1
00:00:22,369 --> 00:00:39,310
I'm ready

2
00:00:44,890 --> 00:00:42,370
future explorers will venture in harsher

3
00:00:47,260 --> 00:00:44,900
environments than ever before at

4
00:00:50,950 --> 00:00:47,270
distances never encountered in human

5
00:00:58,240 --> 00:00:50,960
history for durations never achieved by

6
00:01:04,390 --> 00:01:01,150
a future mission to Mars could take as

7
00:01:07,660 --> 00:01:04,400
long as three years astronauts would

8
00:01:09,280 --> 00:01:07,670
work four years at a lunar base three

9
00:01:13,300 --> 00:01:09,290
Americans undertook the first

10
00:01:17,260 --> 00:01:13,310
long-duration mission in 1974 returning

11
00:01:20,530 --> 00:01:17,270
safely to Earth after 84 days aloft two

12
00:01:22,570 --> 00:01:20,540
Soviets have spent a year in space both

13
00:01:24,969 --> 00:01:22,580

programs have shown that there is much

14
00:01:27,400 --> 00:01:24,979
yet to learn to enable astronauts to

15
00:01:29,639 --> 00:01:27,410
undertake long missions to keep them

16
00:01:32,350 --> 00:01:29,649
healthy physically and psychologically

17
00:01:34,930 --> 00:01:32,360
to provide them with medical care and

18
00:02:01,249 --> 00:01:34,940
life-support and to protect them from

19
00:02:05,999 --> 00:02:04,109
when astronauts travel beyond the

20
00:02:09,479 --> 00:02:06,009
sanctuary of the magnetic field

21
00:02:11,910 --> 00:02:09,489
surrounding our planet they're no longer

22
00:02:14,790 --> 00:02:11,920
protected from cosmic rays and solar

23
00:02:17,490 --> 00:02:14,800
flare radiation without shielding an

24
00:02:20,809 --> 00:02:17,500
astronaut exposed to a solar flare event

25
00:02:23,759 --> 00:02:20,819
would become ill with radiation sickness

26
00:02:25,949 --> 00:02:23,769
chronic exposure to cosmic radiation

27
00:02:29,759 --> 00:02:25,959
could increase an astronauts risk of

28
00:02:32,130 --> 00:02:29,769
developing cancer before explorers can

29
00:02:35,100 --> 00:02:32,140
undertake long missions far from home

30
00:02:36,870 --> 00:02:35,110
life sciences researchers must find out

31
00:02:40,830 --> 00:02:36,880
more about the hazards of space

32
00:02:43,160 --> 00:02:40,840
radiation high on a hillside overlooking

33
00:02:45,690 --> 00:02:43,170
the university campus in Berkeley

34
00:02:47,880 --> 00:02:45,700
scientists use an accelerator to whip

35
00:02:50,400 --> 00:02:47,890
tiny fragments of matter faster and

36
00:02:53,130 --> 00:02:50,410
faster to higher and higher energies and

37
00:02:56,640 --> 00:02:53,140
then hurl them at a target to simulate

38
00:02:59,250 --> 00:02:56,650

space radiation on earth this is the

39
00:03:02,180 --> 00:02:59,260
only way we have to learn more about how

40
00:03:04,140 --> 00:03:02,190
space radiation damages living cells

41
00:03:07,170 --> 00:03:04,150
Greg Nelson of the Jet Propulsion

42
00:03:09,509 --> 00:03:07,180
Laboratory uses this unique facility at

43
00:03:10,289 --> 00:03:09,519
Berkeley to irradiate microscopic

44
00:03:12,660 --> 00:03:10,299
roundworms

45
00:03:15,059 --> 00:03:12,670
it's a nematode or a roundworm called

46
00:03:16,830 --> 00:03:15,069
scene Arab Titus elegans and what we

47
00:03:19,289 --> 00:03:16,840
actually look for after the worms have

48
00:03:21,750 --> 00:03:19,299
been exposed to these artificial cosmic

49
00:03:24,240 --> 00:03:21,760
rays is the presence of mutations or

50
00:03:27,750 --> 00:03:24,250
damage to known populations of cells in

51
00:03:30,090 --> 00:03:27,760
our bodies our ultimate goal is to be

52
00:03:33,900 --> 00:03:30,100
able to use our model animal C elegans

53
00:03:37,319 --> 00:03:33,910
to extrapolate to the cancer risk for

54
