



1
00:00:07,190 --> 00:00:04,470
on august 31st a nasa team of experts

2
00:00:09,830 --> 00:00:07,200
arrived in santiago for about a week as

3
00:00:12,709 --> 00:00:09,840
part of nasa's commitment to provide u.s

4
00:00:14,549 --> 00:00:12,719
assistance nasa's assistance was only a

5
00:00:17,269 --> 00:00:14,559
small contribution to the chilean

6
00:00:19,349 --> 00:00:17,279
government's overall rescue effort

7
00:00:22,230 --> 00:00:19,359
the nasa team included two medical

8
00:00:24,950 --> 00:00:22,240
doctors a psychologist and an engineer

9
00:00:27,349 --> 00:00:24,960
dr michael duncan deputy chief medical

10
00:00:29,509 --> 00:00:27,359
officer and nasa space life sciences

11
00:00:32,389 --> 00:00:29,519
director at nasa's johnson space

12
00:00:34,790 --> 00:00:32,399
center in houston led the team the other

13
00:00:37,190 --> 00:00:34,800

team members are physician j.d polk

14

00:00:42,630 --> 00:00:37,200

psychologist al holland and engineer

15

00:00:48,229 --> 00:00:44,869

the chileans

16

00:00:51,590 --> 00:00:48,239

had a plan for refeeding

17

00:00:53,910 --> 00:00:51,600

we reviewed that plan with them and

18

00:00:55,750 --> 00:00:53,920

basically you know agreed with the kinds

19

00:00:57,830 --> 00:00:55,760

of things that they were doing

20

00:00:59,830 --> 00:00:57,840

as we got to talking about things like

21

00:01:02,310 --> 00:00:59,840

vitamin d supplements

22

00:01:03,510 --> 00:01:02,320

for example we talked to them about how

23

00:01:05,670 --> 00:01:03,520

we do that

24

00:01:07,030 --> 00:01:05,680

in our astronauts in space

25

00:01:09,910 --> 00:01:07,040

and

26

00:01:12,230 --> 00:01:09,920

you know those were the kinds of of

27

00:01:15,910 --> 00:01:12,240

of recommendations that we or

28

00:01:21,350 --> 00:01:18,789

for the ascent portion of this ride in

29

00:01:22,950 --> 00:01:21,360

the rescue cage to the surface

30

00:01:24,789 --> 00:01:22,960

we

31

00:01:26,789 --> 00:01:24,799

received varying

32

00:01:27,910 --> 00:01:26,799

reports on how long that ride was going

33

00:01:30,789 --> 00:01:27,920

to take

34

00:01:32,789 --> 00:01:30,799

it is so cramped in there that you can't

35

00:01:35,429 --> 00:01:32,799

move around much you can't flex your

36

00:01:37,990 --> 00:01:35,439

muscles so you're in in essence

37

00:01:40,469 --> 00:01:38,000

standing at attention

38

00:01:42,389 --> 00:01:40,479

and any any military recruit that has

39

00:01:44,630 --> 00:01:42,399

stand that had stood at attention for

40

00:01:47,109 --> 00:01:44,640

any length of time knows uh the the risk

41

00:01:48,710 --> 00:01:47,119

of fainting is is real

42

00:01:51,670 --> 00:01:48,720

um so

43

00:01:52,550 --> 00:01:51,680

you know the the idea of doing a fluid

44

00:01:54,950 --> 00:01:52,560

load

45

00:01:56,310 --> 00:01:54,960

much like we do with our astronauts

46

00:01:59,190 --> 00:01:56,320

of giving them

47

00:02:01,910 --> 00:01:59,200

giving the miners a

48

00:02:03,270 --> 00:02:01,920

liquids that had carbohydrates in it had

49

00:02:05,510 --> 00:02:03,280

electrolytes

50

00:02:07,990 --> 00:02:05,520

and salt in it

51
00:02:10,070 --> 00:02:08,000
all designed to increase their central

52
00:02:12,070 --> 00:02:10,080
blood volume

53
00:02:14,309 --> 00:02:12,080
we also suggested

