
USA

1
00:00:17,189 --> 00:00:15,829
good afternoon welcome everyone to the

2
00:00:19,109 --> 00:00:17,199
smithsonian national air and space

3
00:00:21,429 --> 00:00:19,119
museum and our moving beyond earth

4
00:00:23,189 --> 00:00:21,439
exhibit i'm jennifer levasser a curator

5
00:00:25,029 --> 00:00:23,199
here at the museum and i want to welcome

6
00:00:26,710 --> 00:00:25,039
you to our program

7
00:00:29,029 --> 00:00:26,720
i'm also the curator for our brand new

8
00:00:30,790 --> 00:00:29,039
exhibit called outside the spacecraft

9
00:00:32,389 --> 00:00:30,800
which we'll go to her afterwards if you

10
00:00:34,389 --> 00:00:32,399
want to join me

11
00:00:39,110 --> 00:00:34,399
and first we're going to show you a

12
00:00:43,510 --> 00:00:41,110
we are in outside the spacecraft 50

13
00:00:46,069 --> 00:00:43,520

years of extravehicular activity this is

14
00:00:48,150 --> 00:00:46,079
an exhibition being staged here at the

15
00:00:50,389 --> 00:00:48,160
museum in celebration of the 50th

16
00:00:51,830 --> 00:00:50,399
anniversary of this first space walks

17
00:00:53,750 --> 00:00:51,840
where right now we're in the middle of

18
00:00:55,110 --> 00:00:53,760
installing objects in preparation for

19
00:00:56,630 --> 00:00:55,120
opening

20
00:00:58,150 --> 00:00:56,640
it's very

21
00:01:00,310 --> 00:00:58,160
inspiring to work on a project like this

22
00:01:02,069 --> 00:01:00,320
to come down here and to see

23
00:01:04,549 --> 00:01:02,079
someone looking at something that

24
00:01:07,109 --> 00:01:04,559
interests them and excites them is

25
00:01:09,109 --> 00:01:07,119
very rewarding space is a very dangerous

26
00:01:11,190 --> 00:01:09,119
place and so to leave the spacecraft to

27
00:01:13,270 --> 00:01:11,200
live and to work outside of it we need

28
00:01:15,670 --> 00:01:13,280
what we call a personal spacecraft

29
00:01:18,149 --> 00:01:15,680
that's the space suit this is the space

30
00:01:20,070 --> 00:01:18,159
suit display first gene cernan spacesuit

31
00:01:22,710 --> 00:01:20,080
from his eva

32
00:01:24,630 --> 00:01:22,720
activity in gemini nine and it's really

33
00:01:25,910 --> 00:01:24,640
really fragile so

34
00:01:27,830 --> 00:01:25,920
we really didn't think we could actually

35
00:01:29,990 --> 00:01:27,840
display this spacesuit at any point in

36
00:01:32,069 --> 00:01:30,000
its lifetime here at the museum until we

37
00:01:33,749 --> 00:01:32,079
came up with this system to

38
00:01:35,670 --> 00:01:33,759

support the suit at the top which

39
00:01:37,749 --> 00:01:35,680
relieves pressure from the heavy section

40
00:01:39,910 --> 00:01:37,759
of the suit and then supports the suit

41
00:01:42,310 --> 00:01:39,920
across the entire body and what we're

42
00:01:44,469 --> 00:01:42,320
looking at is um the interior suit of

43
00:01:47,190 --> 00:01:44,479
gemini nine uh cernan's

44
00:01:48,950 --> 00:01:47,200
space eba flight with his cover layer

45
00:01:50,550 --> 00:01:48,960
next to it which would it's kind of like

46
00:01:51,910 --> 00:01:50,560
an exploded view of the two suits

47
00:01:53,109 --> 00:01:51,920
together we couldn't marry them back

48
00:01:54,950 --> 00:01:53,119
together they had to be displayed

49
00:01:56,630 --> 00:01:54,960
separately

50
00:01:58,230 --> 00:01:56,640
the object behind me is the umbilical

51
00:02:00,709 --> 00:01:58,240
cord that attached ed white to a

52
00:02:03,270 --> 00:02:00,719
spacecraft during his gemini 4 flight

53
00:02:05,030 --> 00:02:03,280
and kept him from floating away in space

54
00:02:07,030 --> 00:02:05,040
it has a gold coating on the outside

55
00:02:08,869 --> 00:02:07,040
which is really really fragile and over

56
00:02:11,270 --> 00:02:08,879
time it's been left coiled so we've

57
00:02:13,190 --> 00:02:11,280
displayed it that way to preserve the

58
00:02:14,710 --> 00:02:13,200
object so our visitors can see it on

59
00:02:18,630 --> 00:02:14,720
display

60
00:02:21,110 --> 00:02:18,640
museum for the very first time it is the

61
00:02:22,949 --> 00:02:21,120
cover to the backpack that gene cernan

62
00:02:25,350 --> 00:02:22,959
wore on the moon which had his life

63
00:02:27,030 --> 00:02:25,360

support system in it and it was returned

64
00:02:29,190 --> 00:02:27,040
from the lunar surface with him during

65
00:02:32,070 --> 00:02:29,200
his mission in 1972

66
00:02:34,309 --> 00:02:32,080
and nasa looked at the cover examined it

67
00:02:37,350 --> 00:02:34,319
we found out that they documented it and

68
00:02:40,550 --> 00:02:37,360
packaged it where it remained sealed

69
00:02:42,470 --> 00:02:40,560
since 1973 20 days after his mission it

70
00:02:45,270 --> 00:02:42,480
was given to our museum it was kept in

71
00:02:46,630 --> 00:02:45,280
storage preserved and we opened it to

72
00:02:49,990 --> 00:02:46,640
display it for the very first time

73
00:02:51,509 --> 00:02:50,000
during this show

74
00:02:53,190 --> 00:02:51,519
these boots before us were the last

75
00:02:56,229 --> 00:02:53,200
boots to walk on the moon they were jean

76
00:02:59,270 --> 00:02:56,239
cernan's apollo 17 eva boots which would

77
00:03:01,270 --> 00:02:59,280
go over the boot of a spacesuit and left

78
00:03:02,630 --> 00:03:01,280
footprints on the lunar surface these

79
00:03:04,869 --> 00:03:02,640
have been displayed in our museum

80
00:03:07,350 --> 00:03:04,879
several times in other galleries but we

81
00:03:09,110 --> 00:03:07,360
haven't shown them in this orientation

82
00:03:11,190 --> 00:03:09,120
we thought it was important to show the

83
00:03:12,710 --> 00:03:11,200
actual boot that made the footprints on

84
00:03:14,470 --> 00:03:12,720
the moon

85
00:03:16,869 --> 00:03:14,480
the last section of the exhibit is on

86
00:03:18,869 --> 00:03:16,879
tools and tools can range anything from

87
00:03:20,470 --> 00:03:18,879
very basic tools that you might use here

88
00:03:22,470 --> 00:03:20,480

on earth to things that are highly

89
00:03:25,110 --> 00:03:22,480
specialized for the space environment so

90
00:03:27,750 --> 00:03:25,120
we have cameras time keeping devices

91
00:03:30,229 --> 00:03:27,760
checklists special cameras and foot

92
00:03:32,550 --> 00:03:30,239
restraints one of our most spectacular

93
00:03:34,550 --> 00:03:32,560
objects in the exhibit is the what's

94
00:03:36,070 --> 00:03:34,560
called manipulator foot restraint from

95
00:03:37,390 --> 00:03:36,080
the last of the hubble servicing

96
00:03:40,070 --> 00:03:37,400
missions

97
00:03:42,070 --> 00:03:40,080
sts-125 as i was doing my work as a

98
00:03:45,110 --> 00:03:42,080
curator and visually confirming that the

99
00:03:47,030 --> 00:03:45,120
object had indeed flown on sts-125

100
00:03:49,190 --> 00:03:47,040
our curator worked with nasa and found

101
00:03:51,830 --> 00:03:49,200
through their paperwork that

102
00:03:54,149 --> 00:03:51,840
not only had it flown on sts-125 it had

103
00:03:56,309 --> 00:03:54,159
also flown previous missions as well

104
00:03:58,229 --> 00:03:56,319
the glove exhibit we're installing is

105
00:04:00,229 --> 00:03:58,239
really a centerpiece quite literally of

106
00:04:01,910 --> 00:04:00,239
the entire gallery it sits in the center

107
00:04:04,149 --> 00:04:01,920
of the gallery and is a pretty

108
00:04:05,990 --> 00:04:04,159
extraordinary looking feature we do have

109
00:04:07,750 --> 00:04:06,000
some historic gloves in the display

110
00:04:10,390 --> 00:04:07,760
itself one of the most important is

111
00:04:13,190 --> 00:04:10,400
kathy sullivan's glove from her eva as

112
00:04:14,949 --> 00:04:13,200
the first u.s woman to do an eva during

113
00:04:16,710 --> 00:04:14,959

the shuttle program there's another

114
00:04:18,550 --> 00:04:16,720
thread in the exhibit and that's about

115
00:04:21,030 --> 00:04:18,560
art and photography and so i wanted to

116
00:04:23,110 --> 00:04:21,040
select artwork from our collection that

117
00:04:25,350 --> 00:04:23,120
really demonstrates how artists have

118
00:04:27,909 --> 00:04:25,360
interpreted the experience of astronauts

119
00:04:29,909 --> 00:04:27,919
on eba and the photographs including the

120
00:04:32,150 --> 00:04:29,919
one here at the entrance to the gallery

121
00:04:34,790 --> 00:04:32,160
are really evocative of that experience

122
00:04:37,590 --> 00:04:34,800
i really wanted to inspire the next

123
00:04:40,070 --> 00:04:37,600
generation so there's a lot of big

124
00:04:42,070 --> 00:04:40,080
scenes in the gallery we can't go there

125
00:04:47,830 --> 00:04:42,080
ourselves but the visuals are really

126
00:04:50,710 --> 00:04:48,790
all right

127
00:04:53,270 --> 00:04:50,720
well let's go back 50 years what was

128
00:04:54,710 --> 00:04:53,280
happening 50 years ago was a competition

129
00:04:56,550 --> 00:04:54,720
between the united states and the soviet

130
00:04:58,870 --> 00:04:56,560
union and it was a competition to be the

131
00:05:00,950 --> 00:04:58,880
first at things and in this case

132
00:05:04,150 --> 00:05:00,960
eva extravaticular activity or

133
00:05:07,189 --> 00:05:04,160
spacewalking so in march of 1965 alexei

134
00:05:09,110 --> 00:05:07,199
leonov a soviet uh cosmonaut will exited

135
00:05:10,790 --> 00:05:09,120
his spacecraft for the first time and

136
00:05:13,830 --> 00:05:10,800
made that first spacewalk and a few

137
00:05:15,430 --> 00:05:13,840
months later ed white on gemini 4 made

138
00:05:17,430 --> 00:05:15,440

his first spacewalk

139
00:05:18,629 --> 00:05:17,440
first american spacewalk

140
00:05:20,469 --> 00:05:18,639
and so

141
00:05:22,469 --> 00:05:20,479
to leave the spacecraft take some very

142
00:05:23,990 --> 00:05:22,479
important things but you have to be able

143
00:05:25,909 --> 00:05:24,000
to carry something with you you have to

144
00:05:27,749 --> 00:05:25,919
carry your own environment when you

145
00:05:29,350 --> 00:05:27,759
leave the spacecraft and so to have that

146
00:05:31,830 --> 00:05:29,360
environment with you you need a very

147
00:05:34,550 --> 00:05:31,840
special tool which is a spacesuit inside

148
00:05:35,830 --> 00:05:34,560
that spacesuit you need to have a few

149
00:05:38,870 --> 00:05:35,840
things that

150
00:05:40,790 --> 00:05:38,880
alive on earth you have to take them

151
00:05:41,990 --> 00:05:40,800
with you and in the case of the early

152
00:05:42,870 --> 00:05:42,000
astronauts

153
00:05:44,790 --> 00:05:42,880
they had to have something that

154
00:05:47,749 --> 00:05:44,800
connected them to the spacecraft an

155
00:05:51,270 --> 00:05:47,759
umbilical cord that provided them with

156
00:05:53,270 --> 00:05:51,280
oxygen it provided them with uh

157
00:05:54,629 --> 00:05:53,280
with their any electricity they needed

158
00:05:56,629 --> 00:05:54,639
in their spacecraft they are in the

159
00:05:58,390 --> 00:05:56,639
space suit they needed to have pressure

160
00:06:00,390 --> 00:05:58,400
you need you have pressure uh weighing

161
00:06:02,469 --> 00:06:00,400
down on you on earth's surface and so

162
00:06:04,230 --> 00:06:02,479
you have to take that with you

163
00:06:05,670 --> 00:06:04,240

and they needed to have uh they needed

164
00:06:07,909 --> 00:06:05,680
to have a tether something that could

165
00:06:09,749 --> 00:06:07,919
hold them to the spacecraft and so we go

166
00:06:11,270 --> 00:06:09,759
to the next slide here you'll see

167
00:06:13,909 --> 00:06:11,280
uh just what that looked like on the

168
00:06:15,749 --> 00:06:13,919
very first spacewalk for ed white you

169
00:06:17,590 --> 00:06:15,759
can see that gold umbilical so that's

170
00:06:19,590 --> 00:06:17,600
carrying all of his

171
00:06:21,270 --> 00:06:19,600
all of the things that he needs it's

172
00:06:23,189 --> 00:06:21,280
carrying it from the spacecraft to his

173
00:06:24,550 --> 00:06:23,199
space suit

174
00:06:26,309 --> 00:06:24,560
and you could see that it was carried

175
00:06:28,309 --> 00:06:26,319
inside that little green bag there and

176
00:06:29,990 --> 00:06:28,319
so as he left the spacecraft that

177
00:06:32,070 --> 00:06:30,000
umbilical would go out farther and

178
00:06:33,830 --> 00:06:32,080
farther next slide

179
00:06:36,710 --> 00:06:33,840
and here you see that umbilical the

180
00:06:38,230 --> 00:06:36,720
gold-coated umbilical in our exhibit

181
00:06:41,270 --> 00:06:38,240
that gold coating would protect the

182
00:06:42,870 --> 00:06:41,280
umbilical cord from radiation and when

183
00:06:45,670 --> 00:06:42,880
we go up to the exhibit later you'll get

184
00:06:47,670 --> 00:06:45,680
a chance to see this next slide

185
00:06:49,189 --> 00:06:47,680
so after ed white on gemini 4 there are

186
00:06:52,230 --> 00:06:49,199
a number of different space walks during

187
00:06:54,150 --> 00:06:52,240
the gemini program in the mid 1960s this

188
00:06:56,629 --> 00:06:54,160

is a photograph of jean cernan's

189
00:06:58,230 --> 00:06:56,639
spacewalk on gemini 9. now gene cernan

190
00:07:00,390 --> 00:06:58,240
was going to do quite a bit of activity

191
00:07:02,230 --> 00:07:00,400
but when he got outside he found out it

192
00:07:04,390 --> 00:07:02,240
was really really difficult

193
00:07:06,950 --> 00:07:04,400
to maneuver himself around outside the

194
00:07:09,909 --> 00:07:06,960
spacecraft he actually got he got

195
00:07:11,749 --> 00:07:09,919
overworked uh his spacesuit visor fogged

196
00:07:14,550 --> 00:07:11,759
up kind of like if you're outside and

197
00:07:16,150 --> 00:07:14,560
you go in between a hot and a cold place

198
00:07:17,589 --> 00:07:16,160
your glasses can fog up that's what

199
00:07:20,230 --> 00:07:17,599
happened to him and he got really

200
00:07:21,749 --> 00:07:20,240
overworked he got very sweaty

201
00:07:23,510 --> 00:07:21,759
and he found out that he really didn't

202
00:07:25,670 --> 00:07:23,520
have the right kind of equipment inside

203
00:07:27,909 --> 00:07:25,680
his spacesuit to control his temperature

204
00:07:29,189 --> 00:07:27,919
and so on later missions he actually

205
00:07:30,870 --> 00:07:29,199
astronauts would wear what's called a

206
00:07:32,390 --> 00:07:30,880
liquid cooling garment to control their

207
00:07:34,230 --> 00:07:32,400
body temperature while they were inside

208
00:07:36,550 --> 00:07:34,240
their spacesuits you can also see the

209
00:07:38,309 --> 00:07:36,560
umbilical cord that he's using in this

210
00:07:39,430 --> 00:07:38,319
picture that white line kind of through

211
00:07:41,830 --> 00:07:39,440
the middle

212
00:07:43,589 --> 00:07:41,840
it's a the umbilical cord was coated in

213
00:07:45,430 --> 00:07:43,599

beta cloth which would protect it from

214
00:07:46,950 --> 00:07:45,440
abrasions and so you could be outside

215
00:07:49,990 --> 00:07:46,960
the spacecraft and not have to worry too

216
00:07:52,550 --> 00:07:50,000
much about having it having anything

217
00:07:55,350 --> 00:07:52,560
damaged inside that umbilical

218
00:07:57,430 --> 00:07:55,360
so certain got very overworked and after

219
00:07:58,869 --> 00:07:57,440
cernan's mission astronauts starting

220
00:08:06,309 --> 00:07:58,879
started training in new and different

221
00:08:10,710 --> 00:08:08,070
so here you see astronaut michael

222
00:08:13,589 --> 00:08:10,720
collins training for his gemini 10 eva

223
00:08:15,430 --> 00:08:13,599
he's inside an airplane that would go up

224
00:08:17,270 --> 00:08:15,440
into the atmosphere and do these large

225
00:08:19,270 --> 00:08:17,280
parabolas to give him some sense of

226
00:08:20,869 --> 00:08:19,280
weightlessness as he came back down and

227
00:08:22,629 --> 00:08:20,879
you can see he's training in a spacesuit

228
00:08:24,230 --> 00:08:22,639
he's got an umbilical attached to the

229
00:08:25,909 --> 00:08:24,240
side of the airplane

230
00:08:27,189 --> 00:08:25,919
he also and many of the astronauts at

231
00:08:28,869 --> 00:08:27,199
this time also started training

232
00:08:30,629 --> 00:08:28,879
underwater and so they're having to do

233
00:08:32,550 --> 00:08:30,639
the same thing where they have some kind

234
00:08:34,469 --> 00:08:32,560
of a cord attached to themselves to

235
00:08:36,870 --> 00:08:34,479
carry to be able to bring them all their

236
00:08:38,550 --> 00:08:36,880
needs uh inside their spacesuit and here

237
00:08:40,630 --> 00:08:38,560
he's also got a very large chest pack

238
00:08:42,870 --> 00:08:40,640

which helps him have additional control

239
00:08:44,310 --> 00:08:42,880
over the conditions inside his spacesuit

240
00:08:45,670 --> 00:08:44,320
and here you could see he's actually

241
00:08:47,670 --> 00:08:45,680
working on something that looks a bit

242
00:08:49,509 --> 00:08:47,680
like the outside of the spacecraft so

243
00:08:50,870 --> 00:08:49,519
that when he would go up into space he

244
00:08:52,630 --> 00:08:50,880
would have a little bit easier time but

245
00:08:54,870 --> 00:08:52,640
unfortunately things still weren't

246
00:08:56,790 --> 00:08:54,880
perfect he was that michael collins had

247
00:08:58,310 --> 00:08:56,800
quite a bit of difficulty on his eva on

248
00:09:00,070 --> 00:08:58,320
gemiini 10.

