  
the wherewithal I think it would have

211  
00:11:01,790 --> 00:10:59,880  
helped to be more exact in the call

212  
00:11:03,920 --> 00:11:01,800  
especially knowing that the flight crew

213  
00:11:05,780 --> 00:11:03,930

was not in there

214

00:11:08,500 --> 00:11:05,790

who probably could have responded very

215

00:11:11,060 --> 00:11:08,510

well to be activate both freon loops

216

00:11:14,090 --> 00:11:11,070

were the support person in there instead

217

00:11:18,290 --> 00:11:14,100

a more precise call like on panel I1

218

00:11:21,410 --> 00:11:18,300

freon pump one off loop - I think that

219

00:11:26,390 --> 00:11:21,420

in hindsight would have helped get that

220

00:11:28,400 --> 00:11:26,400

done much faster if I was a ASP in the

221

00:11:30,560 --> 00:11:28,410

cockpit trying to interpret that call I

222

00:11:35,740 --> 00:11:30,570

probably have trouble myself right here

223

00:11:37,850 --> 00:11:35,750

ms Wanda had seemed in a year where

224

00:11:57,230 --> 00:11:37,860

that's good that's a very good point

225

00:11:58,640 --> 00:11:57,240

that's a good point okay so what was

226

00:12:00,140 --> 00:11:58,650

going on there I made the call for the

227

00:12:02,810 --> 00:12:00,150

Fran loops and now Quinn's calling again

228

00:12:06,350 --> 00:12:02,820

let's get one off yeah so I can tell you

229

00:12:08,510 --> 00:12:06,360

from my perspective I was trying to find

230

00:12:10,670 --> 00:12:08,520

the procedure for a VAT Bell tell about

231

00:12:13,490 --> 00:12:10,680

temple oh I think in the entry checklist

232

00:12:16,460 --> 00:12:13,500

right okay so I was thumbing through the

233

00:12:21,770 --> 00:12:16,470

book to fly to to try and find that

234

00:12:24,170 --> 00:12:21,780

procedure to save myself so I after

235

00:12:27,410 --> 00:12:24,180

making the call to turn both freon loops

236

00:12:29,990 --> 00:12:27,420

off I think I was under the assumption

237

00:12:31,580 --> 00:12:30,000

that that would happen quickly I'm going

238

00:12:36,230 --> 00:12:31,590

to find the procedure to look for

239

00:12:38,480 --> 00:12:36,240

subsequent steps to guide us and so

240

00:12:41,600 --> 00:12:38,490

Quinn called and I'm asking questions I

241

00:12:46,310 --> 00:12:41,610

think out of that procedure and Quinn

242

00:12:47,270 --> 00:12:46,320

says hey I just please turn off it hit

243

00:12:50,780 --> 00:12:47,280

me at that point

244

00:12:52,580 --> 00:12:50,790

oh they didn't respond to the call right

245

00:12:54,560 --> 00:12:52,590

and you Quinn can't see each other here

246

00:12:57,680 --> 00:12:54,570

right ones in one room ones in the other

247

00:13:00,050 --> 00:12:57,690

room so and sometimes there's over the

248

00:13:01,550 --> 00:13:00,060

airwave conversation that goes on and so

249

00:13:02,040 --> 00:13:01,560

you didn't know why they weren't turning

250

00:13:04,739 --> 00:13:02,050

the friendly

251  
00:13:06,419 --> 00:13:04,749  
right and I'd take from the is a mid

252  
00:13:08,249 --> 00:13:06,429  
perspective one thing that really taught

253  
00:13:08,850 --> 00:13:08,259  
me it was okay I've already made the

254  
00:13:12,299 --> 00:13:08,860  
call

255  
00:13:14,369 --> 00:13:12,309  
I'm watching Chuck Chuck is watching

256  
00:13:17,340 --> 00:13:14,379  
this data to don't need a bother he sees

257  
00:13:23,009 --> 00:13:17,350  
what's happening I'm kind of in the

258  
00:13:25,889 --> 00:13:23,019  
background dancing panicking but I am

259  
00:13:27,900 --> 00:13:25,899  
NOT I learned after the fact that when

260  
00:13:31,109 --> 00:13:27,910  
he started talking about what I want to

261  
00:13:32,549 --> 00:13:31,119  
do next it was a fear through fear

262  
00:13:33,840 --> 00:13:32,559  
through mean that he doesn't realize

263  
00:13:37,019 --> 00:13:33,850

they're still not off yet

264

00:13:39,780 --> 00:13:37,029

and then I'm questioning why didn't they

265

00:13:43,169 --> 00:13:39,790

go off why didn't they they actually do

266

00:13:44,999 --> 00:13:43,179

it so but the point in listening for

267

00:13:48,210 --> 00:13:45,009

future guys is you know don't make an

268

00:13:49,739 --> 00:13:48,220

assumption you're free clickers look in

269

00:13:51,269 --> 00:13:49,749

the data this is all växjö it's

270

00:13:54,840 --> 00:13:51,279

happening much quicker than it really is