54
00:02:16,869 --> 00:02:14,319
things like compression stockings to the

55
00:02:19,750 --> 00:02:16,879
lower extremities and lower abdomen

56
00:02:22,630 --> 00:02:19,760
again to drive the blood centrally keep

57
00:02:26,630 --> 00:02:22,640
the blood pressure up and prevent the

58
00:02:32,710 --> 00:02:30,150
as you get past the rescue phase

59
00:02:34,390 --> 00:02:32,720
of of extracting them directly out of

60
00:02:37,750 --> 00:02:34,400
the mind

61
00:02:40,309 --> 00:02:37,760
one of our physicians is a

62
00:02:42,390 --> 00:02:40,319
specialist in emergency

63
00:02:44,550 --> 00:02:42,400

medical evacuation

64

00:02:47,589 --> 00:02:44,560

and he talked to them a lot about you

65

00:02:49,430 --> 00:02:47,599

know some things to consider

66

00:02:52,070 --> 00:02:49,440

having a triage site

67

00:02:53,350 --> 00:02:52,080

which the chileans had already you know

68

00:02:55,589 --> 00:02:53,360

planned for

69

00:02:57,670 --> 00:02:55,599

but you know talking more about how we

70

00:02:59,670 --> 00:02:57,680

would evacuate them from the site and

71

00:03:01,270 --> 00:02:59,680

get them to the hospital

72

00:03:03,670 --> 00:03:01,280

and kind of you know help talk through

73

00:03:05,750 --> 00:03:03,680

some plans there and i think that

74

00:03:08,309 --> 00:03:05,760

our chilean colleagues listened to that

75

00:03:09,830 --> 00:03:08,319

and implemented a lot of things that

76

00:03:12,949 --> 00:03:09,840

that you know he

77

00:03:16,229 --> 00:03:14,790

the other thing that was very important

78

00:03:18,550 --> 00:03:16,239

you know from

79

00:03:20,710 --> 00:03:18,560

the standpoint of the care of the miners

80

00:03:22,630 --> 00:03:20,720

was from the psychological support

81

00:03:25,350 --> 00:03:22,640

standpoint and of course with our

82

00:03:27,509 --> 00:03:25,360

long-duration crews we have

83

00:03:29,990 --> 00:03:27,519

a team of experts

84

00:03:31,990 --> 00:03:30,000

that provide behavioral health and

85

00:03:33,509 --> 00:03:32,000

support not only of the astronaut but of

86

00:03:34,789 --> 00:03:33,519

their families

87

00:03:37,350 --> 00:03:34,799

and this

88

00:03:40,470 --> 00:03:37,360

i think was an important contribution

89

00:03:43,030 --> 00:03:40,480

that that we talked through with their

90

00:03:44,830 --> 00:03:43,040

psychologists that were topside at the

91

00:03:47,110 --> 00:03:44,840

mine

92

00:03:47,990 --> 00:03:47,120

site in addition

93

00:03:57,030 --> 00:03:48,000

the

94

00:03:57,830 --> 00:03:57,040

is completed

95

00:04:03,110 --> 00:03:57,840

the

96

00:04:05,670 --> 00:04:03,120

thinking

97

00:04:07,429 --> 00:04:05,680

uh you know completely outlined on how

98

00:04:09,910 --> 00:04:07,439

they were going to handle the miners

99

00:04:12,229 --> 00:04:09,920

once they they they got them out and i

100

00:04:14,470 --> 00:04:12,239

think we were able to you know provide

101
00:04:16,069 --> 00:04:14,480
some insights and and hopefully there

102
00:04:18,069 --> 00:04:16,079
are some things that they drew from that

103
00:04:20,870 --> 00:04:18,079
that that were

104
00:04:23,670 --> 00:04:20,880
important and that they've implemented

105
00:04:25,510 --> 00:04:23,680
such things as the celebrity status of

106
00:04:27,510 --> 00:04:25,520
the of the minor