249
00:09:02,550 --> 00:09:00,080
and his only lasted it has lasted

250
00:09:04,710 --> 00:09:02,560
actually under an hour on the next slide

251
00:09:07,350 --> 00:09:04,720
you'll see another astronaut richard

252
00:09:09,509 --> 00:09:07,360
gordon on gemini 11. he had so much

253
00:09:11,269 --> 00:09:09,519
trouble on his eva he actually used his

254
00:09:14,070 --> 00:09:11,279
legs to help keep him close to the

255
00:09:16,389 --> 00:09:14,080
spacecraft and his eva lasted about half

256
00:09:17,910 --> 00:09:16,399
an hour so evas aren't lasting any

257
00:09:19,910 --> 00:09:17,920
longer and they still haven't quite

258
00:09:20,870 --> 00:09:19,920
perfected a system for keeping all of

259
00:09:22,470 --> 00:09:20,880
these

260
00:09:24,230 --> 00:09:22,480
needs of your body

261
00:09:26,070 --> 00:09:24,240
working in unison so that you could be

262
00:09:28,949 --> 00:09:26,080
outside the spacecraft and work for long

263
00:09:31,030 --> 00:09:28,959

periods of time next slide

264
00:09:33,350 --> 00:09:31,040
and on the last of the gemini missions a

265
00:09:35,590 --> 00:09:33,360
buzz aldrin went out and did an eva has

266
00:09:37,350 --> 00:09:35,600
lasted for about two hours and he had a

267
00:09:39,110 --> 00:09:37,360
little bit easier of a time he had more

268
00:09:40,949 --> 00:09:39,120
hand holds to keep him close to the

269
00:09:43,030 --> 00:09:40,959
spacecraft but generally the system was

270
00:09:44,949 --> 00:09:43,040
about the same he did quite a bit of

271
00:09:47,190 --> 00:09:44,959
underwater training for his eva he was

272
00:09:48,870 --> 00:09:47,200
very well prepared but still there

273
00:09:51,190 --> 00:09:48,880
wasn't an ability with the umbilical

274
00:09:53,030 --> 00:09:51,200
cord to really move past the spacecraft

275
00:09:54,550 --> 00:09:53,040
and do a lot of exploring

276
00:09:56,150 --> 00:09:54,560
so on the next slide you're going to see

277
00:09:57,990 --> 00:09:56,160
what the solution was for the apollo

278
00:10:00,949 --> 00:09:58,000
program

279
00:10:04,069 --> 00:10:00,959
this is rusty schweikert during apollo 9

280
00:10:07,350 --> 00:10:04,079
early in 1969 he tested the very first

281
00:10:09,990 --> 00:10:07,360
backpack style uh support system you can

282
00:10:11,750 --> 00:10:10,000
see it on his back there the part uh

283
00:10:13,509 --> 00:10:11,760
sort of between his shoulders and his

284
00:10:15,509 --> 00:10:13,519
waist that's the main backpack that

285
00:10:17,590 --> 00:10:15,519
would carry all of the things he needed

286
00:10:19,350 --> 00:10:17,600
with him so now he could go away from

287
00:10:22,069 --> 00:10:19,360
the spacecraft like we would need to do

288
00:10:23,750 --> 00:10:22,079

on the moon and carry all of his life

289
00:10:25,910 --> 00:10:23,760
support system with him this is called

290
00:10:27,750 --> 00:10:25,920
the personal life support system and

291
00:10:29,350 --> 00:10:27,760
also has a backup system which is the

292
00:10:31,110 --> 00:10:29,360
section on the top of the backpack

293
00:10:33,430 --> 00:10:31,120
that's the emergency system called the

294
00:10:34,870 --> 00:10:33,440
oxygen purge system and we'll hear lisa

295
00:10:36,069 --> 00:10:34,880
talk about that a little bit more in a

296
00:10:38,470 --> 00:10:36,079
few minutes

297
00:10:40,389 --> 00:10:38,480
so schweikert tests the first backpack

298
00:10:41,910 --> 00:10:40,399
in space and that went on to be used by

299
00:10:42,790 --> 00:10:41,920
all of the astronauts who explored the

300
00:10:44,150 --> 00:10:42,800
moon

301
00:10:46,069 --> 00:10:44,160
next slide

302
00:10:47,829 --> 00:10:46,079
but there were some special evas during

303
00:10:49,590 --> 00:10:47,839
the apollo program as well that didn't

304
00:10:51,350 --> 00:10:49,600
involve walking on the moon they

305
00:10:54,069 --> 00:10:51,360
actually went back to an umbilical

306
00:10:57,110 --> 00:10:54,079
system for some of the evas done in deep

307
00:10:59,430 --> 00:10:57,120
space this is al warden on apollo 15. he

308
00:11:01,190 --> 00:10:59,440
had to exit the spacecraft in that time

309
00:11:03,509 --> 00:11:01,200
between the moon and coming back to

310
00:11:05,990 --> 00:11:03,519
earth to go back into the spacecraft and

311
00:11:08,230 --> 00:11:06,000
retrieve some film canisters and so he

312
00:11:09,590 --> 00:11:08,240
was attached by an umbilical cord again

313
00:11:11,829 --> 00:11:09,600

went back to

314
00:11:13,430 --> 00:11:11,839
the back side of the spacecraft but in

315
00:11:14,949 --> 00:11:13,440
his case and in the case of the two

316
00:11:17,590 --> 00:11:14,959
other two astronauts who did that during

317
00:11:19,110 --> 00:11:17,600
apollo they had backpacks as a backup

318
00:11:20,230 --> 00:11:19,120
system so

319
00:11:21,670 --> 00:11:20,240
that was another thing that was

320
00:11:24,389 --> 00:11:21,680
available to them

321
00:11:27,509 --> 00:11:24,399
but for future astronauts things changed

322
00:11:29,509 --> 00:11:27,519
back to that backpack next slide

323
00:11:31,750 --> 00:11:29,519
so during the shuttle program and of

324
00:11:33,750 --> 00:11:31,760
course on the space station astronauts

325
00:11:35,829 --> 00:11:33,760
do use the backpack system

326
00:11:38,069 --> 00:11:35,839
a primary life support system here you

327
00:11:39,750 --> 00:11:38,079
can see on sts-125

328
00:11:42,630 --> 00:11:39,760
one of the hubble servicing missions

329
00:11:44,389 --> 00:11:42,640
this is drew feustel using a backpack

330
00:11:47,030 --> 00:11:44,399
and to really be able to explore to

331
00:11:49,350 --> 00:11:47,040
continue to explore and go beyond uh

332
00:11:51,350 --> 00:11:49,360
back to uh to other places like mars and

333
00:11:53,990 --> 00:11:51,360
go back to the moon or to asteroids

334
00:11:56,550 --> 00:11:54,000
astronauts need to have a very simple

335
00:11:58,710 --> 00:11:56,560
system that's able to that that doesn't

336
00:12:01,670 --> 00:11:58,720
tie them down to a spacecraft to be able

337
00:12:04,069 --> 00:12:01,680
to walk around look at things uh and and

338
00:12:07,430 --> 00:12:04,079

have that uh environment inside their

339
00:12:09,509 --> 00:12:07,440
spacesuit kind of going along with them

340
00:12:10,470 --> 00:12:09,519
and so next we're going to be hearing

341
00:12:12,629 --> 00:12:10,480
from

342
00:12:14,710 --> 00:12:12,639
our objects conservator lisa young but

343
00:12:16,310 --> 00:12:14,720
first we'll see a little video that

344
00:12:21,509 --> 00:12:16,320
talks about something special she did

345
00:12:25,110 --> 00:12:23,030
the really cool thing we're here to do

346
00:12:27,030 --> 00:12:25,120
at the museum today is to open a package

347
00:12:30,230 --> 00:12:27,040
of one of the last things to return from

348
00:12:31,750 --> 00:12:30,240
the moon in 1972. the package was closed

349
00:12:36,389 --> 00:12:31,760
up and hasn't been exposed to the air

350
00:12:41,430 --> 00:12:38,389
the object we're looking at today came

351
00:12:43,269 --> 00:12:41,440
from the apollo 17 mission worn by gene

352
00:12:45,350 --> 00:12:43,279
cernan who was the last astronaut to

353
00:12:47,590 --> 00:12:45,360
ever walk on the moon

354
00:12:49,030 --> 00:12:47,600
wow so it was the outer covering that

355
00:12:51,430 --> 00:12:49,040
would have gone on his life support

356
00:12:53,190 --> 00:12:51,440
system at the top part of his backpack

357
00:12:55,350 --> 00:12:53,200
and it would have been exposed to all

358
00:12:57,269 --> 00:12:55,360
the elements on the lunar surface the

359
00:12:59,430 --> 00:12:57,279
apollo 17 mission was significant

360
00:13:01,190 --> 00:12:59,440
because it was the last time humans have

361
00:13:03,670 --> 00:13:01,200
traveled to the moon and back they

362
00:13:05,590 --> 00:13:03,680
traveled quite a few kilometers on their

363
00:13:06,949 --> 00:13:05,600

lunar rovers they did an incredible

364
00:13:08,550 --> 00:13:06,959
amount of scientific work because

365
00:13:10,150 --> 00:13:08,560
harrison schmidt who was the other

366
00:13:12,389 --> 00:13:10,160
astronaut was the only geologist the

367
00:13:15,030 --> 00:13:12,399
only scientist to ever go to the moon so

368
00:13:17,110 --> 00:13:15,040
the intensity of their workload was very

369
00:13:19,269 --> 00:13:17,120
high they were literally covered from

370
00:13:21,190 --> 00:13:19,279
head to foot in lunar dust we wanted to

371
00:13:23,430 --> 00:13:21,200
look at it with experts in the lab today

372
00:13:25,990 --> 00:13:23,440
so we could determine if the object

373
00:13:28,230 --> 00:13:26,000
still had original lunar dust on it if

374
00:13:30,870 --> 00:13:28,240
nasa had cleaned the object after it had

375
00:13:33,030 --> 00:13:30,880
been returned from the lunar surface or

376
00:13:34,389 --> 00:13:33,040
it had been packaged and opened and we

377
00:13:36,629 --> 00:13:34,399
thought it had just been left in a

378
00:13:38,230 --> 00:13:36,639
packaging i really expected it to be a

379
00:13:39,910 --> 00:13:38,240
little bit more dirty and have more

380
00:13:41,990 --> 00:13:39,920
lunar dust and sort of the folds in the

381
00:13:44,710 --> 00:13:42,000
pockets which does lead me to believe

382
00:13:46,470 --> 00:13:44,720
that nasa serviced it before they

383
00:13:48,470 --> 00:13:46,480
packaged it so when we opened up the

384
00:13:50,310 --> 00:13:48,480
package today what was really cool about

385
00:13:53,910 --> 00:13:50,320
seeing this thing for the first time

386
00:13:55,430 --> 00:13:53,920
unfolded and exposed was really just how

387
00:13:57,350 --> 00:13:55,440
scuffed up it looked it looked like it

388
00:13:58,949 --> 00:13:57,360

had really been used quite a bit but

389
00:14:01,509 --> 00:13:58,959
what i couldn't tell until we got it

390
00:14:04,150 --> 00:14:01,519
under the microscope is just how much

391
00:14:06,389 --> 00:14:04,160
lunar dust got embedded into the fibers

392
00:14:08,230 --> 00:14:06,399
it was amazing it's just covered and to

393
00:14:09,269 --> 00:14:08,240
the naked eye you can't see any of that

394
00:14:11,750 --> 00:14:09,279
really

395
00:14:14,230 --> 00:14:11,760
so it looks just used and clearly there

396
00:14:15,670 --> 00:14:14,240
are some cuts and abrasions on it but

397
00:14:17,509 --> 00:14:15,680
what's really great is when you get up

398
00:14:19,030 --> 00:14:17,519
close to it and you get the microscope

399
00:14:21,750 --> 00:14:19,040
on it it's

400
00:14:23,910 --> 00:14:21,760
so clear how that dust just kind of gets

401
00:14:26,069 --> 00:14:23,920
sucked into that material and embedded

402
00:14:27,590 --> 00:14:26,079
underneath the fibers really and then

403
00:14:29,030 --> 00:14:27,600
these little grains that you see the

404
00:14:30,949 --> 00:14:29,040
little spots

405
00:14:33,269 --> 00:14:30,959
are all the angular more angular pieces

406
00:14:36,310 --> 00:14:33,279
of the lunar dust the flags that were

407
00:14:37,910 --> 00:14:36,320
put on to the life support system cover

408
00:14:40,790 --> 00:14:37,920
were painted so

409
00:14:41,990 --> 00:14:40,800
seeing the paint on the surfaces of the

410
00:14:44,470 --> 00:14:42,000
fabrics

411
00:14:46,629 --> 00:14:44,480
is really interesting to me because we