271

00:13:57,269 --> 00:13:54,850

but we had I want to say correct me from

272

00:13:59,579 --> 00:13:57,279

long 60 to 90 seconds somewhere before

273

00:14:02,220 --> 00:13:59,589

we would have damaged the interchanges

274

00:14:05,359 --> 00:14:02,230

so the 45 have about 10 or changes

275

00:14:08,879 --> 00:14:05,369

another 45 and we're ticking along it's

276  
00:14:13,230 --> 00:14:08,889  
20 seconds 30 seconds and I should have

277  
00:14:15,239 --> 00:14:13,240  
been going hey Chuck I should have been

278  
00:14:16,739 --> 00:14:15,249  
more proactive I made the assumption

279  
00:14:18,629 --> 00:14:16,749  
that he's looking the data he's singing

280  
00:14:20,789 --> 00:14:18,639  
it - he's congressman put the fear of

281  
00:14:22,410 --> 00:14:20,799  
God what do you realize he'd made a call

282  
00:14:24,569 --> 00:14:22,420  
like what we're gonna do next and I'm

283  
00:14:26,449 --> 00:14:24,579  
realizing he's not looking at the data

284  
00:14:28,949 --> 00:14:26,459  
and I'm realizing I should have been

285  
00:14:30,780 --> 00:14:28,959  
pushing it well I certainly should have

286  
00:14:33,509 --> 00:14:30,790  
been paying attention to get the primary

287  
00:14:35,039 --> 00:14:33,519  
action to ensure that it was done yeah

288  
00:14:37,799 --> 00:14:35,049

and so that was one of the things that I

289

00:14:39,960 --> 00:14:37,809

wish I had done better back at the time

290

00:14:42,179 --> 00:14:39,970

was to be more cognizant to making sure

291

00:14:44,129 --> 00:14:42,189

that they took the action that we asked

292

00:14:46,559 --> 00:14:44,139

I'm just taking too much it was my job

293

00:14:48,230 --> 00:14:46,569

to watch the systems I should keep them

294

00:14:50,280 --> 00:14:48,240

Kevin it's a team effort both ways

295

00:14:52,289 --> 00:14:50,290

absolutely team effort all the way all

296

00:14:52,759 --> 00:14:52,299

the way around good and bad we work as a

297

00:15:09,680 --> 00:14:52,769

team

298

00:15:13,560 --> 00:15:11,550

sound like he's getting little stressed

299

00:15:15,750 --> 00:15:13,570

out there yeah I think the seriousness

300

00:15:18,030 --> 00:15:15,760

of it was probably starting to soak in

301  
00:15:19,530 --> 00:15:18,040  
yeah you probably I'm just guessing you

302  
00:15:20,820 --> 00:15:19,540  
just realized I made a call and I'm

303  
00:15:24,150 --> 00:15:20,830  
looking at the procedures and my call

304  
00:15:25,890 --> 00:15:24,160  
didn't go go up and number less and I

305  
00:15:26,310 --> 00:15:25,900  
need to push this thing go harder yes

306  
00:15:30,000 --> 00:15:26,320  
yeah

307  
00:15:31,860 --> 00:15:30,010  
the lesson to be learned there was give

308  
00:15:33,750 --> 00:15:31,870  
a more exact call yeah and you're more

309  
00:15:35,490 --> 00:15:33,760  
likely to get a quick response so for

310  
00:15:37,170 --> 00:15:35,500  
you to call it because like you said

311  
00:15:40,200 --> 00:15:37,180  
there was no panel there it's just the

312  
00:15:58,680 --> 00:15:40,210  
pumps and if it was an ASP they might be

313  
00:16:00,990 --> 00:15:58,690

looking he's looking yeah okay the free

314

00:16:02,190 --> 00:16:01,000

loops are off the cold slug is stopped

315

00:16:05,190 --> 00:16:02,200

but it's still sitting there

316

00:16:07,320 --> 00:16:05,200

a silent menace ready to wreak havoc the

317

00:16:09,060 --> 00:16:07,330

team knows this but how does the team

318

00:16:11,519 --> 00:16:09,070

keep the interchange from cracking and

319

00:16:14,280 --> 00:16:11,529

still reestablish cooling now how much

320

00:16:15,540 --> 00:16:14,290

time do they have so you got both frame

321

00:16:18,840 --> 00:16:15,550

loops off and you know that's a drastic

322

00:16:21,840 --> 00:16:18,850

action how long could the frame looks be

323

00:16:23,310 --> 00:16:21,850

off and that you know and how do you

324

00:16:25,500 --> 00:16:23,320

gauge sex it's a big deal to have in the

325

00:16:27,269 --> 00:16:25,510

frame lips off did you are you starting

326

00:16:29,490 --> 00:16:27,279

another timer because you were starting

327

00:16:31,199 --> 00:16:29,500

your your interchange your fries timer

328

00:16:32,850 --> 00:16:31,209

it's like I know I got so much time

329

00:16:35,220 --> 00:16:32,860

before that cold slug hits now turn the

330

00:16:39,600 --> 00:16:35,230