107
00:04:28,629 --> 00:04:27,520
these guys were not prepared for that

108
00:04:30,550 --> 00:04:28,639
and there's going to be a lot of

109
00:04:32,230 --> 00:04:30,560
pressures on them from

110
00:04:33,990 --> 00:04:32,240
society not only

111
00:04:37,030 --> 00:04:34,000
locally but in their country and really

112
00:04:40,070 --> 00:04:38,950
nasa's part in this

113
00:04:42,230 --> 00:04:40,080

was

114

00:04:44,550 --> 00:04:42,240

you know just one small part and a very

115

00:04:46,230 --> 00:04:44,560

uh overwhelming effort by the the

116

00:04:47,830 --> 00:04:46,240

chilean government

117

00:04:50,550 --> 00:04:47,840

it's all about the miners it's all about

118

00:04:52,950 --> 00:04:50,560

the chilean's response and their

119

00:04:54,310 --> 00:04:52,960

spirit and tenacity to go after that you

120

00:04:59,430 --> 00:04:54,320

know we were just pleased to be a part

121

00:05:03,350 --> 00:05:01,270

we had a preconceived notion of what

122

00:05:05,830 --> 00:05:03,360

things might apply from space flight to

123

00:05:07,749 --> 00:05:05,840

the chilean mine and what was surprising

124

00:05:09,590 --> 00:05:07,759

to us and probably to our chilean

125

00:05:11,510 --> 00:05:09,600

counterparts once we got down there and

126

00:05:13,110 --> 00:05:11,520

actually understood what it was the

127

00:05:14,710 --> 00:05:13,120

miners were going through and looked at

128

00:05:16,230 --> 00:05:14,720

the difficulties

129

00:05:18,550 --> 00:05:16,240

that the chilean health authorities and

130

00:05:20,550 --> 00:05:18,560

the engineers were going to attempt to

131

00:05:22,390 --> 00:05:20,560

tackle was how many things we could

132

00:05:23,350 --> 00:05:22,400

actually translate from space flight

133

00:05:24,550 --> 00:05:23,360

that were

134

00:05:27,270 --> 00:05:24,560

over and above

135

00:05:29,350 --> 00:05:27,280

anticipated

136

00:05:30,629 --> 00:05:29,360

whether it was the refeeding plan

137

00:05:32,230 --> 00:05:30,639

whether it was the fluid loading

138

00:05:34,070 --> 00:05:32,240

protocol that we use from the shuttle

139

00:05:35,909 --> 00:05:34,080

and soyuz return

140

00:05:36,790 --> 00:05:35,919

down to the requirements for how to

141

00:05:38,550 --> 00:05:36,800

write

142

00:05:40,469 --> 00:05:38,560

specific requirements for the escape

143

00:05:42,469 --> 00:05:40,479

module and what things to use in the

144

00:05:44,550 --> 00:05:42,479

escape module and

145

00:05:46,950 --> 00:05:44,560

how to guard against certain dangers or

146

00:05:49,110 --> 00:05:46,960

hazards in the escape module so it

147

00:05:51,430 --> 00:05:49,120

really ranged from engineering to

148

00:05:52,550 --> 00:05:51,440

medical to psychological

149

00:05:54,790 --> 00:05:52,560

even

150

00:05:56,950 --> 00:05:54,800

our processes at nasa

151
00:06:00,390 --> 00:05:56,960
how we build

152
00:06:01,670 --> 00:06:00,400
leadership structures or how we develop

153
00:06:04,950 --> 00:06:01,680
documents

154
00:06:06,710 --> 00:06:04,960
to instruct folks how to build certain

155
00:06:08,390 --> 00:06:06,720
elements things that we're used to on a

156
00:06:09,990 --> 00:06:08,400
day-to-day basis

157
00:06:13,670 --> 00:06:10,000
that we take for granted we're actually

158
00:06:17,029 --> 00:06:15,430