00:03:40,160 --> 00:03:37,329
human beings earth-based experiments can

55
00:03:42,479 --> 00:03:40,170
only simulate space radiation soon

56
00:03:44,670 --> 00:03:42,489
scientists will have the opportunity to

57
00:03:47,129 --> 00:03:44,680
study the effects of long-term exposure

58
00:03:49,979 --> 00:03:47,139
to the real space radiation environment

59
00:03:53,750 --> 00:03:49,989
flying round worms and insects plants

60
00:03:56,899 --> 00:03:53,760
and human cells aboard NASA's life's at

61
00:03:58,640 --> 00:03:56,909
what we learn will help physicists as

62
00:04:00,559 --> 00:03:58,650
they investigate the different

63
00:04:03,220 --> 00:04:00,569

spacecraft materials that will protect

64
00:04:05,869 --> 00:04:03,230
our astronauts from space radiation

65
00:04:08,869 --> 00:04:05,879
developing shielding is a difficult task

66
00:04:10,990 --> 00:04:08,879
the shield the skin of the spacecraft

67
00:04:13,990 --> 00:04:11,000
has to be thick enough to stop

68
00:04:16,670 --> 00:04:14,000
micrometeorites but not too thick

69
00:04:19,099 --> 00:04:16,680
because when high-energy particles

70
00:04:21,080 --> 00:04:19,109
collide with the shield the collisions

71
00:04:23,360 --> 00:04:21,090
produce secondary particles that can

72
00:04:26,450 --> 00:04:23,370
also damage the cells of an astronauts

73
00:04:29,150 --> 00:04:26,460
body the thicker the shield the more

74
00:04:32,390 --> 00:04:29,160
collisions the more damaging secondary

75
00:04:34,490 --> 00:04:32,400
particles are produced shielding has to

76
00:04:37,040 --> 00:04:34,500
be thin enough to hold down the effects

77
00:04:40,760 --> 00:04:37,050
of the collisions and still protect the

78
00:04:42,950 --> 00:04:40,770
craft with real data life sciences

79
00:04:44,659 --> 00:04:42,960
researchers will set radiation exposure

80
00:04:47,210 --> 00:04:44,669
limits that will drive the development

81
00:04:49,400 --> 00:04:47,220
of new shielding materials and other

82
00:04:52,310 --> 00:04:49,410
protective measures so that our

83
00:04:54,800 --> 00:04:52,320
explorers can safely undertake extended

84
00:05:02,719 --> 00:04:54,810
missions beyond Earth's magnetic

85
00:05:18,899 --> 00:05:06,239
for most astronauts microgravity is fun

86
00:05:21,269 --> 00:05:18,909
once they get used to it virtually all

87
00:05:23,249 --> 00:05:21,279
of the body's systems systems that have

88
00:05:25,919 --> 00:05:23,259

evolved for millions of years in the

89
00:05:28,169 --> 00:05:25,929
presence of gravity begin adapting to

90
00:05:31,230 --> 00:05:28,179
the absence of gravity within hours of

91
00:05:34,439 --> 00:05:31,240
liftoff but these changes in the body

92
00:05:36,929 --> 00:05:34,449
can cause problems when an astronaut

93
00:05:40,339 --> 00:05:36,939
skeleton is no longer needed to support

94
00:05:42,959 --> 00:05:40,349
his body his bones grow thin and porous

95
00:05:45,589 --> 00:05:42,969
muscles that on earth work against the

96
00:05:49,139 --> 00:05:45,599
downward tug of gravity to remain strong

97
00:05:51,239 --> 00:05:49,149
atrophy if not used the heart shrinks

98
00:05:53,369 --> 00:05:51,249
when it no longer has to pump blood from

99
00:05:55,619 --> 00:05:53,379
the feet to the head against the pull of

100
00:05:58,079 --> 00:05:55,629
gravity because of these and other

101
00:06:00,119 --> 00:05:58,089
changes astronauts on an extended

102
00:06:02,459 --> 00:06:00,129
mission would lose the strength and

103
00:06:04,639 --> 00:06:02,469
stamina needed to return to Earth or

104
00:06:07,319 --> 00:06:04,649
explore the surface of another planet

105
00:06:09,899 --> 00:06:07,329
chief of the Life Sciences Division at

106
