
NEWSEUM

1
00:00:55,610 --> 00:00:54,110
a great day an exciting time then museum

2
00:00:57,979 --> 00:00:55,620
a very pleased of course to partner as

3
00:01:00,350 --> 00:00:57,989
you just heard with NASA to present

4
00:01:03,020 --> 00:01:00,360
today's panel discussion commemorating

5
00:01:05,320 --> 00:01:03,030
the 40th anniversary of the Apollo 11

6
00:01:08,180 --> 00:01:05,330
mission and exploring the future of

7
00:01:11,090 --> 00:01:08,190
space exploration very pleased to be

8
00:01:13,940 --> 00:01:11,100
joined by science centers all across the

9
00:01:16,550 --> 00:01:13,950
country we are going to have questions

10
00:01:18,770 --> 00:01:16,560
from them some of them as young as eight

11
00:01:20,780 --> 00:01:18,780
years old they're going to be very tough

12
00:01:22,789 --> 00:01:20,790
questions you can count on it they'll be

13
00:01:24,380 --> 00:01:22,799

submitted all over also we're going to

14
00:01:26,750 --> 00:01:24,390
be asking those in our studio audience

15
00:01:29,140 --> 00:01:26,760
to prepare questions and be part of the

16
00:01:31,340 --> 00:01:29,150
program as well now this event of course

17
00:01:35,959 --> 00:01:31,350
that we're going to show you right now

18
00:01:37,459 --> 00:01:35,969
this very brief film this is now a very

19
00:01:39,880 --> 00:01:37,469
brief I think just two minutes long and

20
00:01:43,039 --> 00:01:39,890
it of course shows the centerpiece of

21
00:01:57,279 --> 00:01:43,049
the event which is the reason we are

22
00:02:03,260 --> 00:01:59,510
believe that this nation should commit

23
00:02:06,260 --> 00:02:03,270
itself to achieving the goal before this

24
00:02:06,450 --> 00:02:06,270
decade is out of landing a man on the

25
00:02:11,640 --> 00:02:06,460
moon

26
00:02:18,120 --> 00:02:11,650
earth t-minus 15 seconds guidance is

27
00:02:53,970 --> 00:02:18,130
internal 12 11 10 9 ignition sequence

28
00:03:00,690 --> 00:02:57,899
come on out are we now sorry Sam I give

29
00:03:10,600 --> 00:03:00,700
you exact figure key here now hundred

30
00:03:17,120 --> 00:03:14,020
and gaudy base here the eagle has landed

31
00:03:19,130 --> 00:03:17,130
rocket twink tranquility we copy on the

32
00:03:20,930 --> 00:03:19,140
ground you got a bunch of guys about to

33
00:03:23,150 --> 00:03:20,940
turn blue we're breathing again thanks a

34
00:03:26,059 --> 00:03:23,160
lot and we're getting a picture on the

35
00:03:28,699 --> 00:03:26,069
TV there's a great deal of contrast in

36
00:03:30,830 --> 00:03:28,709
and currently it's upside-down on our

37
00:03:33,290 --> 00:03:30,840
monitor but we can make out the firm on

38
00:03:37,970 --> 00:03:33,300

a detail okay Neil we can see you coming

39
00:04:22,879 --> 00:03:37,980
down the ladder now that's one small

40
00:04:28,320 --> 00:04:26,670
okay let's take a look at our panelists

41
00:04:35,140 --> 00:04:28,330
first of all let me introduce to your

42
00:04:47,200 --> 00:04:38,110
Charles M Duke jr. lunar module pilot

43
00:04:49,000 --> 00:04:47,210
Apollo 16 Laurie Leshin Deputy Director

44
00:04:56,470 --> 00:04:49,010
for science and technology of the famous

45
00:04:58,360 --> 00:04:56,480
Goddard Space Flight Center and closest

46
00:05:02,620 --> 00:04:58,370
to me here John Grunsfeld mission

47
00:05:04,630 --> 00:05:02,630
specialist aboard sts-125 Atlantis he

48
00:05:07,060 --> 00:05:04,640
was the lead spacewalker as you will

49
00:05:09,490 --> 00:05:07,070
remember very recently during the Hubble

50
00:05:16,990 --> 00:05:09,500
Space Telescope repair mission at our

51
00:05:19,660 --> 00:05:17,000
heart I just wanted to let you know

52
00:05:21,820 --> 00:05:19,670
where these youngsters are going to be

53
00:05:23,890 --> 00:05:21,830
talking to us from there will be the

54
00:05:25,900 --> 00:05:23,900
science centers all over the country for

55
00:05:27,610 --> 00:05:25,910
instance the Museum of Science in Boston

56
00:05:29,980 --> 00:05:27,620
the American Museum of Natural History

57
00:05:31,720 --> 00:05:29,990
that's in New York the California

58
00:05:34,360 --> 00:05:31,730
Academy of Sciences the Museum of

59