feelings off you got another timer going

331

00:16:42,600 --> 00:16:39,610

now I didn't have a ton I didn't have a

332

00:16:45,329 --> 00:16:42,610

timer guy I had the the the general

333

00:16:48,390 --> 00:16:45,339

knowledge that things don't melt down

334

00:16:52,699 --> 00:16:48,400

instantly right to me probably the fuel

335

00:16:54,960 --> 00:16:52,709

cells or of the biggest concern and I

336

00:16:56,610 --> 00:16:54,970

know that you know for fuel cells what

337

00:16:58,410 --> 00:16:56,620

we could go for loss of coolant pumps

338

00:17:01,769 --> 00:16:58,420

don't feel so we could go like nine

339

00:17:05,490 --> 00:17:01,779

minutes or thereabouts so yeah I think

340

00:17:07,439 --> 00:17:05,500

you have probably at least that order of

341

00:17:09,030 --> 00:17:07,449

magnitude before something you know

342

00:17:13,170 --> 00:17:09,040

catastrophic

343

00:17:14,880 --> 00:17:13,180

so clearly I think you have not a lot of

344

00:17:17,070 --> 00:17:14,890

time but an order of magnitude more time

345

00:17:19,260 --> 00:17:17,080

to deal with them being off than to deal

346

00:17:21,510 --> 00:17:19,270

with the cold slug coming around right

347

00:17:24,570 --> 00:17:21,520

okay that kind of what did you have a

348

00:17:27,750 --> 00:17:24,580

clock going in your mind at all well the

349

00:17:28,920 --> 00:17:27,760

good thing is we had the EPS guys and

350

00:17:31,200 --> 00:17:28,930

the fuel cells that I knew was the

351  
00:17:33,900 --> 00:17:31,210  
shortfall we had the EPS guy washing the

352  
00:17:35,640 --> 00:17:33,910  
fuel cells across there and he would be

353  
00:17:39,180 --> 00:17:35,650  
the one to make the recommendation

354  
00:17:41,310 --> 00:17:39,190  
whether we had to terminate the merge do

355  
00:17:45,930 --> 00:17:41,320  
it and basically a power down of the

356  
00:17:48,150 --> 00:17:45,940  
vehicle we couldn't gain it so now let

357  
00:17:53,450 --> 00:17:48,160  
me ask you this have you guys seemed to

358  
00:17:57,420 --> 00:17:53,460  
this case basically prior to this no I

359  
00:17:58,890 --> 00:17:57,430  
don't remember no not really and the

360  
00:18:02,390 --> 00:17:58,900  
other thing even when they did start

361  
00:18:06,750 --> 00:18:02,400  
simulating this doing it a

362  
00:18:09,780 --> 00:18:06,760  
simms of this later after this event for

363  
00:18:12,480 --> 00:18:09,790

future teams it one of the things about

364

00:18:15,780 --> 00:18:12,490

the post line was always very stressful

365

00:18:19,200 --> 00:18:15,790

for me is you can't recreate in training

366

00:18:20,730 --> 00:18:19,210

the all the noises the ground convoy is

367

00:18:23,580 --> 00:18:20,740

the confusion of the additional loops

368

00:18:26,430 --> 00:18:23,590

the communication that's going all loops

369

00:18:28,290 --> 00:18:26,440

your lives and listening to it was very

370

00:18:30,000 --> 00:18:28,300

noisy it was always a very stressful

371

00:18:31,830 --> 00:18:30,010

time for me when I became an e comment

372

00:18:34,590 --> 00:18:31,840

what asset entry was because we didn't

373

00:18:36,570 --> 00:18:34,600

train it and they were just not only

374

00:18:38,520 --> 00:18:36,580

that even even afterwards was this the

375

00:18:40,320 --> 00:18:38,530

chaos they everyone who's getting done

376

00:18:41,940 --> 00:18:40,330

with her job in the control center it

377

00:18:43,980 --> 00:18:41,950

was noisy in the control center it was

378

00:18:45,930 --> 00:18:43,990

noisy on the loops and he had this

379

00:18:48,750 --> 00:18:45,940

unknown factor what we don't train with

380

00:18:51,450 --> 00:18:48,760

which is the KSC guys very often that we

381

00:18:54,660 --> 00:18:51,460

we did start using direct comm with the

382

00:18:56,550 --> 00:18:54,670

guys trying to minimize any kind of

383

00:18:59,640 --> 00:18:56,560

problems we can directly talk to the

384

00:19:01,920 --> 00:18:59,650

guys at the convoy but no it was the

385

00:19:04,290 --> 00:19:01,930

training was we sat now I walked through

386

00:19:06,120 --> 00:19:04,300

this procedure there was also a lot of

387

00:19:08,220 --> 00:19:06,130

lessons learned like I said from sts-3

388

00:19:09,480 --> 00:19:08,230

with things that they had done after we

389

00:19:12,330 --> 00:19:09,490

handed over they did some additional

390