412
00:14:48,550 --> 00:14:46,639
are able to tell how they were applied

413
00:14:51,670 --> 00:14:48,560

if they are actually flaking out

414
00:14:53,829 --> 00:14:51,680
themselves off the surfaces and then how

415
00:14:56,230 --> 00:14:53,839
the lunar dust sort of embeds itself

416
00:14:58,389 --> 00:14:56,240
between the paint layers of the surface

417
00:15:00,550 --> 00:14:58,399
and the actual fabric itself

418
00:15:02,310 --> 00:15:00,560
the astronauts were asked to take all

419
00:15:03,910 --> 00:15:02,320
the extraneous items off they left their

420
00:15:06,069 --> 00:15:03,920
life support systems up there because

421
00:15:08,150 --> 00:15:06,079
they were very heavy and even though

422
00:15:10,550 --> 00:15:08,160
this is small and very

423
00:15:12,310 --> 00:15:10,560
insignificant in weight wise it was part

424
00:15:14,389 --> 00:15:12,320
of the life support system so he must

425
00:15:16,470 --> 00:15:14,399
have removed the cover and then decided

426
00:15:18,230 --> 00:15:16,480
to take it with him all these extras

427
00:15:20,629 --> 00:15:18,240
that we have from apollo 17 including

428
00:15:22,710 --> 00:15:20,639
his lunar boots which will also be on

429
00:15:25,110 --> 00:15:22,720
display are the only evidence that we

430
00:15:26,949 --> 00:15:25,120
have from that last mission and we don't

431
00:15:29,269 --> 00:15:26,959
have those from earlier missions we

432
00:15:31,910 --> 00:15:29,279
often experience really unique moments

433
00:15:34,870 --> 00:15:31,920
with our artifacts and so to be present

434
00:15:37,110 --> 00:15:34,880
when one this unique and this special is

435
00:15:39,749 --> 00:15:37,120
opened for the first time to see a

436
00:15:42,470 --> 00:15:39,759
package that was sealed in 1973 before i

437
00:15:43,829 --> 00:15:42,480
was even born opened and exposed to the

438
00:15:45,110 --> 00:15:43,839

air and get to look at it under a

439
00:15:50,230 --> 00:15:45,120
microscope is

440
00:15:53,990 --> 00:15:52,389
hi my name is lisa young and i am an

441
00:15:56,949 --> 00:15:54,000
objects conservator at the national air

442
00:15:57,670 --> 00:15:56,959
and space museum and my job is to work

443
00:16:02,629 --> 00:15:57,680
in

444
00:16:03,910 --> 00:16:02,639
at materials that objects are made of

445
00:16:05,990 --> 00:16:03,920
look at the

446
00:16:08,389 --> 00:16:06,000
age of the materials how something's

447
00:16:10,949 --> 00:16:08,399
made work with the curator to determine

448
00:16:13,590 --> 00:16:10,959
the history of an object and then to

449
00:16:15,749 --> 00:16:13,600
keep the object from deteriorating over

450
00:16:17,030 --> 00:16:15,759
time or decaying so if you think of

451
00:16:19,749 --> 00:16:17,040
things that you might have that you've

452
00:16:21,430 --> 00:16:19,759
left outside or

453
00:16:23,749 --> 00:16:21,440
that you have in your own collection at

454
00:16:25,910 --> 00:16:23,759
home a special toy

455
00:16:28,310 --> 00:16:25,920
a special pair of shoes every time you

456
00:16:30,069 --> 00:16:28,320
wear them you're creating uh wear and

457
00:16:31,910 --> 00:16:30,079
use to those materials and we're trying

458
00:16:33,030 --> 00:16:31,920
to stop that from continuing with our

459
00:16:33,910 --> 00:16:33,040
objects

460
00:16:35,509 --> 00:16:33,920
so

461
00:16:36,550 --> 00:16:35,519
usually i work in a really quiet

462
00:16:38,629 --> 00:16:36,560
environment

463
00:16:41,670 --> 00:16:38,639

but we agreed to have our opening of the

464
00:16:43,030 --> 00:16:41,680
ops cover filmed and videotaped so we

465
00:16:44,629 --> 00:16:43,040
could share it with you all today and

466
00:16:46,150 --> 00:16:44,639
put it in the exhibit

467
00:16:47,829 --> 00:16:46,160
we really didn't know what we would find

468
00:16:50,069 --> 00:16:47,839
when we opened it so

469
00:16:51,189 --> 00:16:50,079
as jennifer pointed out in the video

470
00:16:53,749 --> 00:16:51,199
shows

471
00:16:55,509 --> 00:16:53,759
we really needed to focus on our work so

472
00:16:57,030 --> 00:16:55,519
we had everybody else take the pictures

473
00:16:59,509 --> 00:16:57,040
for us but one of the most important

474
00:17:01,269 --> 00:16:59,519
jobs that a conservator does is document

475
00:17:04,390 --> 00:17:01,279
and we have to document everything we do

476
00:17:06,230 --> 00:17:04,400
to objects every time we touch an object

477
00:17:07,429 --> 00:17:06,240
and anytime we handle it in the

478
00:17:09,669 --> 00:17:07,439
laboratory

479
00:17:11,590 --> 00:17:09,679
next slide

480
00:17:13,829 --> 00:17:11,600
we use specialized equipment to look at

481
00:17:16,549 --> 00:17:13,839
the materials up close and this is our

482
00:17:18,630 --> 00:17:16,559
3d microscope it's a digital microscope

483
00:17:20,789 --> 00:17:18,640
system we have in our conservation

484
00:17:22,549 --> 00:17:20,799
laboratory at the iron space museum

485
00:17:24,309 --> 00:17:22,559
which is actually at the udvar hazy

486
00:17:25,990 --> 00:17:24,319
center and here we're looking at the

487
00:17:27,350 --> 00:17:26,000
cover right after we took it out of the

488
00:17:29,190 --> 00:17:27,360

package

489
00:17:30,950 --> 00:17:29,200
which is where i got some of those

490
00:17:34,470 --> 00:17:30,960
really close-up shots of the materials

491
00:17:36,230 --> 00:17:34,480
that we're going to look at next slide

492
00:17:38,230 --> 00:17:36,240
so you can see by the cover it is

493
00:17:39,510 --> 00:17:38,240
scuffed up it was definitely worn and

494
00:17:41,669 --> 00:17:39,520
used

495
00:17:43,909 --> 00:17:41,679
and packaged by nasa when it came back

496
00:17:45,990 --> 00:17:43,919
from the lunar surface mission we're not

497
00:17:48,390 --> 00:17:46,000
sure how much work they actually did to

498
00:17:50,230 --> 00:17:48,400
the cover before they packaged it

499
00:17:51,350 --> 00:17:50,240
but we did note that there weren't a lot

500
00:17:53,909 --> 00:17:51,360
of loose

501
00:17:56,070 --> 00:17:53,919
dirt in the crevices or in the folds so

502
00:17:58,390 --> 00:17:56,080
we know that they did clean it

503
00:18:01,029 --> 00:17:58,400
but you can see by the

504
00:18:03,190 --> 00:18:01,039
instructional tags on the outside of the

505
00:18:05,190 --> 00:18:03,200
ops cover that they are scuffed and

506
00:18:07,669 --> 00:18:05,200
they're abraded and you can see all that

507
00:18:09,750 --> 00:18:07,679
lunar dust the gray dust and the velcro

508
00:18:11,830 --> 00:18:09,760
which is really interesting

509
00:18:14,549 --> 00:18:11,840
next slide

510
00:18:16,390 --> 00:18:14,559
so lunar dust is really abrasive and it

511
00:18:18,070 --> 00:18:16,400
cuts into the materials on the outside

512
00:18:19,909 --> 00:18:18,080
of a spacesuit or

513
00:18:22,390 --> 00:18:19,919

the same materials that this ops cover

514
00:18:23,669 --> 00:18:22,400
is made of and you can see on the

515
00:18:25,510 --> 00:18:23,679
surfaces when you look at it under

516
00:18:27,830 --> 00:18:25,520
magnification that it's still embedded

517
00:18:29,830 --> 00:18:27,840
in all the fibers of that material and

518
00:18:31,430 --> 00:18:29,840
that's called beta cloth and the outside

519
00:18:34,150 --> 00:18:31,440
of all the spacesuits

520
00:18:36,310 --> 00:18:34,160
from the apollo time period ford

521
00:18:38,150 --> 00:18:36,320
is known it's called beta cloth this

522
00:18:40,470 --> 00:18:38,160
material it's a fiberglass material

523
00:18:42,150 --> 00:18:40,480
that's coated with a teflon coating and

524
00:18:44,390 --> 00:18:42,160
it was really really tough and was meant

525
00:18:46,390 --> 00:18:44,400
to keep meteorites out of the spacesuits

526
00:18:48,630 --> 00:18:46,400
or keep the suit from being punctured

527
00:18:50,710 --> 00:18:48,640
when it was being worn in space but this

528
00:18:52,710 --> 00:18:50,720
lunar dust is so abrasive that it embeds

529
00:18:54,230 --> 00:18:52,720
itself between the little fibers on the

530
00:18:57,430 --> 00:18:54,240
textile

531
00:18:59,510 --> 00:18:57,440
next slide

532
00:19:02,070 --> 00:18:59,520
so the spacesuits are made of about 21

533
00:19:03,750 --> 00:19:02,080
to 24 different materials

534
00:19:05,110 --> 00:19:03,760
and a lot of those materials we can't

535
00:19:07,190 --> 00:19:05,120
see so even though we can see the

536
00:19:09,270 --> 00:19:07,200
exterior material the beta cloth that i

537
00:19:11,350 --> 00:19:09,280
just showed you we cannot see any of

538
00:19:14,470 --> 00:19:11,360

these interior materials without looking

539
00:19:15,830 --> 00:19:14,480
through an x-ray machine or a cat scan

540
00:19:18,230 --> 00:19:15,840
machine which we do with some of our

541
00:19:20,150 --> 00:19:18,240
space suits but the ops cover would have

542
00:19:21,909 --> 00:19:20,160
had many of these materials inside

543
00:19:23,990 --> 00:19:21,919
because they're used to insulate that

544
00:19:26,070 --> 00:19:24,000
garment when it's on the lunar surface

545
00:19:27,029 --> 00:19:26,080
from radiation and thermal temperature

546
00:19:29,110 --> 00:19:27,039
changes

547
00:19:30,950 --> 00:19:29,120
so we have things like that you might be

548
00:19:35,350 --> 00:19:30,960
familiar with are velcro

549
00:19:37,029 --> 00:19:35,360
nylon dacron mylar

550
00:19:39,110 --> 00:19:37,039
and some other interesting materials

551
00:19:41,350 --> 00:19:39,120
that were made for the space age

552
00:19:43,029 --> 00:19:41,360
next slide

553
00:19:45,590 --> 00:19:43,039
so even though we see

554
00:19:47,110 --> 00:19:45,600
damage to the object this is actually

555
00:19:49,590 --> 00:19:47,120
damaged through use

556
00:19:52,070 --> 00:19:49,600
so you would not want to actually remove

557
00:19:54,230 --> 00:19:52,080
this damage or to repair it without much

558
00:19:55,270 --> 00:19:54,240
documentation and thought because it

559
00:19:57,110 --> 00:19:55,280
actually

560
00:19:59,029 --> 00:19:57,120
gives you interesting information about

561
00:20:01,750 --> 00:19:59,039
how the object was used on the lunar

562
00:20:03,750 --> 00:20:01,760
surface and these commander stripes

563
00:20:05,270 --> 00:20:03,760

which represented gene cern and as the

564
00:20:08,870 --> 00:20:05,280
commander of that

565
00:20:10,390 --> 00:20:08,880
mission were applied to his suit to so

566
00:20:12,310 --> 00:20:10,400
when people looked at the lunar surface

567
00:20:14,149 --> 00:20:12,320
during apollo 17 you would see one

568
00:20:15,750 --> 00:20:14,159
person that had red stripes on their

569
00:20:17,830 --> 00:20:15,760
spacesuit and one person that did not

570
00:20:19,909 --> 00:20:17,840
and you could tell them on television

571
00:20:21,909 --> 00:20:19,919
so the commander stripes are made out of

572
00:20:24,149 --> 00:20:21,919
a plastic material that's sewn to the

573
00:20:26,230 --> 00:20:24,159
outside of the textile and it got

574
00:20:28,470 --> 00:20:26,240
abraded on the surface and we see this

575
00:20:30,950 --> 00:20:28,480
abrasion a lot on the back of the

576
00:20:32,549 --> 00:20:30,960
spacesuit and in this particular case

577
00:20:35,430 --> 00:20:32,559
the cover where they sat in the lunar

578
00:20:37,510 --> 00:20:35,440
rover and the back of their portable

579
00:20:40,390 --> 00:20:37,520