00:05:37,180 --> 00:05:34,370
Science and Industry in Chicago and the

60
00:05:41,110 --> 00:05:37,190
Denver Museum of Nature and Science and

61
00:05:43,660 --> 00:05:41,120
one more the st. Louis science center

62
00:05:44,860 --> 00:05:43,670
now let's begin talking to our panelists

63
00:05:46,570 --> 00:05:44,870

we're going to begin with you buzz and

64
00:05:49,060 --> 00:05:46,580
i'll tell you why because if i

65
00:05:50,740 --> 00:05:49,070
understand correctly you are going to

66
00:05:52,600 --> 00:05:50,750
have to you might have to leave us

67
00:05:54,250 --> 00:05:52,610
before the end of this program there's

68
00:05:55,840 --> 00:05:54,260
something about 10 blocks away what is

69
00:05:58,410 --> 00:05:55,850
it late lunch or something what do you

70
00:06:05,230 --> 00:05:58,420
what's going 1600 Pennsylvania Avenue

71
00:06:06,430 --> 00:06:05,240
and father would desert us that's great

72
00:06:09,550 --> 00:06:06,440
we're looking for it now you did a

73
00:06:11,410 --> 00:06:09,560
commentary for CNN just a couple of

74
00:06:13,570 --> 00:06:11,420
months ago that was darn interesting you

75
00:06:15,880 --> 00:06:13,580
thought that we would need to inspire

76
00:06:17,800 --> 00:06:15,890
youngsters more than we're doing now and

77
00:06:19,450 --> 00:06:17,810
you thought the way to do that was with

78
00:06:21,400 --> 00:06:19,460
the mission to Mars manned mission to

79
00:06:23,620 --> 00:06:21,410
Mars but more than that you used the

80
00:06:26,850 --> 00:06:23,630
word and not just to make a mission but

81
00:06:29,770 --> 00:06:26,860
the homestead Mars what you mean by then

82
00:06:32,950 --> 00:06:29,780
well it's not going to happen in within

83
00:06:36,730 --> 00:06:32,960
a decade and it's not going to require

84
00:06:39,160 --> 00:06:36,740
breaking the bank right now we can maybe

85
00:06:42,670 --> 00:06:39,170
save some money by realigning what we're

86
00:06:45,010 --> 00:06:42,680
doing and then a gradual course and how

87
00:06:47,179 --> 00:06:45,020
about the moon well we got a lot of

88
00:06:50,939 --> 00:06:47,189

experience on the moon

89
00:06:52,439 --> 00:06:50,949
40 years ago and we have an awful lot of

90
00:06:54,540 --> 00:06:52,449
experience on the moon the last four

91
00:06:56,969 --> 00:06:54,550
years because we've been planning on

92
00:07:01,679 --> 00:06:56,979
going to ourselves so we can take that

93
00:07:04,709 --> 00:07:01,689
experience and communicate it help work

94
00:07:06,600 --> 00:07:04,719
with the international nations will they

95
00:07:10,549 --> 00:07:06,610
come together for the move I don't know

96
00:07:13,169 --> 00:07:10,559
but they have an umbrella organization

97
00:07:15,239 --> 00:07:13,179
that's over and above the international

98
00:07:17,850 --> 00:07:15,249
space station so we need to start there

99
00:07:20,730 --> 00:07:17,860
and bring in China bring in India South

100
00:07:24,449 --> 00:07:20,740
Korea the other spacefaring nations into

101
00:07:27,689 --> 00:07:24,459
the space station and based on that we

102
00:07:30,529 --> 00:07:27,699
have an international lunar Economic

103
00:07:33,389 --> 00:07:30,539
Development Authority communic

104
00:07:35,070 --> 00:07:33,399
corporation whatever it is and and the

105
00:07:37,260 --> 00:07:35,080
US says we're going to help you people

106
00:07:39,570 --> 00:07:37,270
all you want because you your nations

107
00:07:42,600 --> 00:07:39,580
and your international groups want to

108
00:07:45,269 --> 00:07:42,610
land on the moon we do too but we'll

109
00:07:46,769 --> 00:07:45,279
ride with you in your rockets in your

110
00:07:50,189 --> 00:07:46,779
spacecraft because we're going to take

111
00:07:51,929 --> 00:07:50,199
our resources our resources that we put

112
00:07:53,299 --> 00:07:51,939
into the International Space Station to

113
00:07:55,949 --> 00:07:53,309

the tune of one hundred billion dollars

114
00:07:59,219 --> 00:07:55,959
okay we're going to take our resources

115
00:08:02,009 --> 00:07:59,229
and have it establish a pathway a

116
00:08:06,299 --> 00:08:02,019
pathway that may take a little more than