00:06:12,600 --> 00:06:09,909
NASA's Ames Research Center Joan Vern

107
00:06:14,459 --> 00:06:12,610
echoes when they return to Earth even

108
00:06:16,799 --> 00:06:14,469
with all the exercise and

109
00:06:19,319 --> 00:06:16,809
countermeasures they do Romanenko for

110
00:06:22,079 --> 00:06:19,329
instance and other Soviets so they

111
00:06:24,269 --> 00:06:22,089
cannot walk unassisted for at least 48

112
00:06:26,429 --> 00:06:24,279
hours well you can't do that on landing

113
00:06:30,499 --> 00:06:26,439

on Mars you have to be able to either

114
00:06:33,749 --> 00:06:30,509
egress rapidly in case of emergency or

115
00:06:35,730 --> 00:06:33,759
get out in this relatively alien

116
00:06:38,429 --> 00:06:35,740
environment and build a shelter or a

117
00:06:40,859 --> 00:06:38,439
habitat before you go exploring around

118
00:06:44,730 --> 00:06:40,869
the Martian surface and therefore you

119
00:06:47,699 --> 00:06:44,740
cannot afford to be weak or unable to

120
00:06:50,159 --> 00:06:47,709
move to help our astronauts overcome

121
00:06:52,019 --> 00:06:50,169
space deconditioning researchers at the

122
00:06:54,419 --> 00:06:52,029
Johnson Space Center are developing

123
00:06:57,089 --> 00:06:54,429
countermeasures chief of the medical

124
00:06:58,949 --> 00:06:57,099
operations branch Jeff Davis on the

125
00:07:01,049 --> 00:06:58,959
Space Shuttle we employ countermeasures

126
00:07:03,480 --> 00:07:01,059
that range from things as simple as flu

127
00:07:06,389 --> 00:07:03,490
loading to replace volume that's lost

128
00:07:08,500 --> 00:07:06,399
during flight to exercise for a

129
00:07:11,650 --> 00:07:08,510
cardiovascular conditioning and muscle

130
00:07:13,960 --> 00:07:11,660
strength to the use of a g-suit to help

131
00:07:16,480 --> 00:07:13,970
the body overcome the forces of gravity

132
00:07:18,820 --> 00:07:16,490
during entry during a recent space

133
00:07:20,770 --> 00:07:18,830
shuttle flight bonny Dunbar tested a

134
00:07:22,840 --> 00:07:20,780
countermeasure device that could help an

135
00:07:25,570 --> 00:07:22,850
astronaut prepare for the return to

136
00:07:28,600 --> 00:07:25,580
gravity completely enclosing her lower

137
00:07:30,790 --> 00:07:28,610
body the device uses a partial vacuum to

138
00:07:34,150 --> 00:07:30,800

pull blood down to the feet in the same

139
00:07:35,770 --> 00:07:34,160
way that gravity does on earth for Space

140
00:07:39,100 --> 00:07:35,780
Station we'll be interested in looking

141
00:07:41,080 --> 00:07:39,110
at research into areas such as bone loss

142
00:07:43,900 --> 00:07:41,090
and potential use of medications as a

143
00:07:48,670 --> 00:07:43,910
countermeasure to diet and dietary

144
00:07:51,310 --> 00:07:48,680
supplements high school teacher Vincent

145
00:07:54,040 --> 00:07:51,320
du is in perfect health but beginning

146
00:07:57,940 --> 00:07:54,050
today he'll be confined to bed for the

147
00:08:01,240 --> 00:07:57,950
next 17 weeks he'll never get up or sit

148
00:08:03,820 --> 00:08:01,250
up even to eat keeping his feet higher

149
00:08:06,010 --> 00:08:03,830
than his head shifts fluids to his upper

150
00:08:08,230 --> 00:08:06,020
body and takes the stress off his

151
00:08:10,450 --> 00:08:08,240
muscles and bones to simulate the

152
00:08:13,390 --> 00:08:10,460
changes that astronauts experience in

153
00:08:15,580 --> 00:08:13,400
the absence of gravity through bedrest

154
00:08:18,100 --> 00:08:15,590
studies like this one conducted at the

155
00:08:19,540 --> 00:08:18,110
Ames Research Center scientists can

156
00:08:23,170 --> 00:08:19,550
experiment with different combinations

157
00:08:24,640 --> 00:08:23,180