00:19:13,590 --> 00:19:12,340

ammonia boiler tests that they under Tim

391

00:19:15,240 --> 00:19:13,600

and there were some lesson learned from

392

00:19:17,850 --> 00:19:15,250

that and the fact that that happened

393

00:19:20,660 --> 00:19:17,860

there made it very cognizant

394

00:19:22,799 --> 00:19:20,670

what happened once it could happen again

395

00:19:27,630 --> 00:19:22,809

yeah I think I just can't emphasize

396

00:19:30,289 --> 00:19:27,640

enough the few minutes of time that we

397

00:19:35,520 --> 00:19:30,299

took preparing and walking through that

398

00:19:37,950 --> 00:19:35,530

was just enormous hell I think it's as

399

00:19:40,260 --> 00:19:37,960

much better is as I could have done in

400

00:19:43,650 --> 00:19:40,270

that situation and I and I certainly

401  
00:19:48,000 --> 00:19:43,660  
wish that I had I think I could have

402  
00:19:49,980 --> 00:19:48,010  
done a lot worse had we not done that

403  
00:19:56,100 --> 00:19:49,990  
preparation because turning off of freon

404  
00:20:00,150 --> 00:19:56,110  
loops is a you want to do what yeah the

405  
00:20:02,789 --> 00:20:00,160  
fact that we had talked through it it at

406  
00:20:05,070 --> 00:20:02,799  
least it resonated with me that yeah

407  
00:20:07,440 --> 00:20:05,080  
that's what we have to do we talked

408  
00:20:11,010 --> 00:20:07,450  
through that we talked about the the

409  
00:20:13,440 --> 00:20:11,020  
urgency of time and how that has to be

410  
00:20:17,280 --> 00:20:13,450  
done to preserve that heat exchangers so

411  
00:20:20,159 --> 00:20:17,290  
that I at least never questioned that

412  
00:20:24,990 --> 00:20:20,169  
aspect of it had we not talked through

413  
00:20:27,750 --> 00:20:25,000

that case is is deeper respect as I have

414

00:20:31,500 --> 00:20:27,760

for Quinn and knew that he was I had the

415

00:20:34,650 --> 00:20:31,510

best thermal guy in in the back room I

416

00:20:38,700 --> 00:20:34,660

don't think I would have just said okay

417

00:20:41,669 --> 00:20:38,710

whatever you say I think I would have at

418

00:20:43,409 --> 00:20:41,679

least questioned some and that might

419

00:20:47,340 --> 00:20:43,419

have made the difference in the case so

420

00:20:48,990 --> 00:20:47,350

so that preparation we we did was just

421

00:20:51,510 --> 00:20:49,000

worth invaluable

422

00:20:53,430 --> 00:20:51,520

now was that SOP for you like if you had

423

00:20:55,799 --> 00:20:53,440

an event coming up that you would talk

424

00:20:57,030 --> 00:20:55,809

to the backroom say this is the things

425

00:20:59,669 --> 00:20:57,040

that could go wrong this is what we're

426  
00:21:01,080 --> 00:20:59,679  
gonna do was that just SOP or what you

427  
00:21:04,890 --> 00:21:01,090  
just kind of got lucky that time that

428  
00:21:07,380 --> 00:21:04,900  
you did that you know I don't know it's

429  
00:21:09,930 --> 00:21:07,390  
probably SOP when you feel like you

430  
00:21:13,500 --> 00:21:09,940  
don't know as much as you should know

431  
00:21:14,640 --> 00:21:13,510  
about something and and again coming

432  
00:21:16,260 --> 00:21:14,650  
from the electrical side of the house

433  
00:21:20,039 --> 00:21:16,270  
and trying to pick up the thermal and

434  
00:21:22,530 --> 00:21:20,049  
life-support stuff you you don't pick up

435  
00:21:24,900 --> 00:21:22,540  
all the knowledge you need in a matter

436  
00:21:27,440 --> 00:21:24,910  
of a couple of years which is probably

437  
00:21:30,980 --> 00:21:27,450  
as long as I had been thinking about it

438  
00:21:35,269 --> 00:21:30,990

so it's many years of a preparation to

439

00:21:38,299 --> 00:21:35,279

really understand those systems so to me

440

00:21:40,970 --> 00:21:38,309

it was basically all that we could all

441

00:21:44,440 --> 00:21:40,980

that I could do personally in limited

442

00:21:49,190 --> 00:21:44,450

time in order to be the most prepared

443

00:21:50,419 --> 00:21:49,200

that I could so had I had five or ten

444

00:21:52,639 --> 00:21:50,429

years experience and then I might have

445

00:21:54,409 --> 00:21:52,649

been more complacent to not felt the

446

00:21:58,549 --> 00:21:54,419

need to do that but I did it out of a

447

00:22:01,909 --> 00:21:58,559

personal I have to cover myself right

448

00:22:03,230 --> 00:22:01,919

right gotcha excellent let's keep going

449