life support system was rubbing up

580
00:20:42,549 --> 00:20:40,400
against the seat so because that sort of

581
00:20:44,870 --> 00:20:42,559
tells a story and it's information

582
00:20:46,549 --> 00:20:44,880
that's with the object we want to try to

583
00:20:48,870 --> 00:20:46,559
keep that information with the object as

584
00:20:50,950 --> 00:20:48,880
long as possible we do not want to

585
00:20:53,669 --> 00:20:50,960
repair it or

586
00:20:55,350 --> 00:20:53,679
take it away from the object so

587
00:20:57,350 --> 00:20:55,360
that's the kind of

588
00:20:59,350 --> 00:20:57,360

damage that we're used to seeing on

589
00:21:01,510 --> 00:20:59,360
space items it's all

590
00:21:03,510 --> 00:21:01,520
due to them actually using the object

591
00:21:05,909 --> 00:21:03,520
during its operation

592
00:21:07,669 --> 00:21:05,919
and we expect that

593
00:21:09,510 --> 00:21:07,679
next slide

594
00:21:11,430 --> 00:21:09,520
but what we didn't expect to see on this

595
00:21:13,590 --> 00:21:11,440
object which is interesting are these

596
00:21:16,549 --> 00:21:13,600
repairs that were made and we found

597
00:21:18,630 --> 00:21:16,559
several repairs on the ops cover

598
00:21:20,230 --> 00:21:18,640
and on top of the repairs were this

599
00:21:22,230 --> 00:21:20,240
opaque white

600
00:21:24,789 --> 00:21:22,240
silicone coating that somebody painted

601
00:21:27,110 --> 00:21:24,799
on the repair the beta cloth like i said

602
00:21:29,270 --> 00:21:27,120
to you was fiberglass so the fiberglass

603
00:21:31,350 --> 00:21:29,280
fibers are always breaking

604
00:21:33,110 --> 00:21:31,360
and often are fragmented when they come

605
00:21:34,470 --> 00:21:33,120
back from the lunar surface and we look

606
00:21:35,270 --> 00:21:34,480
at the objects

607
00:21:36,950 --> 00:21:35,280
so

608
00:21:39,029 --> 00:21:36,960
it's not uncommon that we would see

609
00:21:39,990 --> 00:21:39,039
fragmented fibers that may need to be

610
00:21:41,909 --> 00:21:40,000
fixed

611
00:21:43,750 --> 00:21:41,919
but on other suits in our collection

612
00:21:45,430 --> 00:21:43,760
we've also seen repairs similar in

613
00:21:47,750 --> 00:21:45,440

nature to this just not with the same

614
00:21:49,510 --> 00:21:47,760
sort of coating and we don't have an

615
00:21:52,149 --> 00:21:49,520
answer right now as to who coded the

616
00:21:53,990 --> 00:21:52,159
repair or when it was done did he do it

617
00:21:55,909 --> 00:21:54,000
in the limb did he do it

618
00:21:59,190 --> 00:21:55,919
in the capsule when they were bringing

619
00:22:00,870 --> 00:21:59,200
back the ops cover or did nasa do it to

620
00:22:01,909 --> 00:22:00,880
service the item when it was returned to

621
00:22:03,510 --> 00:22:01,919
earth

622
00:22:05,110 --> 00:22:03,520
so we are still looking into that and

623
00:22:07,190 --> 00:22:05,120
it's something we need to research more

624
00:22:08,230 --> 00:22:07,200
fully after the exhibits taken down in

625
00:22:09,750 --> 00:22:08,240
june

626
00:22:12,789 --> 00:22:09,760
next slide

627
00:22:14,710 --> 00:22:12,799
we also saw these hand-stitched threads

628
00:22:15,909 --> 00:22:14,720
across one of the repairs through the

629
00:22:17,510 --> 00:22:15,919
coating

630
00:22:19,510 --> 00:22:17,520
so

631
00:22:21,270 --> 00:22:19,520
i'm still not sure as well who would

632
00:22:22,310 --> 00:22:21,280
have stitched the materials back

633
00:22:24,070 --> 00:22:22,320
together

634
00:22:26,470 --> 00:22:24,080
they're definitely not

635
00:22:28,310 --> 00:22:26,480
a material that you would use

636
00:22:29,270 --> 00:22:28,320
in manufacturing the ops cover

637
00:22:31,830 --> 00:22:29,280
everything was

638
00:22:33,590 --> 00:22:31,840

machine stitched and they had very tight

639
00:22:35,270 --> 00:22:33,600
white little threads

640
00:22:36,230 --> 00:22:35,280
so we still need to look into this

641
00:22:38,950 --> 00:22:36,240
repair

642
00:22:42,070 --> 00:22:38,960
as soon as it comes off display

643
00:22:45,750 --> 00:22:44,549
so this is a close-up picture of the

644
00:22:48,230 --> 00:22:45,760
paints

645
00:22:50,789 --> 00:22:48,240
on the surface of the beta cloth so you

646
00:22:52,390 --> 00:22:50,799
can see the shiny material here where

647
00:22:55,110 --> 00:22:52,400
you can see that it's actually a glass

648
00:22:57,430 --> 00:22:55,120
fiber and the paints are sort of wearing

649
00:23:00,390 --> 00:22:57,440
away off that surface this is actually

650
00:23:01,830 --> 00:23:00,400
part of his name tag and if you noticed

651
00:23:03,830 --> 00:23:01,840
when we showed one of the first slides

652
00:23:06,390 --> 00:23:03,840
the name tag was painted or printed in

653
00:23:09,270 --> 00:23:06,400
red most of the printed name tags on any

654
00:23:11,270 --> 00:23:09,280
of the spacesuits or covers are black

655
00:23:13,350 --> 00:23:11,280
but gene cernan's was red and i still do

656
00:23:15,350 --> 00:23:13,360
not have an answer as to why that

657
00:23:17,270 --> 00:23:15,360
happened either but you can see the

658
00:23:19,190 --> 00:23:17,280
paints on the surface so this is

659
00:23:21,350 --> 00:23:19,200
something where we would just try to

660
00:23:22,549 --> 00:23:21,360
monitor the object and to keep track of

661
00:23:24,149 --> 00:23:22,559
its condition

662
00:23:26,870 --> 00:23:24,159
and to make sure that that's not

663
00:23:28,950 --> 00:23:26,880

worsening over time

664
00:23:31,029 --> 00:23:28,960
next slide

665
00:23:32,789 --> 00:23:31,039
this is another shot of the star

666
00:23:34,470 --> 00:23:32,799
and i just wanted to point out carefully

667
00:23:36,789 --> 00:23:34,480
that even though you can't see when you

668
00:23:38,070 --> 00:23:36,799
see the object upstairs on display

669
00:23:39,909 --> 00:23:38,080
you're not going to be able to see the

670
00:23:42,470 --> 00:23:39,919
lunar dust in the star

671
00:23:44,549 --> 00:23:42,480
itself the star is an unpainted

672
00:23:47,190 --> 00:23:44,559
portion of the flag that was applied

673
00:23:49,029 --> 00:23:47,200
with the original fabric showing through

674
00:23:51,430 --> 00:23:49,039
and under magnification you can see the

675
00:23:53,190 --> 00:23:51,440
lunar dust embedded in those tiny fibers

676
00:23:54,470 --> 00:23:53,200
but to the naked eye you don't see that

677
00:23:55,990 --> 00:23:54,480
so that's why we need to look at

678
00:23:57,430 --> 00:23:56,000
everything really really closely in the

679
00:23:59,269 --> 00:23:57,440
laboratory

680
00:24:00,789 --> 00:23:59,279
we don't want to

681
00:24:02,710 --> 00:24:00,799
do anything to the object or

682
00:24:04,149 --> 00:24:02,720
unnecessarily clean the surface of an

683
00:24:05,909 --> 00:24:04,159
object if we're not sure that it does

684
00:24:07,990 --> 00:24:05,919
have lunar dust on it

685
00:24:10,470 --> 00:24:08,000
and all these interesting repairs that i

686
00:24:11,909 --> 00:24:10,480
mentioned and features of the object are

687
00:24:13,830 --> 00:24:11,919
all information that we're going to

688
00:24:16,630 --> 00:24:13,840

archive with our object at the museum

689
00:24:18,310 --> 00:24:16,640
for future research and for people to

690
00:24:20,390 --> 00:24:18,320
learn about this is not stuff that was

691
00:24:22,390 --> 00:24:20,400
written in the history books so

692
00:24:24,470 --> 00:24:22,400
if somebody were to ask me what my

693
00:24:25,350 --> 00:24:24,480
coolest part of my job is which i often

694
00:24:27,029 --> 00:24:25,360
get

695
00:24:29,510 --> 00:24:27,039
it's that we're adding information to

696
00:24:30,950 --> 00:24:29,520
history that the history is coming alive

697
00:24:33,669 --> 00:24:30,960
and we're recording things about our

698
00:24:35,269 --> 00:24:33,679
objects that no one's ever seen before

699
00:24:38,310 --> 00:24:35,279
especially in this case this object's

700
00:24:40,390 --> 00:24:38,320
been wrapped up for 40 years and

701
00:24:42,390 --> 00:24:40,400
we're adding information to that history

702
00:24:44,070 --> 00:24:42,400
of those lunar missions

703
00:24:46,549 --> 00:24:44,080
next slide

704
00:24:48,710 --> 00:24:46,559
and just to wrap up quickly this is the

705
00:24:50,070 --> 00:24:48,720
object after conservation it doesn't

706
00:24:52,070 --> 00:24:50,080
look much different than it did when i

707
00:24:54,789 --> 00:24:52,080
unwrapped it but i have documented

708
00:24:56,390 --> 00:24:54,799
analyzed it and stabilized it for

709
00:24:57,830 --> 00:24:56,400
display and we're going to see this up

710
00:24:59,990 --> 00:24:57,840
in the gallery when we go up for our

711
00:25:01,510 --> 00:25:00,000
tour afterwards

712
00:25:06,549 --> 00:25:01,520
thank you

713
00:25:09,029 --> 00:25:06,559

dr gregory quinn he is a

714
00:25:11,669 --> 00:25:09,039
research science research engineer at

715
00:25:13,669 --> 00:25:11,679
utc aerospace systems

716
00:25:16,310 --> 00:25:13,679
jennifer

717
00:25:19,029 --> 00:25:16,320
my job at utc aerospace systems is to

718
00:25:20,470 --> 00:25:19,039
research new technologies for spacesuits

719
00:25:21,590 --> 00:25:20,480
and spacecraft

720
00:25:22,630 --> 00:25:21,600
and

721
00:25:27,990 --> 00:25:22,640
we

722
00:25:30,470 --> 00:25:28,000
backpack for the apollo space suit as

723
00:25:34,070 --> 00:25:30,480
well as the one for the space suit that

724
00:25:36,390 --> 00:25:34,080
flew on shuttle is in and is up on the

725
00:25:38,870 --> 00:25:36,400
space station right now this afternoon

726
00:25:40,789 --> 00:25:38,880
i'm going to tell you a little bit about

727
00:25:42,950 --> 00:25:40,799
what a space suit has to do for the

728
00:25:45,669 --> 00:25:42,960
astronaut in a little more detail and

729
00:25:47,750 --> 00:25:45,679
then going to what's being done for the

730
00:25:49,750 --> 00:25:47,760
next generation of spacesuits some of

731
00:25:52,230 --> 00:25:49,760
the challenges that we face in getting

732
00:25:55,269 --> 00:25:52,240
people beyond low earth orbit and how

733
00:25:55,279 --> 00:25:59,590
next slide please

734
00:26:03,190 --> 00:26:00,950
so this is a

735
00:26:06,149 --> 00:26:03,200
thank you the

736
00:26:08,870 --> 00:26:06,159
basic life support functions uh as were

737
00:26:11,510 --> 00:26:08,880
mentioned earlier is to provide

738
00:26:13,669 --> 00:26:11,520

oxygen for the crew member to breathe

739
00:26:16,710 --> 00:26:13,679
provide pressure on the body right now

740
00:26:18,310 --> 00:26:16,720
we're at 14.7 pounds per square inch of

741
00:26:20,310 --> 00:26:18,320
air pressure

742
00:26:22,470 --> 00:26:20,320
you need at least two to survive and

743
00:26:24,789 --> 00:26:22,480
most spacesuits operate at around four

744
00:26:27,669 --> 00:26:24,799
or five pounds per square inch so that

745
00:26:29,269 --> 00:26:27,679
has to be provided

746
00:26:31,590 --> 00:26:29,279
we have to remove

747
00:26:34,149 --> 00:26:31,600
the gases that everyone exhales most of

748
00:26:36,549 --> 00:26:34,159
that is carbon dioxide and it's a closed

749
00:26:37,990 --> 00:26:36,559
circulation loop so it would go into the

750
00:26:41,029 --> 00:26:38,000
suit and come back around into the

751
00:26:42,950 --> 00:26:41,039
helmet again if we didn't get rid of it

752
00:26:45,269 --> 00:26:42,960