of diet medication and exercise to

158
00:08:27,550 --> 00:08:24,650
offset the effects of space

159
00:08:29,260 --> 00:08:27,560
deconditioning for Vincent the

160
00:08:31,750 --> 00:08:29,270
experiment ends with a ride in a

161
00:08:37,420 --> 00:08:31,760
centrifuge to simulate an astronaut's

162
00:08:43,190 --> 00:08:40,130
since Vincent had no problem with his

163
00:08:44,990 --> 00:08:43,200

reentry these same countermeasures might

164
00:08:48,670 --> 00:08:45,000
work to keep an astronaut in good

165
00:08:50,900 --> 00:08:48,680
condition during an extended mission

166
00:08:54,020 --> 00:08:50,910
exercise has been an effective

167
00:08:56,270 --> 00:08:54,030
countermeasure for Soviet cosmonauts but

168
00:08:59,060 --> 00:08:56,280
near the end of an 11 month stay aboard

169
00:09:01,220 --> 00:08:59,070
the Soviet space station Mir cosmonaut

170
00:09:04,130 --> 00:09:01,230
Yuri Romanenko was working out as much

171
00:09:06,910 --> 00:09:04,140
as four hours a day severely limiting

172
00:09:10,670 --> 00:09:06,920
the time he could devote to his mission

173
00:09:12,560 --> 00:09:10,680
so in a parallel effort nasa researchers

174
00:09:14,480 --> 00:09:12,570
are investigating the benefits of the

175
00:09:17,060 --> 00:09:14,490
artificial gravity produced by

176
00:09:19,130 --> 00:09:17,070
centrifugal force such as the gravity

177
00:09:22,430 --> 00:09:19,140
produced by the spinning spacecraft of

178
00:09:24,980 --> 00:09:22,440
science fiction scientists don't yet

179
00:09:27,980 --> 00:09:24,990
know if artificial gravity will work or

180
00:09:30,110 --> 00:09:27,990
if it does just how much is needed would

181
00:09:33,560 --> 00:09:30,120
an hour a day spend in a small exercise

182
00:09:36,650 --> 00:09:33,570
centrifuge keep astronauts fit or would

183
00:09:38,200 --> 00:09:36,660
the entire spacecraft have to rotate 24

184
00:09:40,400 --> 00:09:38,210
hours a day

185
00:09:42,740 --> 00:09:40,410
answers to these questions will

186
00:09:44,990 --> 00:09:42,750
significantly influence the design and

187
00:09:47,540 --> 00:09:45,000
cost of the spacecraft that will carry

188
00:09:51,269 --> 00:09:47,550

our astronauts further into the space

189
00:10:00,119 --> 00:09:57,720
a spacecraft bound for Mars will be so

190
00:10:02,879 --> 00:10:00,129
massive that it won't be launched from

191
00:10:06,660 --> 00:10:02,889
Earth in one piece it will be assembled

192
00:10:09,449 --> 00:10:06,670
on orbit to do the job our astronauts

193
00:10:13,319 --> 00:10:09,459
will spend many long hours working evey

194
00:10:15,720 --> 00:10:13,329
a so biomechanics engineers at the

195
00:10:17,220 --> 00:10:15,730
Johnson Space Center are working to make

196
00:10:19,710 --> 00:10:17,230
sure that the tasks they'll be

197
00:10:24,119 --> 00:10:19,720
performing don't ask more than an

198
00:10:25,910 --> 00:10:24,129
astronaut has to give tests are

199
00:10:31,499 --> 00:10:25,920
conducted in simulated weightlessness

200
00:10:33,720 --> 00:10:31,509
under water the crank measures how much

201
00:10:36,629 --> 00:10:33,730
strength the space-suited astronaut can

202
00:10:39,389 --> 00:10:36,639
exert underwater video captures the

203
00:10:43,679 --> 00:10:39,399
action sensors record which muscles

204
00:10:45,900 --> 00:10:43,689
produce the motion engineers analyze the

205
00:10:50,460 --> 00:10:45,910
data and determine how much force an

206
00:10:52,499 --> 00:10:50,470
astronaut can deliver they then

207
00:10:55,679 --> 00:10:52,509
developed computer models of human

208
00:10:58,290 --> 00:10:55,689
capabilities these smart tools will help

209
00:11:01,110 --> 00:10:58,300
researchers see how astronauts will work