00:22:21,470 --> 00:22:03,240

here so we got that right now the free

450

00:22:23,289 --> 00:22:21,480

loops are that's something

451

00:22:26,180 --> 00:22:23,299

sounds like we you talked about this

452

00:22:28,250 --> 00:22:26,190

previously so had you already stepped to

453

00:22:32,810 --> 00:22:28,260

kind of through the recovery of yes

454

00:22:34,610 --> 00:22:32,820

actually over time for him we actually

455

00:22:36,889 --> 00:22:34,620

went through all the continued CG

456

00:22:39,950 --> 00:22:36,899

aspects or recovery steps and kind of

457

00:22:41,450 --> 00:22:39,960

walking through it was really uh so we

458

00:22:54,639 --> 00:22:41,460

kind of do the plan that we're going to

459

00:23:00,440 --> 00:22:57,379

remember where those steps in the Indian

460

00:23:04,700 --> 00:23:00,450

trajecsys Tyvek kilo to reactivate like

461

00:23:06,049 --> 00:23:04,710

that yes okay that's good and so your

462

00:23:07,519 --> 00:23:06,059

sounds like you're doing one loop at a

463

00:23:10,190 --> 00:23:07,529

time why don't you just turn them you

464

00:23:11,360 --> 00:23:10,200

know the under temps we've stopped it

465

00:23:13,310 --> 00:23:11,370

let's go and turn them both on why did

466

00:23:15,200 --> 00:23:13,320

you do it that way instead of one loop

467

00:23:16,610 --> 00:23:15,210

at a time oh it was actually part of a

468

00:23:18,889 --> 00:23:16,620

procedure but the real reason is is

469

00:23:23,330 --> 00:23:18,899

you're owing your you're only activating

470

00:23:25,529 --> 00:23:23,340

one so half the ones saying you're only

471

00:23:27,479 --> 00:23:25,539

doing with half the coleslaw at a time

472

00:23:29,399 --> 00:23:27,489

and the vehicles being hot right now

473

00:23:30,719 --> 00:23:29,409

water loops we've got interchanges been

474

00:23:33,149 --> 00:23:30,729

hot since it's been running without any

475

00:23:37,080 --> 00:23:33,159

cooling so we trying to introduce one

476  
00:23:39,359 --> 00:23:37,090  
loop look it over only add you know and

477  
00:23:42,119 --> 00:23:39,369  
one of the cold slugs at a time and then

478  
00:23:44,700 --> 00:23:42,129  
evaluate you know how the system is

479  
00:23:46,440 --> 00:23:44,710  
working so you get the insight into the

480  
00:23:48,749 --> 00:23:46,450  
situation whether or not you're under

481  
00:23:51,869 --> 00:23:48,759  
temp situation is right basically

482  
00:23:53,729 --> 00:23:51,879  
remedied right or not with with you

483  
00:23:55,739 --> 00:23:53,739  
could look at as half the risk you know

484  
00:23:57,690 --> 00:23:55,749  
half the heat rejection right quality

485  
00:23:58,979 --> 00:23:57,700  
the heat exchanger and I wasn't paying

486  
00:24:00,839 --> 00:23:58,989  
attention to gel pick where you're

487  
00:24:02,519 --> 00:24:00,849  
picking the freon loop that was

488  
00:24:04,769 --> 00:24:02,529

associated with the ammonia system I

489

00:24:06,539 --> 00:24:04,779

wasn't paying attention to that actually

490

00:24:08,430 --> 00:24:06,549

Baltimore loops were off at the time so

491

00:24:09,839 --> 00:24:08,440

I mean we turn it back oh you knew both

492

00:24:11,969 --> 00:24:09,849

ammonia systems are off it didn't matter

493

00:24:16,080 --> 00:24:11,979

right okay that's right okay do we have

494

00:24:18,239 --> 00:24:16,090

an additional measurement on one yeah

495

00:24:20,789 --> 00:24:18,249

you had an interchange are in on loop

496

00:24:21,960 --> 00:24:20,799

one okay yeah so out of the fit swipe we

497

00:24:22,710 --> 00:24:21,970

might have picked you might have picked

498

00:24:27,930 --> 00:24:22,720

that one first

499

00:24:30,719 --> 00:24:27,940

okay I just did what he says chuckles

500

00:24:32,639 --> 00:24:30,729

good okay now I can tremor now if he

501  
00:24:34,409 --> 00:24:32,649  
already gone flow proportioning valve to

502  
00:24:36,989 --> 00:24:34,419  
payload at this point I can't actually

503  
00:24:38,879 --> 00:24:36,999  
believe it or not the old procedure was

504  
00:24:40,379 --> 00:24:38,889  
go to interchange er the assumption was

505  
00:24:42,839 --> 00:24:40,389  
the payload loop was gonna be the so

506  
00:24:45,690 --> 00:24:42,849  
slower flowing loops so with the

507  
00:24:46,560 --> 00:24:45,700  
procedures written generically always go

508  
00:24:49,859 --> 00:24:46,570  
to interchange