117
00:08:10,949 --> 00:08:06,309
two decades but it is a pathway that

118
00:08:13,529 --> 00:08:10,959
will achieve more things than dedicating

119
00:08:16,199 --> 00:08:13,539
a return to the moon right away that's a

120
00:08:19,049 --> 00:08:16,209
pretty aggressive plan isn't it well yes

121
00:08:21,059 --> 00:08:19,059
it is but there's no reason why at the

122
00:08:23,809 --> 00:08:21,069
International Space Station we can't put

123
00:08:26,549 --> 00:08:23,819
a test module of the long-duration

124
00:08:28,469 --> 00:08:26,559
life-support equipment that we've sort

125
00:08:30,959 --> 00:08:28,479
of been hopefully developing all these

126
00:08:32,999 --> 00:08:30,969
times but in the same time we develop an

127
00:08:36,569 --> 00:08:33,009
exploration module that can accompany

128
00:08:38,879 --> 00:08:36,579
Orion on 12 year missions you're not

129
00:08:42,360 --> 00:08:38,889
going to put people in sight and Orion

130
00:08:44,730 --> 00:08:42,370
Apollo like capsule for six months at a

131
00:08:46,470 --> 00:08:44,740
time no you're going to put them there

132
00:08:48,210 --> 00:08:46,480
to go to the moon and come back but how

133
00:08:50,939 --> 00:08:48,220
about going to much longer distance

134
00:08:53,129 --> 00:08:50,949
you've got to have more room you've got

135
00:08:55,259 --> 00:08:53,139
to have the equipment that can support

136
00:08:57,240 --> 00:08:55,269
these people with the redundancy that

137
00:08:59,199 --> 00:08:57,250
doesn't require you cramp it all

138
00:09:02,350 --> 00:08:59,209

together for it for a launch you

139
00:09:04,840 --> 00:09:02,360
you make it larger and as a matter of

140
00:09:08,650 --> 00:09:04,850
fact you can model this sort of thing

141
00:09:11,290 --> 00:09:08,660
after a Mars habitat and a Mars Lander

142
00:09:15,100 --> 00:09:11,300
so that we're looking at those vehicles

143
00:09:17,769 --> 00:09:15,110
and we're using those soon to begin to

144
00:09:20,169 --> 00:09:17,779
plan outward movements you know thursday

145
00:09:22,299 --> 00:09:20,179
night in Dayton pardon me friday night

146
00:09:24,189 --> 00:09:22,309
in Dayton you told us something all of

147
00:09:25,480 --> 00:09:24,199
us assembled in the audience something

148
00:09:27,280 --> 00:09:25,490
that we didn't know before at least I

149
00:09:28,949 --> 00:09:27,290
didn't and according to their reaction

150
00:09:32,590 --> 00:09:28,959
they didn't either this is on the moon

151
00:09:34,600 --> 00:09:32,600
you and Neil the first ones to step out

152
00:09:36,429 --> 00:09:34,610
onto the moon you told us there were a

153
00:09:38,590 --> 00:09:36,439
couple of other firsts there as well

154
00:09:44,470 --> 00:09:38,600
would you like to tell the people what

155
00:09:47,619 --> 00:09:44,480
you told us well I failed my first

156
00:09:49,299 --> 00:09:47,629
assignment on the surface of the Moon it

157
00:09:51,910 --> 00:09:49,309
was to get down the bottom and jump back

158
00:09:55,439 --> 00:09:51,920
up again I was overconfident I've done a

159
00:09:58,749 --> 00:09:55,449
fairly great job space walking on

160
00:10:00,579 --> 00:09:58,759
Germany 12 and I was a little

161
00:10:03,160 --> 00:10:00,589
overconfident I didn't think the lunar

162
00:10:07,509 --> 00:10:03,170
gravity 16 was going to be that big so I

163
00:10:10,239 --> 00:10:07,519

jumped back up and missed ok next time I

164
00:10:12,850 --> 00:10:10,249
I made why did we do that well because

165
00:10:15,069 --> 00:10:12,860
we knew we couldn't take the rock boxes

166
00:10:16,960 --> 00:10:15,079
and climb up the ladder with them we had

167
00:10:19,449 --> 00:10:16,970
to send the rock boxes up on the

168
00:10:21,579 --> 00:10:19,459
clothesline and the same clothes line

169
00:10:24,069 --> 00:10:21,589
was used to send a camera down so that

170
00:10:27,929 --> 00:10:24,079
obviously Neil could take my picture

171
00:10:31,210 --> 00:10:27,939
when I came down excellent photographer

172
00:10:34,059 --> 00:10:31,220
that's not what you're talking about we

173
00:10:37,780 --> 00:10:34,069
had great confidence in the inside the