210
00:11:05,220 --> 00:11:01,120
in environments that don't even yet

211
00:11:07,230 --> 00:11:05,230
exist real requirements can then be set

212
00:11:18,230 --> 00:11:07,240
to make sure that tasks can be

213
00:11:25,020 --> 00:11:22,680

when gene cernan Ronald Evans and Jack

214
00:11:27,690 --> 00:11:25,030
Schmitt departed earth on the last and

215
00:11:31,530 --> 00:11:27,700
longest Apollo mission they took some

216
00:11:36,090 --> 00:11:31,540
500 pounds of air food and water with

217
00:11:38,370 --> 00:11:36,100
them were those same three men to go to

218
00:11:40,950 --> 00:11:38,380
work at a lunar outpost for a two-year

219
00:11:43,320 --> 00:11:40,960
tour of duty using the same life-support

220
00:11:45,330 --> 00:11:43,330
system we have today each man's

221
00:11:50,700 --> 00:11:45,340
provisions would require a dedicated

222
00:11:52,950 --> 00:11:50,710
launch a prohibitive expense what's

223
00:11:56,730 --> 00:11:52,960
needed is a life-support system that can

224
00:11:59,160 --> 00:11:56,740
recycle food and air water and waste in

225
00:12:01,530 --> 00:11:59,170
a closed system astronauts will grow

226
00:12:03,390 --> 00:12:01,540
their own crops just like the wheat

227
00:12:06,510 --> 00:12:03,400
grown in this environmentally sealed

228
00:12:08,700 --> 00:12:06,520
chamber at the Kennedy Space Center with

229
00:12:10,380 --> 00:12:08,710
this component of a closed life-support

230
00:12:12,750 --> 00:12:10,390
system researchers here are

231
00:12:15,150 --> 00:12:12,760
demonstrating the feasibility of using

232
00:12:19,290 --> 00:12:15,160
plants to provide fresh air clean water

233
00:12:21,630 --> 00:12:19,300
and nutritious food by carefully

234
00:12:24,000 --> 00:12:21,640
controlling the nutrient solution the

235
00:12:26,640 --> 00:12:24,010
moisture in the atmosphere and exposure

236
00:12:29,450 --> 00:12:26,650
to simulated sunlight this biological

237
00:12:32,960 --> 00:12:29,460
system is proving to be very reliable

238
00:12:36,210 --> 00:12:32,970

but will it work as well without gravity

239
00:12:38,880 --> 00:12:36,220
the space station freedom will serve as

240
00:12:41,010 --> 00:12:38,890
a testbed to qualify the life-support

241
00:12:54,180 --> 00:12:41,020
system that will sustain our space

242
00:13:02,010 --> 00:12:57,580
for researchers in the Antarctic it is

243
00:13:11,470 --> 00:13:05,440
in this remote corner of the globe the

244
00:13:14,260 --> 00:13:11,480
nearest medical care is hours away on an

245
00:13:18,750 --> 00:13:14,270
expedition to Mars when an emergency

246
00:13:21,490 --> 00:13:18,760
occurs there is no place to go

247
00:13:25,900 --> 00:13:21,500
crews must handle medical emergencies

248
00:13:28,000 --> 00:13:25,910
and treat routine illness themselves so

249
00:13:29,530 --> 00:13:28,010
doctors and engineers at the Johnson

250
00:13:32,070 --> 00:13:29,540
Space Center are putting the

251
00:13:35,970 --> 00:13:32,080
capabilities of an emergency room a

252
00:13:39,780 --> 00:13:35,980
medical laboratory and an x-ray facility

253
00:13:42,790 --> 00:13:39,790
into a compact clinic for use in space

254
00:13:44,440 --> 00:13:42,800
for tightly packed racks of specially

255
00:13:46,600 --> 00:13:44,450
engineered medical equipment and

256
00:13:49,570 --> 00:13:46,610
supplies will provide what's needed to

257
00:13:51,970 --> 00:13:49,580
perform diagnostic tests treat injuries

258
00:13:54,850 --> 00:13:51,980
and illness and keep track of patient

259
00:13:57,490 --> 00:13:54,860
records but medical systems and

260
00:13:59,710 --> 00:13:57,500
procedures for use in space must be more

261
00:14:02,740 --> 00:13:59,720