509  
00:24:51,989 --> 00:24:49,869  
oh it's been changed and so right right

510  
00:24:54,060 --> 00:24:51,999  
right so if you had a payload you would

511  
00:25:26,450 --> 00:24:54,070  
freeze that payloads water if it was

512  
00:25:30,210 --> 00:25:28,800  
did I catch that right y'all didn't turn

513  
00:25:32,580 --> 00:25:30,220

the water loop off unless they must have

514

00:25:35,010 --> 00:25:32,590

said it wrong you may have said on well

515

00:25:37,140 --> 00:25:35,020

maybe that's on yeah one of the points

516

00:25:40,050 --> 00:25:37,150

to is in when you listen to this loop

517

00:25:41,850 --> 00:25:40,060

it's amazing to me after listening to

518

00:25:44,520 --> 00:25:41,860

this thing how I knew exactly what I'm

519

00:25:53,550 --> 00:25:44,530

going to do but I was under the stress

520

00:25:55,650 --> 00:25:53,560

in panic but under the stress I was

521

00:25:58,890 --> 00:25:55,660

having trying to communicating exactly I

522

00:26:01,290 --> 00:25:58,900

was having trouble between between 1 and

523

00:26:02,850 --> 00:26:01,300

2 and what pump I was filling to

524

00:26:03,780 --> 00:26:02,860

communicate Chuck did an excellent job

525

00:26:05,430 --> 00:26:03,790

it's ok

526

00:26:07,710 --> 00:26:05,440

I heard what you said is this really

527

00:26:09,300 --> 00:26:07,720

what you wanted were you saying and it

528

00:26:11,430 --> 00:26:09,310

was very easy to go back and say yes

529

00:26:14,370 --> 00:26:11,440

that's what I meant to say but it was

530

00:26:15,960 --> 00:26:14,380

amazing how simple things like loop 1

531

00:26:17,460 --> 00:26:15,970

loop 2 even they had the procedure over

532

00:26:19,140 --> 00:26:17,470

I was saying the wrong thing he just

533

00:26:21,150 --> 00:26:19,150

gonna stress it and I think Chuck said

534

00:26:23,100 --> 00:26:21,160

you had you got yourself out of the

535

00:26:24,360 --> 00:26:23,110

quick response situation by turn of the

536

00:26:26,520 --> 00:26:24,370

friend loose off now you had kind of an

537

00:26:27,750 --> 00:26:26,530

order of magnitude more so you could

538

00:26:29,940 --> 00:26:27,760

slow down a little bit right a little

539

00:26:32,730 --> 00:26:29,950

you know yeah not a lot you got the fuel

540

00:26:34,140 --> 00:26:32,740

cells out there heating up but yeah you

541

00:26:35,580 --> 00:26:34,150

could able to slow down a little so does

542

00:26:37,140 --> 00:26:35,590

that go through your mind ok I can take

543

00:26:39,540 --> 00:26:37,150

a little bit more time make sure I'm

544

00:27:08,170 --> 00:26:39,550

understanding the you know pedal to the

545

00:28:32,750 --> 00:27:36,080

okay I never heard that before until you

546

00:28:36,780 --> 00:28:34,920

at that point you had one friend loop up

547

00:28:38,460 --> 00:28:36,790

and I heard the EPSS mentor right when

548

00:28:40,080 --> 00:28:38,470

that Larry men are back there saying the

549

00:28:43,560 --> 00:28:40,090

fuel cell returned temps starting to

550

00:28:45,570 --> 00:28:43,570

skyrocket at that point with one

551

00:28:46,980 --> 00:28:45,580

friendly pup were y'all feeling pretty

552

00:28:50,970 --> 00:28:46,990

good about yourselves or did you need to

553

00:28:53,040 --> 00:28:50,980

keep going get both loops up to you know

554

00:29:03,420 --> 00:28:53,050

get yourself in a really good config or

555

00:29:36,480 --> 00:29:03,430

what was your clock like or starting to

556

00:29:38,070 --> 00:29:36,490

get over the hump so I know you just

557

00:29:40,800 --> 00:29:38,080

said it there but just to put it out

558

00:29:42,090 --> 00:29:40,810

there so at that point what was the

559

00:29:48,540 --> 00:29:42,100

problem and how did this whole thing

560

00:29:51,860 --> 00:29:48,550

kind of evolve they did a new when they

561

00:29:54,870 --> 00:29:51,870

did a new procedure at on the cooling

562

00:29:59,580 --> 00:29:54,880

cart with a research fluid

563

00:30:01,590 --> 00:29:59,590

I believe research recirculated the

564

00:30:06,810 --> 00:30:01,600

fluid in the cooling cart it would allow

565

00:30:08,430 --> 00:30:06,820

this old slug to build up and so when

566

00:30:10,020 --> 00:30:08,440

they initiated they got this really cold

567

00:30:12,420 --> 00:30:10,030

slug to occur and I think that was it

568

00:30:14,490 --> 00:30:12,430

was a but there was a new procedure they