we need to provide the right temperature

753
00:26:47,750 --> 00:26:45,279
for the crew members for the astronauts

754
00:26:51,590 --> 00:26:47,760
it can be very very cold in space down

755
00:26:53,110 --> 00:26:51,600
to minus 250 degrees or as much as 250

756
00:26:55,990 --> 00:26:53,120
degrees

757
00:26:57,430 --> 00:26:56,000
in the sun and in hot locations so they

758
00:26:59,190 --> 00:26:57,440
need to work in those environments that

759
00:27:01,190 --> 00:26:59,200
could change within minutes of each

760
00:27:03,110 --> 00:27:01,200
other and the suits need to protect them

761
00:27:05,750 --> 00:27:03,120
from that

762
00:27:07,909 --> 00:27:05,760
we also provide communications to

763
00:27:09,909 --> 00:27:07,919

the astronauts you can't just talk

764
00:27:11,669 --> 00:27:09,919
through your helmet bubble to the person

765
00:27:14,630 --> 00:27:11,679
next to you because there's no air to

766
00:27:17,190 --> 00:27:14,640
carry your voice from person to person

767
00:27:19,510 --> 00:27:17,200
and finally emergency provisions if

768
00:27:22,149 --> 00:27:19,520
there's a tear in the suit if the fan

769
00:27:23,110 --> 00:27:22,159
stops working if the pump stops working

770
00:27:27,029 --> 00:27:23,120
the

771
00:27:29,510 --> 00:27:27,039
oxygen pack

772
00:27:32,310 --> 00:27:29,520
provide emergency functions to the suit

773
00:27:34,149 --> 00:27:32,320
for about 30 minutes so that you can the

774
00:27:37,110 --> 00:27:34,159
astronauts can get safely back into

775
00:27:37,120 --> 00:27:40,389
next slide please

776
00:27:45,669 --> 00:27:43,510
now we've provided these functions to

777
00:27:46,789 --> 00:27:45,679
the gemini astronauts the apollo

778
00:27:49,430 --> 00:27:46,799
astronauts

779
00:27:50,389 --> 00:27:49,440
shuttle and the space station but going

780
00:27:53,350 --> 00:27:50,399
further

781
00:27:56,549 --> 00:27:53,360
will require a new generation of suit

782
00:27:58,549 --> 00:27:56,559
that's more self-reliant lighter weight

783
00:28:01,990 --> 00:27:58,559
and more reliable than the past suits

784
00:28:04,230 --> 00:28:02,000
have been as amazing as those have been

785
00:28:06,149 --> 00:28:04,240
i liken it to the space station too

786
00:28:08,230 --> 00:28:06,159
being at a hotel you drive up to the

787
00:28:10,789 --> 00:28:08,240
hotel you can take your huge bags with

788
00:28:12,710 --> 00:28:10,799

you you put them in your room you can go

789
00:28:14,549 --> 00:28:12,720
out and get dinner and come back you can

790
00:28:15,430 --> 00:28:14,559
have family members come and supply you

791
00:28:17,750 --> 00:28:15,440
with

792
00:28:19,669 --> 00:28:17,760
fresh clothes if you run out

793
00:28:22,310 --> 00:28:19,679
similar the space station gets

794
00:28:24,070 --> 00:28:22,320
resupplies regularly from the earth

795
00:28:26,070 --> 00:28:24,080
and they have a lot of room to store

796
00:28:27,909 --> 00:28:26,080
spare parts and everything they need the

797
00:28:30,230 --> 00:28:27,919
provisions

798
00:28:32,389 --> 00:28:30,240
going to the moon was more difficult

799
00:28:34,870 --> 00:28:32,399
they had about a three day return they

800
00:28:37,350 --> 00:28:34,880
were going to be there doing up to three

801
00:28:38,789 --> 00:28:37,360
moon walks for each mission

802
00:28:40,389 --> 00:28:38,799
and they had to take everything with

803
00:28:42,549 --> 00:28:40,399
them and take everything back that they

804
00:28:44,310 --> 00:28:42,559
could it's a lot like backpacking you

805
00:28:46,230 --> 00:28:44,320
might be on the trail it might take you

806
00:28:47,430 --> 00:28:46,240
a day to get off the trail if something

807
00:28:51,110 --> 00:28:47,440
goes wrong

808
00:28:52,630 --> 00:28:51,120
equipment your backpack your boots you

809
00:28:54,149 --> 00:28:52,640
had to deal with it for a short amount

810
00:28:56,789 --> 00:28:54,159
of time

811
00:28:58,630 --> 00:28:56,799
going as far as mars though is a whole

812
00:29:00,149 --> 00:28:58,640
other story

813
00:29:01,990 --> 00:29:00,159

the astronauts that go to mars

814
00:29:03,909 --> 00:29:02,000
eventually or back to the moon for a

815
00:29:05,510 --> 00:29:03,919
moon base

816
00:29:07,830 --> 00:29:05,520
will be out there for

817
00:29:09,669 --> 00:29:07,840
possibly years at a time without

818
00:29:11,590 --> 00:29:09,679
reliable resupply

819
00:29:13,590 --> 00:29:11,600
they'll have to be able to service their

820
00:29:16,230 --> 00:29:13,600
equipment including their spacesuits

821
00:29:19,110 --> 00:29:16,240
with only what they have on hand

822
00:29:21,350 --> 00:29:19,120
so it's more akin to being at something

823
00:29:23,510 --> 00:29:21,360
like an arctic research station

824
00:29:25,430 --> 00:29:23,520
where weather and other events can have

825
00:29:26,389 --> 00:29:25,440
them snowed in for months and months on

826
00:29:27,830 --> 00:29:26,399
end

827
00:29:29,669 --> 00:29:27,840
so the spacesuits even though they're

828
00:29:32,310 --> 00:29:29,679
supplying the same functions to the

829
00:29:34,149 --> 00:29:32,320
astronauts they have to be

830
00:29:35,430 --> 00:29:34,159
built to be serviced built to be

831
00:29:38,470 --> 00:29:35,440
reliable

832
00:29:41,269 --> 00:29:38,480
and built to last a lot longer

833
00:29:43,669 --> 00:29:41,279
the components on the apollo suits only

834
00:29:45,590 --> 00:29:43,679
had to last three walks and some of them

835
00:29:47,669 --> 00:29:45,600
were getting pretty beat up by the end

836
00:29:49,909 --> 00:29:47,679
of those moon walks

837
00:29:53,430 --> 00:29:49,919
that can't happen on mars when they need

838
00:29:56,149 --> 00:29:53,440

to be used possibly for a hundred times

839
00:29:59,110 --> 00:29:56,159
so that's one of the challenges that

840
00:30:01,669 --> 00:29:59,120
nasa and engineers will have to solve to

841
00:30:04,310 --> 00:30:01,679
get us past low earth orbit

842
00:30:09,110 --> 00:30:06,789
fortunately work has already begun on

843
00:30:11,590 --> 00:30:09,120
this and this to me is exciting work

844
00:30:14,149 --> 00:30:11,600
it's work that i've participated in that

845
00:30:14,950 --> 00:30:14,159
with nasa in the community

846
00:30:16,710 --> 00:30:14,960
and

847
00:30:17,909 --> 00:30:16,720
one of the

848
00:30:19,590 --> 00:30:17,919
uh

849
00:30:23,350 --> 00:30:19,600
efforts has been on the life support

850
00:30:26,070 --> 00:30:23,360
system back about four years ago in 2011

851
00:30:29,750 --> 00:30:26,080
nasa put together a functional system so

852
00:30:32,389 --> 00:30:29,760
they had all the different parts of the

853
00:30:34,789 --> 00:30:32,399
portable life support system spread over

854
00:30:36,230 --> 00:30:34,799
lots of different racks in in the lab

855
00:30:38,789 --> 00:30:36,240
and you can see the picture on the left

856
00:30:40,870 --> 00:30:38,799
there ha is is fairly big it doesn't

857
00:30:42,310 --> 00:30:40,880
look anything like a backpack but it did

858
00:30:44,230 --> 00:30:42,320
all of those functions that i talked

859
00:30:45,909 --> 00:30:44,240
about earlier

860
00:30:48,470 --> 00:30:45,919
just last year they finished building

861
00:30:50,950 --> 00:30:48,480
and started testing the next version of

862
00:30:53,190 --> 00:30:50,960
that that had upgraded components

863
00:30:55,510 --> 00:30:53,200

and incorporated the lessons that they

864
00:30:57,509 --> 00:30:55,520
learned on that previous system and they

865
00:31:00,789 --> 00:30:57,519
packaged it down to something about the

866
00:31:02,870 --> 00:31:00,799
size of a backpack today

867
00:31:04,789 --> 00:31:02,880
that one is still under test but one of

868
00:31:06,310 --> 00:31:04,799
the things that's been exciting about

869
00:31:08,470 --> 00:31:06,320
that is

870
00:31:09,430 --> 00:31:08,480
uh test subjects have actually breathed

871
00:31:11,750 --> 00:31:09,440
on it

872
00:31:13,029 --> 00:31:11,760
not down at low pressures or with pure

873
00:31:15,269 --> 00:31:13,039
oxygen but

874
00:31:17,830 --> 00:31:15,279
roon type gases but they have been

875
00:31:18,789 --> 00:31:17,840
breathing on it and getting test data

876
00:31:20,389 --> 00:31:18,799
from

877
00:31:23,509 --> 00:31:20,399
subjects that way

878
00:31:25,430 --> 00:31:23,519
the next version is already being built

879
00:31:27,830 --> 00:31:25,440
it probably won't be ready for at least

880
00:31:30,310 --> 00:31:27,840
around two or three years but it will be

881
00:31:32,310 --> 00:31:30,320
a functional prototype in the end that

882
00:31:34,470 --> 00:31:32,320
they'll be putting in vacuum chambers so

883
00:31:36,630 --> 00:31:34,480
they pump out all the gases in the room

884
00:31:38,149 --> 00:31:36,640
and the crew member will be breathing on

885
00:31:40,149 --> 00:31:38,159
that unit

886
00:31:42,549 --> 00:31:40,159
and that's the last step necessary

887
00:31:45,269 --> 00:31:42,559
before a production unit is made and

888
00:31:48,710 --> 00:31:45,279

people fly with it in space again

889
00:31:50,470 --> 00:31:48,720
so these new items are addressing the

890
00:31:52,470 --> 00:31:50,480
technology needs

891
00:31:54,470 --> 00:31:52,480
for getting us back outside the

892
00:31:56,630 --> 00:31:54,480
spacecraft in the future

893
00:31:58,470 --> 00:31:56,640
next slide

894
00:31:59,350 --> 00:31:58,480
one of the other interesting challenges

895
00:32:02,950 --> 00:31:59,360
that

896
00:32:06,549 --> 00:32:02,960
i face as an engineer nasa faces is

897
00:32:10,870 --> 00:32:08,710
nasa's been addressing this in quite a

898
00:32:13,190 --> 00:32:10,880
unique way and there's some

899
00:32:15,669 --> 00:32:13,200
exhibits here in this gallery in fact

900
00:32:17,909 --> 00:32:15,679
that point to it where they're looking

901
00:32:19,830 --> 00:32:17,919
to commercialize travel up to orbit to

902
00:32:22,310 --> 00:32:19,840
the space station where they're paying

903
00:32:25,430 --> 00:32:22,320
companies like spacex and in orbital

904
00:32:26,870 --> 00:32:25,440
sciences to ship crew and cargo up to

905
00:32:29,590 --> 00:32:26,880
the station they pay them for the

906
00:32:31,909 --> 00:32:29,600
services and they get their

907
00:32:34,789 --> 00:32:31,919
uh astronauts and and resupplies that

908
00:32:37,029 --> 00:32:34,799
way what that lets nasa do is focus

909
00:32:39,350 --> 00:32:37,039
their energy and more of their money on

910
00:32:40,310 --> 00:32:39,360
deep space exploration going to those

911
00:32:42,389 --> 00:32:40,320
next

912
00:32:44,070 --> 00:32:42,399
amazing destinations like mars or an

913
00:32:45,990 --> 00:32:44,080

asteroid

914
00:32:48,389 --> 00:32:46,000
at the same time

915
00:32:51,269 --> 00:32:48,399
the companies that partner with nasa

916
00:32:53,350 --> 00:32:51,279
have to invest in cost savings for those

917
00:32:55,509 --> 00:32:53,360
commercial endeavors

918
00:32:59,110 --> 00:32:55,519
that also benefit things like the space

919
00:33:00,710 --> 00:32:59,120
suit so we figure out how to make things

920
00:33:01,830 --> 00:33:00,720
less expensive

921
00:33:04,789 --> 00:33:01,840
and

922
00:33:06,870 --> 00:33:04,799
that helps us all get out into space

923
00:33:09,669 --> 00:33:06,880
sooner

924
00:33:12,789 --> 00:33:10,389
so

925
00:33:14,789 --> 00:33:12,799