the urine test strip

159
00:06:18,790 --> 00:06:17,039
which can test for something we call

160
00:06:20,629 --> 00:06:18,800
specific gravity which can tell you how

161
00:06:23,029 --> 00:06:20,639
well hydrated you are

162
00:06:24,790 --> 00:06:23,039
ketones which can tell you whether or

163
00:06:26,629 --> 00:06:24,800

not you've got adequate nutrition or in

164

00:06:28,950 --> 00:06:26,639

our starvation state

165

00:06:30,550 --> 00:06:28,960

and even check for blood or myoglobin

166

00:06:32,469 --> 00:06:30,560

which is a protein

167

00:06:33,590 --> 00:06:32,479

from muscle breakdown that can bombard

168

00:06:35,430 --> 00:06:33,600

the kidney

169

00:06:36,469 --> 00:06:35,440

that was very

170

00:06:39,350 --> 00:06:36,479

fruitful

171

00:06:41,270 --> 00:06:39,360

chileans

172

00:06:42,550 --> 00:06:41,280

because they took that advice they used

173

00:06:44,790 --> 00:06:42,560

that with the miners and they found out

174

00:06:47,670 --> 00:06:44,800

that about 50 percent of those miners

175

00:06:49,029 --> 00:06:47,680

had positive myoglobin for that protein

176

00:06:51,270 --> 00:06:49,039

breaking down

177

00:06:53,909 --> 00:06:51,280

which could cause kidney failure if left

178

00:06:58,150 --> 00:06:55,749

being confined in a high stress

179

00:06:59,430 --> 00:06:58,160

environment in an enclosed space

180

00:07:01,350 --> 00:06:59,440

like the mine

181

00:07:04,070 --> 00:07:01,360

can cause reactivation of viruses

182

00:07:05,189 --> 00:07:04,080

epstein-barr virus herpes virus we see

183

00:07:07,510 --> 00:07:05,199

that in space flight with the

184

00:07:09,510 --> 00:07:07,520

reactivation of those viruses and that

185

00:07:12,070 --> 00:07:09,520

can last for months even after you're

186

00:07:13,909 --> 00:07:12,080

out on the surface or after the ordeal

187

00:07:16,070 --> 00:07:13,919

we see that months after astronauts

188

00:07:19,430 --> 00:07:16,080

return from space flight the same thing

189

00:07:24,950 --> 00:07:22,150

it was astounding to see it in this and

190

00:07:27,430 --> 00:07:24,960

that type of in your face direct

191

00:07:29,670 --> 00:07:27,440

applicability of space flight technology

192

00:07:31,749 --> 00:07:29,680

and development and protocols that we've

193

00:07:33,189 --> 00:07:31,759

had an engineering

194

00:07:35,670 --> 00:07:33,199

expertise

195

00:07:37,830 --> 00:07:35,680

used directly on the ground

196

00:07:43,749 --> 00:07:37,840

and there's no better payoff than to

197

00:07:48,309 --> 00:07:45,990

when we arrived down there at the end of

198

00:07:50,869 --> 00:07:48,319

august first of september

199

00:07:52,790 --> 00:07:50,879

there was a mindset which was rather

200

00:07:54,790 --> 00:07:52,800

short-term

201
00:07:56,710 --> 00:07:54,800
they were a mining community thinking

202
00:07:58,390 --> 00:07:56,720
about rescue and all the

203
00:08:02,869 --> 00:07:58,400
mine disasters that had occurred in the

204
00:08:04,390 --> 00:08:02,879
past rescues occurred very quickly

205
00:08:07,670 --> 00:08:04,400
one of the things we try to do is to

206
00:08:09,990 --> 00:08:07,680
shift that mindset in the minors in the

207
00:08:11,909 --> 00:08:10,000
families in the top side personnel and

208
00:08:13,670 --> 00:08:11,919
in the message that went out from these