569

00:30:18,390 --> 00:30:14,500

implemented it for 27 and I think they

570

00:30:20,910 --> 00:30:18,400

didn't change it back after 27

571

00:30:24,930 --> 00:30:20,920

although standard procedure they had was

572

00:30:26,490 --> 00:30:24,940

it back then was it standard to have the

573

00:30:27,750 --> 00:30:26,500

ammonia in the ground cooling but at the

574

00:30:29,040 --> 00:30:27,760

same time they both came up at the same

575

00:30:31,170 --> 00:30:29,050

time right he had ammonia and they

576

00:30:33,360 --> 00:30:31,180

hooked up is that was that standard back

577

00:30:35,400 --> 00:30:33,370

then normally they would notify us ahead

578

00:30:37,410 --> 00:30:35,410

of time that they're ready to initiate

579

00:30:39,690 --> 00:30:37,420

at that point we would make the call at

580

00:30:41,160 --> 00:30:39,700

deactivate the ammonia and then they

581

00:30:42,000 --> 00:30:41,170

would initiate in this case they

582

00:30:44,910 --> 00:30:42,010

initiated

583

00:30:46,620 --> 00:30:44,920

I don't know wasn't because it's a new

584

00:30:50,010 --> 00:30:46,630

procedure researched and this Cole

585

00:30:51,210 --> 00:30:50,020

suddenly initiated it up but we were not

586

00:30:53,010 --> 00:30:51,220

notified that they were about to

587

00:30:54,960 --> 00:30:53,020

initiate it and that there was also

588

00:30:56,880 --> 00:30:54,970

there was some pressure that they knew

589

00:30:59,280 --> 00:30:56,890

that we're getting near the end of our

590

00:31:01,800 --> 00:30:59,290

second ammonia tank right and there has

591

00:31:04,080 --> 00:31:01,810

there being a schedule right there to

592

00:31:06,270 --> 00:31:04,090

get scheduled pressure to get get that

593

00:31:08,340 --> 00:31:06,280

initiated so I think that they got in a

594

00:31:10,890 --> 00:31:08,350

hurry and they initiated without going

595

00:31:12,510 --> 00:31:10,900

to mal seizure with a contact and say

596

00:31:13,620 --> 00:31:12,520

I'm more about to initiate wow so

597

00:31:15,420 --> 00:31:13,630

there's another another piece of an

598

00:31:16,710 --> 00:31:15,430

error change you got some some guys on

599

00:31:18,360 --> 00:31:16,720

the other end her feelings and schedule

600

00:31:21,270 --> 00:31:18,370

pressure we've got some procedures that

601  
00:31:23,730 --> 00:31:21,280  
weren't synced up to calm but wasn't

602  
00:31:25,830 --> 00:31:23,740  
synced up people starting to get

603  
00:31:27,630 --> 00:31:25,840  
distracted with the plaque King there

604  
00:31:30,680 --> 00:31:27,640  
was a lot of a lot of variables going on

605  
00:31:33,570 --> 00:31:30,690  
in there and I captured that really well

606  
00:31:36,390 --> 00:31:33,580  
I didn't realize that that all that was

607  
00:31:38,460 --> 00:31:36,400  
going on and even listening to the to

608  
00:31:40,710 --> 00:31:38,470  
the recording I didn't realize you could

609  
00:31:42,660 --> 00:31:40,720  
guys had you guys had obstacles out in

610  
00:31:45,630 --> 00:31:42,670  
front of you didn't know about right

611  
00:31:48,270 --> 00:31:45,640  
yeah that's really good in hindsight is

612  
00:31:53,130 --> 00:31:48,280  
always 20/20 I I wish that I would have

613  
00:32:01,350 --> 00:31:58,500

KSC end to have a better handoff and I

614

00:32:04,680 --> 00:32:01,360

think we did improve on that a lot after

615

00:32:18,480 --> 00:32:04,690

after that right right let's see what

616

00:32:19,919 --> 00:32:18,490

else so sounds like EPS is freaking out

617

00:32:23,460 --> 00:32:19,929

a little bit but you know it's it's

618

00:32:25,200 --> 00:32:23,470

gonna get better here I was like I I

619

00:32:26,850 --> 00:32:25,210

don't know if it was out of ignorance or

620

00:32:30,060 --> 00:32:26,860

not but I was less concerned about it

621

00:32:32,549 --> 00:32:30,070

then then Larry was at the at the time

622

00:32:33,900 --> 00:32:32,559

yes and you knew you had you had one

623

00:32:35,549 --> 00:32:33,910

friendly pup senior you had some cool

624

00:32:38,100 --> 00:32:35,559

you remember what the kW was about that

625

00:32:40,380 --> 00:32:38,110

time I think he was saying for about

626

00:32:42,480 --> 00:32:40,390

four probably are never fuel stuff for

627

00:32:44,159 --> 00:32:42,490

that fuel cell right I see but so if

628

00:32:45,840 --> 00:32:44,169