with the technology challenges starting

926
00:33:17,750 --> 00:33:14,799
to be met the cost challenge is being

927
00:33:19,990 --> 00:33:17,760
met and the technology is evolving

928
00:33:22,870 --> 00:33:20,000
we're going to be able to get

929
00:33:25,110 --> 00:33:22,880
astronauts back into deep space

930
00:33:26,470 --> 00:33:25,120
fairly soon certainly within all of our

931
00:33:28,710 --> 00:33:26,480
lifetimes

932
00:33:31,509 --> 00:33:28,720
and i hope that

933
00:33:32,630 --> 00:33:31,519
these galleries and the presentations

934
00:33:34,389 --> 00:33:32,640
today

935
00:33:37,430 --> 00:33:34,399
start instilling some of that excitement

936
00:33:40,310 --> 00:33:37,440
in all of you because for all i know

937
00:33:42,549 --> 00:33:40,320
10 15 years down the line

938
00:33:44,549 --> 00:33:42,559

you could be looking for jobs at nasa at

939
00:33:45,830 --> 00:33:44,559
the aerospace companies that make all of

940
00:33:47,269 --> 00:33:45,840
this happen

941
00:33:49,350 --> 00:33:47,279
so i

942
00:33:51,350 --> 00:33:49,360
hope that excitement catches in all of

943
00:33:52,710 --> 00:33:51,360
you a little bit today

944
00:33:56,870 --> 00:33:52,720
thank you

945
00:33:58,149 --> 00:33:56,880
question and answers um and some of

946
00:33:59,909 --> 00:33:58,159
those we'll be getting from our online

947
00:34:00,870 --> 00:33:59,919
viewers as well so if you have a

948
00:34:10,950 --> 00:34:00,880
question you can step up to the

949
00:34:10,960 --> 00:34:17,190
we have an online question

950
00:34:22,310 --> 00:34:19,190
what is the most challenging part of

951
00:34:23,909 --> 00:34:22,320
preparing these objects for display

952
00:34:28,629 --> 00:34:23,919
i think lisa will probably take that one

953
00:34:32,710 --> 00:34:30,629
thank you katie

954
00:34:36,310 --> 00:34:32,720
the most challenging part of preparing

955
00:34:38,069 --> 00:34:36,320
an object for displays as i said earlier

956
00:34:41,030 --> 00:34:38,079
is making sure that the materials

957
00:34:42,710 --> 00:34:41,040
actually just don't change over time so

958
00:34:44,149 --> 00:34:42,720
when you're handling the object and

959
00:34:45,829 --> 00:34:44,159
you're thinking about the environment

960
00:34:47,030 --> 00:34:45,839
that you're going to put it in in the

961
00:34:51,270 --> 00:34:47,040
exhibition

962
00:34:55,349 --> 00:34:53,829
influence those materials over time

963
00:34:57,109 --> 00:34:55,359

what kind of things would make them

964
00:34:59,910 --> 00:34:57,119
change and then try to build an

965
00:35:02,230 --> 00:34:59,920
environment to keep them from changing

966
00:35:03,510 --> 00:35:02,240
so we call that stabilizing the object

967
00:35:04,630 --> 00:35:03,520
and we think about things like

968
00:35:05,910 --> 00:35:04,640
temperature

969
00:35:08,630 --> 00:35:05,920
humidity

970
00:35:09,910 --> 00:35:08,640
light levels uv radiation

971
00:35:12,390 --> 00:35:09,920
pollutants

972
00:35:13,910 --> 00:35:12,400
and even people's handling the objects

973
00:35:16,390 --> 00:35:13,920
which is why our objects are all in

974
00:35:18,069 --> 00:35:16,400
display cases in the museum so nothing

975
00:35:23,109 --> 00:35:18,079
happens to that object for the entire

976
00:35:28,870 --> 00:35:25,750
my name is richard baker doctor what are

977
00:35:32,550 --> 00:35:31,510
solar radiation cosmic radiation versus

978
00:35:33,990 --> 00:35:32,560
your

979
00:35:39,829 --> 00:35:34,000
spacesuits

980
00:35:46,710 --> 00:35:41,349
part

981
00:35:48,470 --> 00:35:46,720
exposure to radiation especially on mars

982
00:35:50,310 --> 00:35:48,480
where

983
00:35:51,670 --> 00:35:50,320
we have a

984
00:35:53,349 --> 00:35:51,680
belt of radiation around the earth

985
00:35:55,510 --> 00:35:53,359
called the van allen belts that protect

986
00:35:57,430 --> 00:35:55,520
us from some of the cosmic rays and more

987
00:35:59,430 --> 00:35:57,440
dangerous radiation that we get

988
00:36:01,109 --> 00:35:59,440

bombarded with that's not the case on

989
00:36:02,870 --> 00:36:01,119
mars that it doesn't have that same

990
00:36:06,069 --> 00:36:02,880
protection

991
00:36:07,990 --> 00:36:06,079
fortunately on the surface of mars

992
00:36:10,069 --> 00:36:08,000
you have 50 percent protection just by

993
00:36:12,790 --> 00:36:10,079
standing on the ground the planet itself

994
00:36:15,829 --> 00:36:12,800
protects the the crew members from half

995
00:36:19,750 --> 00:36:17,670
part of it will be looking at the total

996
00:36:21,829 --> 00:36:19,760
dosage of what they expect get exposed

997
00:36:23,750 --> 00:36:21,839
to and protecting them on the way there

998
00:36:24,630 --> 00:36:23,760
by surrounding their

999
00:36:27,030 --> 00:36:24,640
living

1000
00:36:28,550 --> 00:36:27,040
capsules perhaps with water or other

1001
00:36:30,790 --> 00:36:28,560
protection

1002
00:36:33,190 --> 00:36:30,800
there's been some ideas about

1003
00:36:35,510 --> 00:36:33,200
putting crew quarters underground

1004
00:36:38,150 --> 00:36:35,520
building up enough ground around them to

1005
00:36:40,790 --> 00:36:38,160
protect them while they're not on eva

1006
00:36:43,349 --> 00:36:40,800
protecting them on eva it's them itself

1007
00:36:46,150 --> 00:36:43,359
is going to be quite a challenge and i

1008
00:36:48,150 --> 00:36:46,160
i'm not sure that the suits are going to

1009
00:36:51,349 --> 00:36:48,160
provide the same level of protection as

1010
00:36:53,349 --> 00:36:51,359
the crew modules themselves um there's

1011
00:36:55,589 --> 00:36:53,359
the balance between

1012
00:36:58,069 --> 00:36:55,599
the ability to do work and and the

1013
00:37:03,670 --> 00:36:58,079

weight that they carry so it might be a

1014
00:37:11,910 --> 00:37:06,150
and we have another online question

1015
00:37:11,920 --> 00:37:15,030
go ahead lisa

1016
00:37:18,630 --> 00:37:16,870
lunar dust consists of a lot of

1017
00:37:21,349 --> 00:37:18,640
different elements there's actually a

1018
00:37:22,950 --> 00:37:21,359
lot of iron in the dust and

1019
00:37:24,870 --> 00:37:22,960
even though it appears gray when you

1020
00:37:27,109 --> 00:37:24,880
look at lunar pictures or you look at

1021
00:37:29,270 --> 00:37:27,119
the pictures of the objects up close is

1022
00:37:31,990 --> 00:37:29,280
actually an orange brown color

1023
00:37:33,670 --> 00:37:32,000
so it has a lot of iron in it

1024
00:37:36,550 --> 00:37:33,680
calcium

1025
00:37:39,109 --> 00:37:36,560
and a lot of glass silicon particles

1026
00:37:40,710 --> 00:37:39,119
which makes it very angular and

1027
00:37:48,870 --> 00:37:40,720
that's what makes it so abrasive to the

1028
00:37:53,349 --> 00:37:50,950
this is uh i'm david devorkin i'm a

1029
00:37:56,390 --> 00:37:53,359
curator here and i'm always wondering

1030
00:37:58,710 --> 00:37:56,400
how people get interested in this this

1031
00:38:00,470 --> 00:37:58,720
kind of subject and i think this should

1032
00:38:02,630 --> 00:38:00,480
apply to all three of you

1033
00:38:04,390 --> 00:38:02,640
uh when you were kids

1034
00:38:05,990 --> 00:38:04,400
uh what was it that

1035
00:38:07,829 --> 00:38:06,000
did you ever think that you would get

1036
00:38:10,790 --> 00:38:07,839
involved in building spacesuits or

1037
00:38:12,390 --> 00:38:10,800
displaying spacesuits and uh

1038
00:38:15,750 --> 00:38:12,400

i think for the

1039
00:38:18,310 --> 00:38:15,760
kids in the audience including myself uh

1040
00:38:19,030 --> 00:38:18,320
be always be interesting to

1041
00:38:20,950 --> 00:38:19,040
to

1042
00:38:23,190 --> 00:38:20,960
get a sense of

1043
00:38:24,310 --> 00:38:23,200
how you got where you were you know who

1044
00:38:26,550 --> 00:38:24,320
you are

1045
00:38:28,630 --> 00:38:26,560
and uh maybe

1046
00:38:31,349 --> 00:38:28,640
you can choose which one of you wants to

1047
00:38:33,270 --> 00:38:31,359
start off with that sure

1048
00:38:35,430 --> 00:38:33,280
uh how did i get to where i am well i'm

1049
00:38:38,630 --> 00:38:35,440
a curator here uh which means that part

1050
00:38:40,550 --> 00:38:38,640
of my job is taking care of artifacts uh

1051
00:38:41,990 --> 00:38:40,560
and also researching them i do a lot of

1052
00:38:44,390 --> 00:38:42,000
history research so i'm really a

1053
00:38:45,750 --> 00:38:44,400
historian who gets to work with objects

1054
00:38:46,630 --> 00:38:45,760
which is a really cool thing to get to

1055
00:38:48,470 --> 00:38:46,640
do

1056
00:38:51,670 --> 00:38:48,480
i was always interested in history as a

1057
00:38:53,109 --> 00:38:51,680
kid i thought it was really interesting

1058
00:38:55,589 --> 00:38:53,119
just learning about how people used to

1059
00:38:57,589 --> 00:38:55,599
do things but i also had a really strong

1060
00:38:59,270 --> 00:38:57,599
interest in science fiction

1061
00:39:01,030 --> 00:38:59,280
when i was growing up star wars was the

1062
00:39:02,950 --> 00:39:01,040
really big thing and so because i really

1063
00:39:05,670 --> 00:39:02,960

enjoyed that i ended up getting really

1064
00:39:07,109 --> 00:39:05,680
lucky in that i could um get inspired by

1065
00:39:09,910 --> 00:39:07,119
some of those movies and things that i

1066
00:39:11,750 --> 00:39:09,920
watched as a kid and uh when i got to

1067
00:39:13,430 --> 00:39:11,760
college i got my degree in history and i

1068
00:39:15,430 --> 00:39:13,440
kind of kept going with things

1069
00:39:18,550 --> 00:39:15,440
to the point of applying for a job here

1070
00:39:21,349 --> 00:39:18,560
and as i worked here i worked on my phd

1071
00:39:23,190 --> 00:39:21,359
and i get to be a real full-fledged

1072
00:39:25,190 --> 00:39:23,200
curator i get to go and hang out with

1073
00:39:26,870 --> 00:39:25,200
people like lisa and get to learn about

1074
00:39:29,030 --> 00:39:26,880
the more of the science that we do here

1075
00:39:30,390 --> 00:39:29,040
at the museum i'm not a scientist myself

1076
00:39:32,390 --> 00:39:30,400
but i'm really interested in the work

1077
00:39:33,910 --> 00:39:32,400
she does because it's different than

1078
00:39:35,990 --> 00:39:33,920
what i do and she gets to learn about

1079
00:39:37,589 --> 00:39:36,000
objects in a different way i learn about

1080
00:39:39,270 --> 00:39:37,599
objects usually by looking at a lot of

1081
00:39:41,430 --> 00:39:39,280
papers which is what a lot of historians

1082
00:39:43,829 --> 00:39:41,440
do they look at documents

1083
00:39:45,670 --> 00:39:43,839
and lisa though gets to investigate

1084
00:39:47,829 --> 00:39:45,680
things with microscopes so i work with

1085
00:39:49,430 --> 00:39:47,839
her a lot and just seeing exactly how

1086
00:39:51,589 --> 00:39:49,440
things are made which is a really fun

1087
00:39:54,069 --> 00:39:51,599
part of my job getting to spend time in

1088
00:39:55,990 --> 00:39:54,079

that with the objects but also we get to

1089
00:39:58,069 --> 00:39:56,000
develop exhibits here as curators which

1090
00:39:59,270 --> 00:39:58,079
is part of what i've been doing for the

1091
00:40:01,349 --> 00:39:59,280
last um

1092
00:40:03,829 --> 00:40:01,359
probably six or seven years i worked on

1093
00:40:05,430 --> 00:40:03,839
this exhibit here moving beyond earth

1094
00:40:07,030 --> 00:40:05,440
and i also worked on the exhibit will go