209
00:08:15,990 --> 00:08:13,680
people

210
00:08:18,230 --> 00:08:16,000
toward the long-term run so that their

211
00:08:20,309 --> 00:08:18,240
expectations

212
00:08:22,469 --> 00:08:20,319
about when they might be coming out were

213
00:08:24,869 --> 00:08:22,479

more realistic and therefore their

214

00:08:28,550 --> 00:08:24,879

coping would be more realistic therefore

215

00:08:32,469 --> 00:08:30,950

we provided information

216

00:08:33,750 --> 00:08:32,479

and guidance

217

00:08:35,750 --> 00:08:33,760

regarding

218

00:08:38,149 --> 00:08:35,760

individual self-control and how what

219

00:08:39,430 --> 00:08:38,159

individual coping mechanisms could be

220

00:08:42,389 --> 00:08:39,440

encouraged

221

00:08:44,550 --> 00:08:42,399

by topside on the part of the miners

222

00:08:46,630 --> 00:08:44,560

advice to give the miners some training

223

00:08:48,710 --> 00:08:46,640

to give the miners about how to manage

224

00:08:51,430 --> 00:08:48,720

themselves and their emotions and their

225

00:08:53,269 --> 00:08:51,440

expectations over a long period of time

226
00:08:55,509 --> 00:08:53,279
in a small space

227
00:08:57,190 --> 00:08:55,519
about how to manage their relationships

228
00:08:58,870 --> 00:08:57,200
with other minors

229
00:09:00,470 --> 00:08:58,880
and for the

230
00:09:02,470 --> 00:09:00,480
leaders

231
00:09:05,030 --> 00:09:02,480
and some of the key personnel is how to

232
00:09:08,150 --> 00:09:05,040
manage team dynamics in confinement over

233
00:09:10,870 --> 00:09:08,160
a long period of time

234
00:09:12,710 --> 00:09:10,880
we were concerned about desynchrony

235
00:09:15,030 --> 00:09:12,720
among the miners of their sleep wake

236
00:09:16,949 --> 00:09:15,040
cycles that they would start to perhaps

237
00:09:20,389 --> 00:09:16,959
free run

238
00:09:22,550 --> 00:09:20,399

which is a situation in which your sleep

239

00:09:24,550 --> 00:09:22,560

wake cycles begin to drift off the usual

240

00:09:27,670 --> 00:09:24,560

24 hour

241

00:09:30,230 --> 00:09:27,680

pattern so we wanted to entrain the

242

00:09:32,949 --> 00:09:30,240

individuals sleep wake cycles and their

243

00:09:35,670 --> 00:09:32,959

internal clock so to speak

244

00:09:37,990 --> 00:09:35,680

with a regular light dark pattern

245

00:09:40,070 --> 00:09:38,000

which was similar to the one top side so

246

00:09:42,150 --> 00:09:40,080

that they would be able to communicate

247

00:09:45,910 --> 00:09:42,160

more effectively with topside people as

248

00:09:49,910 --> 00:09:47,509

also made regular

249

00:09:51,829 --> 00:09:49,920

the social life down under so that

250

00:09:53,670 --> 00:09:51,839

everyone was on the same wake up go to

251

00:09:56,550 --> 00:09:53,680

sleep time

252

00:09:58,230 --> 00:09:56,560

people were able to eat together

253

00:10:00,150 --> 00:09:58,240

there was communication with the doctor

254

00:10:02,150 --> 00:10:00,160

at a certain time of day and so you had

255

00:10:05,590 --> 00:10:02,160

this regularity which not only

256

00:10:07,670 --> 00:10:05,600

stabilizes an individual but stabilizes

257

00:10:12,710 --> 00:10:07,680

their small community that they had down

258

00:10:17,509 --> 00:10:15,110

one of my recommendations was that nasa

259

00:10:19,350 --> 00:10:17,519

could help

260