than compact they must work without

262
00:14:04,870 --> 00:14:02,750
gravity and so they're tested by a team

263
00:14:08,110 --> 00:14:04,880

of doctors and technicians in a very

264
00:14:11,440 --> 00:14:08,120
unusual test facility research engineer

265
00:14:14,470 --> 00:14:11,450
Terry yes just like a roller coaster the

266
00:14:17,020 --> 00:14:14,480
kc-135 flies in a parabolic flight path

267
00:14:19,300 --> 00:14:17,030
as the plane reaches the peak of his

268
00:14:21,700 --> 00:14:19,310
path it starts to nose over and at that

269
00:14:24,010 --> 00:14:21,710
point you get 25 to 30 seconds of zero

270
00:14:25,390 --> 00:14:24,020
gravity this doesn't sound like a lot

271
00:14:35,540 --> 00:14:25,400
but it's the only way we have on earth

272
00:14:40,140 --> 00:14:37,830
performing medical procedures without

273
00:14:42,870 --> 00:14:40,150
gravity requires an entirely different

274
00:14:51,020 --> 00:14:42,880
approach to medical care with much

275
00:14:57,480 --> 00:14:54,030
astronauts may seem very different from

276
00:14:59,490 --> 00:14:57,490
aquanauts but this diver experiences

277
00:15:02,490 --> 00:14:59,500
some of the same psychological stress

278
00:15:05,820 --> 00:15:02,500
from isolation and confinement that an

279
00:15:07,980 --> 00:15:05,830
astronaut will on a long mission the

280
00:15:11,100 --> 00:15:07,990
diver works for weeks at a time cut off

281
00:15:13,830 --> 00:15:11,110
from family and friends he lives in a

282
00:15:16,320 --> 00:15:13,840
facility that is cramped and closed with

283
00:15:19,140 --> 00:15:16,330
a tiny kitchen and living area and six

284
00:15:21,930 --> 00:15:19,150
bunks stacked three on a side it is a

285
00:15:24,810 --> 00:15:21,940
habitat for aquanauts not unlike that of

286
00:15:27,650 --> 00:15:24,820
astronauts which is why human factors

287
00:15:30,960 --> 00:15:27,660
researchers study the divers behavior

288
00:15:33,330 --> 00:15:30,970

how do people handle the isolation the

289
00:15:35,610 --> 00:15:33,340
lack of privacy and the prolonged

290
00:15:38,610 --> 00:15:35,620
confinement how do different

291
00:15:40,670 --> 00:15:38,620
personalities mix how does the group

292
00:15:43,350 --> 00:15:40,680
function as a whole

293
00:15:45,360 --> 00:15:43,360
continued human factors research with

294
00:15:47,790 --> 00:15:45,370
divers and others at work in remote

295
00:15:50,340 --> 00:15:47,800
environments will determine selection

296
00:15:52,800 --> 00:15:50,350
criteria and training and psychological

297
00:15:59,820 --> 00:15:52,810
support techniques that will help ensure

298
00:16:05,050 --> 00:16:02,860
life sciences researchers are at work on

299
00:16:07,300 --> 00:16:05,060
a variety of fronts studying the

300
00:16:10,060 --> 00:16:07,310
physical and psychological impacts of

301
00:16:12,940 --> 00:16:10,070
extended missions this research is

302
00:16:16,480 --> 00:16:12,950
critical if we are to sustain nurture

303
00:16:19,000 --> 00:16:16,490
and protect our space explorers it is

304
00:16:23,220 --> 00:16:19,010
this research that will turn our dreams

305
00:16:25,420 --> 00:16:23,230
of space exploration into reality I

306
00:16:29,140 --> 00:16:25,430
believe that this nation should commit

307
00:16:31,810 --> 00:16:29,150
itself to achieving the goal before this

308
00:16:33,940 --> 00:16:31,820
decade is out of landing a man on the

309
00:16:39,400 --> 00:16:33,950
moon and returning him safely to the

310
00:16:42,100 --> 00:16:39,410
earth I believe before Apollo celebrates

311
00:16:44,560 --> 00:16:42,110
the 50th anniversary of its landing on

312
00:16:49,660 --> 00:16:44,570
the moon the American flag should be