1095
00:40:08,870 --> 00:40:07,040
see i was a curator for the outside the

1096
00:40:10,950 --> 00:40:08,880
spacecraft exhibit so you get to think

1097
00:40:12,950 --> 00:40:10,960
about how do we show our visitors how do

1098
00:40:14,710 --> 00:40:12,960
we get to show all of you the history of

1099
00:40:16,390 --> 00:40:14,720
space flight and

1100
00:40:18,470 --> 00:40:16,400
that's one of my favorite parts actually

1101
00:40:19,829 --> 00:40:18,480
is getting to think in terms of what a

1102
00:40:22,710 --> 00:40:19,839
visitor would come to the museum and

1103
00:40:24,790 --> 00:40:22,720
want to see so it's kind of where my

1104
00:40:28,230 --> 00:40:24,800
path to getting to this point and i'll

1105
00:40:32,390 --> 00:40:29,829
well i

1106
00:40:33,270 --> 00:40:32,400
have been interested in space

1107
00:40:34,790 --> 00:40:33,280
for

1108
00:40:36,790 --> 00:40:34,800
as long as i can remember but there are

1109
00:40:38,790 --> 00:40:36,800
a few things in particular when i was

1110
00:40:41,270 --> 00:40:38,800
very young that that i

1111
00:40:42,550 --> 00:40:41,280
can recall one i remember reading a book

1112
00:40:44,390 --> 00:40:42,560
about a boy

1113
00:40:46,309 --> 00:40:44,400

who goes to a space station it was a

1114
00:40:48,230 --> 00:40:46,319
children's book and i was very

1115
00:40:50,309 --> 00:40:48,240
disappointed to find out after reading

1116
00:40:51,829 --> 00:40:50,319
the book that

1117
00:40:53,589 --> 00:40:51,839
kids couldn't go to the space station

1118
00:40:56,470 --> 00:40:53,599
because there wasn't one

1119
00:40:59,829 --> 00:40:56,480
well i wanted to help remedy that

1120
00:41:03,030 --> 00:40:59,839
uh i also built untold numbers of lego

1121
00:41:04,950 --> 00:41:03,040
spaceships not unlike uh the one in the

1122
00:41:06,950 --> 00:41:04,960
spaceship movie benny's spaceship the

1123
00:41:09,030 --> 00:41:06,960
little space guy well i played with the

1124
00:41:11,670 --> 00:41:09,040
original ones of them and made lots of

1125
00:41:13,589 --> 00:41:11,680
them i like the science fiction star

1126
00:41:14,470 --> 00:41:13,599
wars star trek as well

1127
00:41:15,910 --> 00:41:14,480
but

1128
00:41:17,030 --> 00:41:15,920
as i got older

1129
00:41:18,790 --> 00:41:17,040
i took some

1130
00:41:21,190 --> 00:41:18,800
courses in high school that were

1131
00:41:23,270 --> 00:41:21,200
engineering based construction based and

1132
00:41:26,870 --> 00:41:23,280
i went from there into college into

1133
00:41:28,550 --> 00:41:26,880
engineering and i happened to

1134
00:41:30,470 --> 00:41:28,560
have an alumni from my college who

1135
00:41:33,109 --> 00:41:30,480
recruited me to

1136
00:41:40,309 --> 00:41:33,119
utc aerospace and have been enjoying my

1137
00:41:44,870 --> 00:41:42,390
i was always interested in science as a

1138
00:41:47,030 --> 00:41:44,880

child but i will have to

1139
00:41:49,750 --> 00:41:47,040
play my mom for dragging me to museums

1140
00:41:52,309 --> 00:41:49,760
my entire life and exposing me to

1141
00:41:54,309 --> 00:41:52,319
all the history and culture out there

1142
00:41:56,710 --> 00:41:54,319
but i think really when i saw

1143
00:41:59,030 --> 00:41:56,720
the tuta common exhibit in the 1980s

1144
00:42:01,109 --> 00:41:59,040
here at the national gallery

1145
00:42:03,030 --> 00:42:01,119
and saw the king traveled here and the

1146
00:42:04,470 --> 00:42:03,040
materials involved with that

1147
00:42:06,470 --> 00:42:04,480
exhibit that i really wanted to do

1148
00:42:08,069 --> 00:42:06,480
archaeology so i actually started in

1149
00:42:11,910 --> 00:42:08,079
archaeology

1150
00:42:13,510 --> 00:42:11,920
and went into science from there because

1151
00:42:15,190 --> 00:42:13,520
two parts of archaeology you're really

1152
00:42:17,510 --> 00:42:15,200
digging in the field or you're working

1153
00:42:19,510 --> 00:42:17,520
in the laboratory doing science or in a

1154
00:42:21,510 --> 00:42:19,520
museum so i chose

1155
00:42:24,069 --> 00:42:21,520
laboratories and science but the main

1156
00:42:26,069 --> 00:42:24,079
reason i love my job and

1157
00:42:28,309 --> 00:42:26,079
went into conservation was because i get

1158
00:42:29,670 --> 00:42:28,319
to touch everything in the museum and i

1159
00:42:32,230 --> 00:42:29,680
didn't like going to exhibits and not

1160
00:42:33,990 --> 00:42:32,240
being able to touch anything so

1161
00:42:35,750 --> 00:42:34,000
unfortunately you all can't touch

1162
00:42:38,390 --> 00:42:35,760
everything in our displays

1163
00:42:39,829 --> 00:42:38,400

but um there are a few of us that can

1164
00:42:42,150 --> 00:42:39,839
and i want to just make sure that

1165
00:42:44,630 --> 00:42:42,160
everything that we do touch is available

1166
00:42:46,630 --> 00:42:44,640
to you all for future generations to

1167
00:42:47,910 --> 00:42:46,640
enjoy and to come see at the museum and

1168
00:42:51,349 --> 00:42:47,920
that nothing's happening to those

1169
00:42:51,359 --> 00:42:55,829
we have another online question

1170
00:42:59,670 --> 00:42:57,750
can astronauts eat inside their

1171
00:43:01,190 --> 00:42:59,680
spacesuits

1172
00:43:02,630 --> 00:43:01,200
that's actually a great question

1173
00:43:04,870 --> 00:43:02,640
something that we don't talk about in

1174
00:43:07,030 --> 00:43:04,880
the outside the spacecraft exhibit but

1175
00:43:08,550 --> 00:43:07,040
astronauts at least in recent years have

1176
00:43:09,990 --> 00:43:08,560
been given the option

1177
00:43:13,670 --> 00:43:10,000
astronauts

1178
00:43:15,030 --> 00:43:13,680
had shorter evas early on but later on

1179
00:43:16,150 --> 00:43:15,040
astronauts were given the option of

1180
00:43:18,470 --> 00:43:16,160
having

1181
00:43:19,910 --> 00:43:18,480
basically some kind of food inside it

1182
00:43:21,750 --> 00:43:19,920
needed to be something that didn't turn

1183
00:43:23,910 --> 00:43:21,760
into crumbs that's true of foods and

1184
00:43:25,589 --> 00:43:23,920
space generally is that if you have say

1185
00:43:27,349 --> 00:43:25,599
a piece of bread it's very easy for

1186
00:43:29,829 --> 00:43:27,359
those crumbs to just go floating away

1187
00:43:32,309 --> 00:43:29,839
and cause a lot of damage but there is

1188
00:43:34,230 --> 00:43:32,319

something that's similar to a power bar

1189
00:43:35,990 --> 00:43:34,240
is probably a good way to think about it

1190
00:43:38,390 --> 00:43:36,000
that they can have inside the spacesuit

1191
00:43:40,230 --> 00:43:38,400
and they can snack on that evas can last

1192
00:43:41,750 --> 00:43:40,240
now up to eight hours or so so that

1193
00:43:43,990 --> 00:43:41,760
sometimes they do need a little snack

1194
00:43:45,510 --> 00:43:44,000
they always have water available but

1195
00:43:47,270 --> 00:43:45,520
they not all of them choose to eat

1196
00:43:48,870 --> 00:43:47,280
because they have a lot of work to do

1197
00:43:50,550 --> 00:43:48,880
out there and sometimes

1198
00:43:52,230 --> 00:43:50,560
they just like to get their jobs done

1199
00:43:53,430 --> 00:43:52,240
and get back inside and then be able to

1200
00:43:55,670 --> 00:43:53,440
have a real meal once they're back

1201
00:43:57,349 --> 00:43:55,680
inside the spacecraft

1202
00:44:00,150 --> 00:43:57,359
and i want to let the audience in here

1203
00:44:01,910 --> 00:44:00,160
know if you have questions come up here

1204
00:44:04,069 --> 00:44:01,920
and i'll show you where to stand so we

1205
00:44:06,550 --> 00:44:04,079
have a question in the audience sure i'm

1206
00:44:08,309 --> 00:44:06,560
laura this is a question for lisa

1207
00:44:09,910 --> 00:44:08,319
when you're doing conservation work on

1208
00:44:12,069 --> 00:44:09,920
materials is there any difference

1209
00:44:13,990 --> 00:44:12,079
between older materials like you know

1210
00:44:15,910 --> 00:44:14,000
cotton fibers and so forth and the newer

1211
00:44:17,190 --> 00:44:15,920
materials like dacron and nylon and so

1212
00:44:19,829 --> 00:44:17,200
forth like that

1213
00:44:21,990 --> 00:44:19,839

thank you that's a really good question

1214
00:44:23,589 --> 00:44:22,000
actually older materials that are made

1215
00:44:25,109 --> 00:44:23,599
of natural

1216
00:44:27,190 --> 00:44:25,119
fibers like wood

1217
00:44:28,870 --> 00:44:27,200
cotton linens they actually survive

1218
00:44:30,790 --> 00:44:28,880
better

1219
00:44:32,630 --> 00:44:30,800
a lot of the materials used in spacesuit

1220
00:44:33,990 --> 00:44:32,640
production and you'll see in our display

1221
00:44:36,390 --> 00:44:34,000
upstairs are about reaching their

1222
00:44:39,589 --> 00:44:36,400
50-year time period and a lot of them

1223
00:44:41,510 --> 00:44:39,599
are synthetic polymers and the materials

1224
00:44:43,589 --> 00:44:41,520
are not aging so well so we're just

1225
00:44:45,030 --> 00:44:43,599
learning about how to care for those and

1226
00:44:46,710 --> 00:44:45,040
i think because people thought they were

1227
00:44:49,510 --> 00:44:46,720
modern and they were tough enough to go

1228
00:44:51,510 --> 00:44:49,520
to the lunar earth surface or into space

1229
00:44:54,230 --> 00:44:51,520
that they would last forever

1230
00:44:56,470 --> 00:44:54,240
so i think

1231
00:44:58,950 --> 00:44:56,480
we're just learning now about how to

1232
00:45:00,069 --> 00:44:58,960
take care of those materials what to do

1233
00:45:02,069 --> 00:45:00,079
for them

1234
00:45:02,870 --> 00:45:02,079
we see different types of damages with

1235
00:45:05,030 --> 00:45:02,880
them

1236
00:45:07,109 --> 00:45:05,040
and the chemical changes are not as

1237
00:45:08,870 --> 00:45:07,119
great but when they happen they're very

1238
00:45:10,230 --> 00:45:08,880

sudden and very quickly

1239
00:45:12,069 --> 00:45:10,240
so

1240
00:45:13,990 --> 00:45:12,079
i hope that answered your question

1241
00:45:15,270 --> 00:45:14,000
and we have another in-audience question

1242
00:45:16,829 --> 00:45:15,280
do you want to see your name answer the

1243
00:45:19,270 --> 00:45:16,839
question

1244
00:45:22,150 --> 00:45:19,280
mataya um

1245
00:45:26,230 --> 00:45:22,160
do you enjoy what you do

1246
00:45:28,150 --> 00:45:26,240
enjoy what i do i've been here for

1247
00:45:29,589 --> 00:45:28,160
almost 13 years i like to tell people

1248
00:45:30,870 --> 00:45:29,599
all the time i have the coolest job in

1249
00:45:33,109 --> 00:45:30,880
the world because i get to see all this

1250
00:45:34,710 --> 00:45:33,119
stuff every single day

1251
00:45:36,630 --> 00:45:34,720
i think some of my family members think

1252
00:45:38,069 --> 00:45:36,640
that's a little boring now but my kids

1253
00:45:39,430 --> 00:45:38,079
really like coming here and hearing me

1254
00:45:41,270 --> 00:45:39,440
talk about it because they haven't seen

1255
00:45:42,950 --> 00:45:41,280
it before and i like bringing all of

1256
00:45:45,670 --> 00:45:42,960
that experience and all my excitement

1257
00:45:47,349 --> 00:45:45,680
about my job to all of you so

1258
00:45:49,109 --> 00:45:47,359
yeah it's fun every day i work with a

1259
00:45:50,950 --> 00:45:49,119
lot of really great people i've made a

1260
00:45:52,630 --> 00:45:50,960
lot of really good friends here

1261
00:45:53,750 --> 00:45:52,640