00:10:22,870 --> 00:10:19,360

perhaps flushing out some of these

261

00:10:24,949 --> 00:10:22,880

requirements for the rescue capsule

262

00:10:26,710 --> 00:10:24,959

upon returning to the united states i

263

00:10:28,069 --> 00:10:26,720

got an email from the minister of health

264

00:10:29,990 --> 00:10:28,079

asking for that

265

00:10:31,670 --> 00:10:30,000

asking for us to

266

00:10:34,150 --> 00:10:31,680

to provide them some requirements for

267

00:10:35,030 --> 00:10:34,160

the capsule and so i put together a team

268

00:10:38,470 --> 00:10:35,040

of

269

00:10:41,990 --> 00:10:38,480

around

270

00:10:44,790 --> 00:10:42,000

center

271

00:10:46,630 --> 00:10:44,800

and over the course of three days we we

272

00:10:49,590 --> 00:10:46,640

hammered out

273

00:10:51,750 --> 00:10:49,600

about a 12 or 13 page

274

00:10:54,550 --> 00:10:51,760

requirements list for the capsule and

275

00:10:57,509 --> 00:10:56,069

after we had sent these requirements

276
00:10:59,509 --> 00:10:57,519
down

277
00:11:01,670 --> 00:10:59,519
i got a

278
00:11:03,110 --> 00:11:01,680
some communication with

279
00:11:05,430 --> 00:11:03,120
another

280
00:11:08,230 --> 00:11:05,440
navy chilean navy commander that i had

281
00:11:10,630 --> 00:11:08,240
met down there and he was intimately

282
00:11:12,230 --> 00:11:10,640
involved in the design process of this

283
00:11:15,190 --> 00:11:12,240
capsule

284
00:11:18,230 --> 00:11:15,200
with the chilean navy engineers and he

285
00:11:21,110 --> 00:11:18,240
told me that that they had incorporated

286
00:11:24,150 --> 00:11:21,120
most of the suggestions that we had

287
00:11:28,630 --> 00:11:26,470
when i saw the first

288
00:11:29,430 --> 00:11:28,640

minor being extracted last night i was

289

00:11:31,190 --> 00:11:29,440

uh

290

00:11:31,910 --> 00:11:31,200

you know both happy and very relieved

291

00:11:36,550 --> 00:11:31,920

and

292

00:11:38,949 --> 00:11:36,560

final design of the capsule is working

293

00:11:42,150 --> 00:11:38,959

just you know just great so i'm very

294

00:11:43,509 --> 00:11:42,160

happy about that

295

00:11:45,350 --> 00:11:43,519

a couple things that i'll remember most

296

00:11:46,790 --> 00:11:45,360

about this whole experience is one one

297

00:11:48,949 --> 00:11:46,800

is the uh

298

00:11:51,030 --> 00:11:48,959

the open openness and graciousness of

299

00:11:53,030 --> 00:11:51,040

the chilean people i thought they were

300

00:11:54,870 --> 00:11:53,040

very very nice

301
00:11:58,550 --> 00:11:54,880
very

302
00:12:00,389 --> 00:11:58,560
of the things that we

303
00:12:01,910 --> 00:12:00,399
recommended they ought to do

304
00:12:03,910 --> 00:12:01,920
the other thing i'm taking away from

305
00:12:06,550 --> 00:12:03,920
this is that

306
00:12:08,230 --> 00:12:06,560
our agency is really really has a lot of

307
00:12:08,949 --> 00:12:08,240
exceptional people

308
00:12:10,790 --> 00:12:08,959
and

309
00:12:13,350 --> 00:12:10,800
that that

310
00:12:15,030 --> 00:12:13,360
20 or so engineers that uh offered to

311
00:12:17,350 --> 00:12:15,040
drop everything and work with me for

312
00:12:18,710 --> 00:12:17,360
three days to put this requirements list

313
00:12:21,269 --> 00:12:18,720

together i think

314

00:12:22,710 --> 00:12:21,279

really exemplifies that the things that