there even is probably about 12 or so

629

00:32:48,120 --> 00:32:45,850

right yeah so one friend lives should be

630

00:33:13,600 --> 00:32:48,130

able to handle handle 12 pretty well

631

00:33:18,019 --> 00:33:15,019

yeah

632

00:33:28,310 --> 00:33:18,029

here we see cooling on now or go to

633

00:33:46,399 --> 00:33:28,320

think free only to to pump I just I

634

00:33:49,430 --> 00:33:46,409

couldn't take freon pump so as quickly

635

00:33:50,659 --> 00:33:49,440

as it came and almost subsided and

636

00:33:53,029 --> 00:33:50,669

forget all about you right

637

00:33:54,830 --> 00:33:53,039

yeah like when said that since that was

638

00:34:00,409 --> 00:33:54,840

the Vox I think the pain lasted a little

639

00:34:01,759 --> 00:34:00,419

bit yeah this is a box this is what we

640

00:34:04,759 --> 00:34:01,769

got about nine and a half minutes there

641

00:34:06,320 --> 00:34:04,769

so unboxed how long do you think the

642

00:34:08,659 --> 00:34:06,330

situation really went about double that

643

00:34:13,240 --> 00:34:08,669

maybe your you'll recall that's probably

644

00:34:16,010 --> 00:34:13,250

yes right let's excellent any other

645

00:34:17,599 --> 00:34:16,020

summary thoughts about the situation he

646

00:34:20,210 --> 00:34:17,609

gave a lot of hindsight while you were

647

00:34:23,740 --> 00:34:20,220

well we were going but any any other

648

00:34:26,089 --> 00:34:23,750

thoughts about the situation I guess

649

00:34:28,819 --> 00:34:26,099

some of the things that came from this

650

00:34:32,149 --> 00:34:28,829

mission and like we talked about like

651  
00:34:34,909 --> 00:34:32,159  
rule one last one got changed we started

652  
00:34:37,849 --> 00:34:34,919  
to Train post-landing we spent a lot of

653  
00:34:40,129 --> 00:34:37,859  
time with the KSC folks trying to

654  
00:34:42,319 --> 00:34:40,139  
establish better protocols and

655  
00:34:48,379 --> 00:34:42,329  
communication between the e common

656  
00:34:51,819 --> 00:34:48,389  
ground and the ground convoy guys we we

657  
00:34:54,980 --> 00:34:51,829  
improved the about t-mobile procedure a

658  
00:35:00,710 --> 00:34:54,990  
lot of improvements on how to go through

659  
00:35:05,540 --> 00:35:00,720  
it what else to do we your Miami stuff I

660  
00:35:07,010 --> 00:35:05,550  
long there was a lot of improvements on

661  
00:35:08,690 --> 00:35:07,020  
how oh and the communication with the

662  
00:35:11,540 --> 00:35:08,700  
flight director stressing with them that

663  
00:35:13,970 --> 00:35:11,550

hey look at the vehicle here's what

664

00:35:16,520 --> 00:35:13,980

under temp occurs this is why we're so

665

00:35:17,500 --> 00:35:16,530

scared of it and they in the flight

666

00:35:19,180 --> 00:35:17,510

Richards in a lot

667

00:35:21,310 --> 00:35:19,190

better job post-landing to make sure the

668

00:35:24,040 --> 00:35:21,320

team is cognizant hey not me ain't

669

00:35:27,190 --> 00:35:24,050

handing over until keep the room quiet

670

00:35:30,790 --> 00:35:27,200

until around who's established and the

671

00:35:32,860 --> 00:35:30,800

crews out itself sometimes even when the

672

00:35:35,620 --> 00:35:32,870

missions seemingly over it may not be

673

00:35:37,750 --> 00:35:35,630

over in the midst of distraction the

674

00:35:40,540 --> 00:35:37,760

EECOM team identified the under temp

675

00:35:42,600 --> 00:35:40,550

situation diagnose the cause of two

676  
00:35:45,310 --> 00:35:42,610  
cooling systems running simultaneously

677  
00:35:47,380 --> 00:35:45,320  
then resolve the situation while

678  
00:35:50,500 --> 00:35:47,390  
preserving crew safety and all vehicle

679  
00:35:52,480 --> 00:35:50,510  
hardware the mcc flight controller is

680  
00:35:55,780 --> 00:35:52,490  
one who must always be aware that

681  
00:35:57,130 --> 00:35:55,790  
suddenly and unexpectedly we may find

682  
00:35:59,250 --> 00:35:57,140  
ourselves in a role where our

683  
00:36:02,580 --> 00:35:59,260  
performance has ultimate consequences

684  
00:36:05,740 --> 00:36:02,590  
discipline competence confidence

685  
00:36:08,290 --> 00:36:05,750  
responsibility toughness teamwork and

686  
00:36:10,450 --> 00:36:08,300  
vigilance these are our core values

687  
00:36:12,400 --> 00:36:10,460  
values that have served us well

688  
00:36:14,320 --> 00:36:12,410

values that have allowed us to slip the