so coming to work every day is actually

1262
00:45:55,109 --> 00:45:53,760
pretty fun

1263
00:45:56,309 --> 00:45:55,119

and i encourage all of you to find

1264
00:45:57,670 --> 00:45:56,319
something you really care about i think

1265
00:45:59,430 --> 00:45:57,680
that's what makes it fun for me is i

1266
00:46:01,030 --> 00:45:59,440
really care about what i do i think it

1267
00:46:02,470 --> 00:46:01,040
makes a difference i think people learn

1268
00:46:08,710 --> 00:46:02,480
things when they come here and so it

1269
00:46:08,720 --> 00:46:14,230
and we have another online question

1270
00:46:19,750 --> 00:46:16,950
what is the longest eva that anyone has

1271
00:46:21,430 --> 00:46:19,760
ever completed

1272
00:46:23,510 --> 00:46:21,440
do you know the longest

1273
00:46:25,109 --> 00:46:23,520
it's it was over it's over eight hours

1274
00:46:26,790 --> 00:46:25,119
yeah i don't know the exact one it's

1275
00:46:29,990 --> 00:46:26,800
certainly been within the last within

1276
00:46:31,349 --> 00:46:30,000
the shuttle iss period uh lasted over

1277
00:46:33,190 --> 00:46:31,359
eight hours

1278
00:46:35,030 --> 00:46:33,200
they usually they're they because

1279
00:46:37,750 --> 00:46:35,040
they're using a backpack system they do

1280
00:46:39,030 --> 00:46:37,760
have a limited supply of oxygen and

1281
00:46:40,710 --> 00:46:39,040
things like that so they are limited in

1282
00:46:42,069 --> 00:46:40,720
how long they can be out there

1283
00:46:43,750 --> 00:46:42,079
but i'd have to check on the exact

1284
00:46:44,630 --> 00:46:43,760
timing but i'm i'm sure it's over eight

1285
00:46:46,150 --> 00:46:44,640
hours

1286
00:46:48,150 --> 00:46:46,160
and we have an in-house question you're

1287
00:46:49,990 --> 00:46:48,160
gonna state your name in your question

1288
00:47:00,150 --> 00:46:50,000

my name is charles

1289
00:47:05,589 --> 00:47:01,589
the longer i've worked here the less

1290
00:47:05,599 --> 00:47:08,829
do you want to go into space

1291
00:47:16,230 --> 00:47:13,910
yeah hi uh are all the um space suits

1292
00:47:19,270 --> 00:47:16,240
are they custom-made do each astronaut

1293
00:47:20,710 --> 00:47:19,280
have their own number one and my second

1294
00:47:21,829 --> 00:47:20,720
question was i knew there was problems

1295
00:47:25,750 --> 00:47:21,839
with a space

1296
00:47:26,950 --> 00:47:25,760
suit with water accumulating on a recent

1297
00:47:29,349 --> 00:47:26,960
uh

1298
00:47:32,069 --> 00:47:29,359
space station mission has that been

1299
00:47:34,630 --> 00:47:32,079
resolved or where does that stand that

1300
00:47:35,589 --> 00:47:34,640
one either of you could take that

1301
00:47:45,910 --> 00:47:35,599
the

1302
00:47:49,270 --> 00:47:45,920
match arm lengths leg lengths upper

1303
00:47:51,109 --> 00:47:49,280
torso sizes to fit the particular crew

1304
00:47:53,750 --> 00:47:51,119
members gloves

1305
00:47:56,069 --> 00:47:53,760
uh they try to find gloves that will

1306
00:47:57,510 --> 00:47:56,079
fit the astronauts but those because

1307
00:47:59,990 --> 00:47:57,520
they're

1308
00:48:01,829 --> 00:48:00,000
where the work is being done are often

1309
00:48:04,230 --> 00:48:01,839
custom made those are laser they do

1310
00:48:05,829 --> 00:48:04,240
laser scans of the hands to custom make

1311
00:48:07,589 --> 00:48:05,839
those gloves

1312
00:48:09,910 --> 00:48:07,599
there are only

1313
00:48:11,750 --> 00:48:09,920

around 12 backpacks

1314
00:48:13,589 --> 00:48:11,760
for all the astronauts on the american

1315
00:48:16,710 --> 00:48:13,599
side of the station so

1316
00:48:19,510 --> 00:48:16,720
they're semi-custom

1317
00:48:21,270 --> 00:48:19,520
as far as the the water intrusion into

1318
00:48:22,390 --> 00:48:21,280
the helmet during

1319
00:48:23,430 --> 00:48:22,400
eva

1320
00:48:26,069 --> 00:48:23,440
the

1321
00:48:28,230 --> 00:48:26,079
that has been resolved

1322
00:48:31,910 --> 00:48:28,240
they are performing american

1323
00:48:33,829 --> 00:48:31,920
evas with the american suits again

1324
00:48:36,470 --> 00:48:33,839
the as the suits

1325
00:48:39,430 --> 00:48:36,480
continue their use

1326
00:48:41,510 --> 00:48:39,440
we do tend to see more issues come up

1327
00:48:42,470 --> 00:48:41,520
over time the suits have been in service

1328
00:48:43,750 --> 00:48:42,480
for

1329
00:48:46,790 --> 00:48:43,760
uh

1330
00:48:48,630 --> 00:48:46,800
30 35 years and part of the engineering

1331
00:48:51,270 --> 00:48:48,640
challenge is how do we service those

1332
00:48:53,190 --> 00:48:51,280
suits that are now up on station for

1333
00:48:56,870 --> 00:48:53,200
great periods of time so that's an

1334
00:48:58,710 --> 00:48:56,880
engineering challenge it's being met

1335
00:49:01,990 --> 00:48:58,720
and that particular challenge has been

1336
00:49:05,750 --> 00:49:03,910
okay we have another uh in-house

1337
00:49:09,430 --> 00:49:05,760
question

1338
00:49:17,030 --> 00:49:12,549

how does the engine start when a

1339
00:49:18,150 --> 00:49:17,040
spaceship is about to launch into space

1340
00:49:20,950 --> 00:49:18,160
so you're talking more about the

1341
00:49:24,549 --> 00:49:20,960
spaceship about the the spacecraft

1342
00:49:26,230 --> 00:49:24,559
um well with a space shuttle um they are

1343
00:49:28,630 --> 00:49:26,240
they they you want to know how it

1344
00:49:29,829 --> 00:49:28,640
launches itself uh well there's on the

1345
00:49:32,470 --> 00:49:29,839
space shuttle you can see over on the

1346
00:49:34,790 --> 00:49:32,480
model over here that it has uh different

1347
00:49:37,109 --> 00:49:34,800
types of fuel there's the two boosters

1348
00:49:40,309 --> 00:49:37,119
at the side the white rockets those are

1349
00:49:42,309 --> 00:49:40,319
solid fuel and so when those are ignited

1350
00:49:45,190 --> 00:49:42,319
those just keep burning and that helps

1351
00:49:47,910 --> 00:49:45,200
get it up into get it up into space and

1352
00:49:49,910 --> 00:49:47,920
then the big orange tank is a fuel tank

1353
00:49:51,829 --> 00:49:49,920
and that supplies fuel to the engines on

1354
00:49:54,069 --> 00:49:51,839
the bottom of the space shuttle so there

1355
00:49:56,230 --> 00:49:54,079
are three engines at the bottom and that

1356
00:49:59,670 --> 00:49:56,240
helps lift it and get it the rest of the

1357
00:50:01,510 --> 00:49:59,680
way into space now the spacecraft that

1358
00:50:05,109 --> 00:50:01,520
are being used that are launching

1359
00:50:07,030 --> 00:50:05,119
astronauts are all coming from russia

1360
00:50:09,990 --> 00:50:07,040
and those are launched like traditional

1361
00:50:12,710 --> 00:50:10,000
rockets that that have a liquid fuel in

1362
00:50:14,549 --> 00:50:12,720
them that launches so you can actually

1363
00:50:16,790 --> 00:50:14,559

you can make a little rockets on your

1364
00:50:19,589 --> 00:50:16,800
own here probably not nearly as powerful

1365
00:50:21,349 --> 00:50:19,599
but um you have to just ignite it

1366
00:50:22,870 --> 00:50:21,359
and there's obviously a special way of

1367
00:50:24,309 --> 00:50:22,880
igniting a rocket

1368
00:50:25,589 --> 00:50:24,319
that big as opposed to one that you

1369
00:50:28,309 --> 00:50:25,599
might light with a match so it's a

1370
00:50:29,750 --> 00:50:28,319
little bit more complex than that but

1371
00:50:31,589 --> 00:50:29,760
just a simple fight they have to ignite

1372
00:50:33,829 --> 00:50:31,599
the fuel and that goes through a big

1373
00:50:37,430 --> 00:50:33,839
system and then that pushes the rocket

1374
00:50:42,069 --> 00:50:40,390
my name is jakari

1375
00:50:47,430 --> 00:50:42,079
has every

1376
00:50:50,390 --> 00:50:47,440
has anyone ever been stranded in space

1377
00:50:52,549 --> 00:50:50,400
stranded stranded no thankfully there's

1378
00:50:54,069 --> 00:50:52,559
never been an experience like that

1379
00:50:56,390 --> 00:50:54,079
if you saw if you know of the movie

1380
00:50:58,790 --> 00:50:56,400
gravity there was a a

1381
00:51:00,309 --> 00:50:58,800
certainly a possibility of that in a

1382
00:51:01,910 --> 00:51:00,319
movie setting but no one's ever been

1383
00:51:04,390 --> 00:51:01,920
stranded one of the things that's really

1384
00:51:06,150 --> 00:51:04,400
important when astronauts go out on uh

1385
00:51:08,470 --> 00:51:06,160
spacewalks is that they have some way of

1386
00:51:10,230 --> 00:51:08,480
getting back to their spacecraft and so

1387
00:51:12,069 --> 00:51:10,240
early on they used a tether that

1388
00:51:13,670 --> 00:51:12,079

umbilical cord would keep them attached

1389
00:51:15,510 --> 00:51:13,680
to the spacecraft

1390
00:51:17,030 --> 00:51:15,520
the very first time an astronaut did it

1391
00:51:19,190 --> 00:51:17,040
without a tether

1392
00:51:21,270 --> 00:51:19,200
was in the 1980s an astronaut named

1393
00:51:23,430 --> 00:51:21,280
bruce mccandless tested a backpack that

1394
00:51:25,109 --> 00:51:23,440
was more like a jet pack and he went

1395
00:51:26,630 --> 00:51:25,119
away from the spaceship and then he came

1396
00:51:28,870 --> 00:51:26,640
back and when you come up on the tour of

1397
00:51:31,589 --> 00:51:28,880
the exhibit we'll see a picture of that

1398
00:51:34,710 --> 00:51:31,599
that's not um often done uh usually

1399
00:51:36,470 --> 00:51:34,720
there's a very thin metal wire a tether

1400
00:51:39,030 --> 00:51:36,480
still that the astronauts stay attached

1401
00:51:40,230 --> 00:51:39,040
to the spaceship with uh and but there

1402
00:51:41,589 --> 00:51:40,240
are ways that they could get back they

1403
00:51:43,910 --> 00:51:41,599
do have something

1404
00:51:46,470 --> 00:51:43,920
on their backpack that allows them in an

1405
00:51:48,150 --> 00:51:46,480
emergency to kind of jet back a little

1406
00:51:50,790 --> 00:51:48,160
bit they're able to push them their

1407
00:51:52,790 --> 00:51:50,800
bodies back it's called a safer it helps

1408
00:51:54,230 --> 00:51:52,800
some uh the astronauts if if something

1409
00:51:55,910 --> 00:51:54,240
were to happen to that tether they would

1410
00:51:57,190 --> 00:51:55,920
still be able to get back and of course

1411
00:51:58,390 --> 00:51:57,200
there would always be a way especially

1412
00:52:01,109 --> 00:51:58,400
at the space shuttle that they could

1413
00:52:03,190 --> 00:52:01,119

kind of go and and pick them up very

1414
00:52:05,829 --> 00:52:03,200
carefully of course but nobody's ever

1415
00:52:07,829 --> 00:52:05,839
been stranded thankfully

1416
00:52:10,710 --> 00:52:07,839
that's all the time we have i know that

1417
00:52:12,230 --> 00:52:10,720
for the in-house audience um jennifer

1418
00:52:14,309 --> 00:52:12,240
and lisa

1419
00:52:16,549 --> 00:52:14,319
will be taking you on a tour upstairs if

1420
00:52:18,390 --> 00:52:16,559
you're interested so you can

1421
00:52:19,589 --> 00:52:18,400
hang out yeah and i want to thank all of

1422
00:52:22,230 --> 00:52:19,599
you for coming today i want to thank all

1423
00:52:25,030 --> 00:52:22,240
of our online viewers uh and our viewers

1424
00:52:26,630 --> 00:52:25,040
on on tv and uh

1425
00:52:28,309 --> 00:52:26,640
for those of you who are able to stay

1426
00:52:30,309 --> 00:52:28,319
after for the tour that's great also

1427
00:52:31,750 --> 00:52:30,319
thank you for our uh to our sponsors