174
00:10:41,189 --> 00:10:37,790
spacesuit plumbing we had great

175
00:10:44,169 --> 00:10:41,199
confidence in the backpack the the many

176
00:10:48,509 --> 00:10:44,179
spacecraft on our back that gave us the

177
00:10:52,509 --> 00:10:48,519
electricity the water cooled underwear

178
00:10:55,059 --> 00:10:52,519
and the of course the life-sustaining

179
00:10:57,400 --> 00:10:55,069
oxygen with an emergency oxygen that's

180
00:10:59,499 --> 00:10:57,410
not what I'm talking about this no but I

181
00:11:01,869 --> 00:10:59,509
had we had great confidence in the

182
00:11:05,259 --> 00:11:01,879
interior plumbing as a matter of fact we

183
00:11:07,600 --> 00:11:05,269
just emptied it all out so that we could

184
00:11:12,070 --> 00:11:07,610
throw it out on the surface later on so

185
00:11:17,500 --> 00:11:12,080
there was plenty of capacity in the UCD

186
00:11:19,960 --> 00:11:17,510
you're in collection device right and I

187
00:11:21,310 --> 00:11:19,970
I just had that moment you know I knew

188
00:11:23,650 --> 00:11:21,320

when I got to the bottom of the ladder

189
00:11:25,990 --> 00:11:23,660
that that it was clearly going to be

190
00:11:27,400 --> 00:11:26,000
very easy to walk around the moon what

191
00:11:29,850 --> 00:11:27,410
am I supposed to do for the next 30

192
00:11:32,140 --> 00:11:29,860
seconds while I'm checking civility

193
00:11:35,200 --> 00:11:32,150
maybe we're a little nervous here and

194
00:11:38,740 --> 00:11:35,210
there but what I do is I talk about

195
00:11:44,290 --> 00:11:38,750
things that are human and and I talked

196
00:11:46,840 --> 00:11:44,300
about how people are compelled and

197
00:11:48,130 --> 00:11:46,850
really worried about what they're trying

198
00:11:50,020 --> 00:11:48,140
to do they're not worried but they're

199
00:11:51,600 --> 00:11:50,030
alert to what they're trying to do on

200
00:11:54,910 --> 00:11:51,610
the surface remember what you said I

201
00:11:56,950 --> 00:11:54,920
said magnificent desolation not right

202
00:11:59,640 --> 00:11:56,960
away but I gave it a little bit of

203
00:12:03,910 --> 00:11:59,650
thought and in the magnificence of

204
00:12:07,120 --> 00:12:03,920
humanity mankind coming down from the

205
00:12:10,260 --> 00:12:07,130
trees or wherever we came from and then

206
00:12:13,540 --> 00:12:10,270
doing all the things necessary to get

207
00:12:17,020 --> 00:12:13,550
steam he's not going to tell you what he

208
00:12:19,720 --> 00:12:17,030
said rockets no spacecraft and and

209
00:12:20,890 --> 00:12:19,730
putting on the surface of the Moon I'll

210
00:12:23,050 --> 00:12:20,900
tell you what he said and and it's

211
00:12:31,139 --> 00:12:23,060
lonely as hell up there maybe I won't

212
00:12:36,819 --> 00:12:34,509
what I said we're Alan Shepard when he

213
00:12:41,410 --> 00:12:36,829

sat on that redstone rocket he didn't

214
00:12:44,139 --> 00:12:41,420
have a UCD so he was floating on water

215
00:12:46,480 --> 00:12:44,149
for a while before his 15 minutes in

216
00:12:48,610 --> 00:12:46,490
flight well that's great but what was

217
00:12:50,610 --> 00:12:48,620
actually said to us on Friday night was

218
00:12:59,110 --> 00:12:50,620
well maybe Neil was the first one to

219
00:13:02,499 --> 00:12:59,120
walk on the moon but he hadn't disputed

220
00:13:08,850 --> 00:13:02,509
that fact he had 20 minutes to set

221
00:13:11,790 --> 00:13:08,860
another record haha Charles Apollo 16

222
00:13:14,470 --> 00:13:11,800
there were some problems particularly

223
00:13:16,829 --> 00:13:14,480
bring us up to date remind us what went

224
00:13:20,050 --> 00:13:16,839
on as you were just getting ready well

225
00:13:23,530 --> 00:13:20,060
Apollo 16 like all the other Apollo

226
00:13:25,329 --> 00:13:23,540
flights has problems you know you look

227
00:13:27,160 --> 00:13:25,339
back now 40 years and we had six

228
00:13:29,050 --> 00:13:27,170
landings and everybody is a piece of

229
00:13:30,730 --> 00:13:29,060
cake but it wasn't a piece of cake I

230
00:13:34,329 --> 00:13:30,740
mean landing on the moon is a really

231
00:13:36,670 --> 00:13:34,339
difficult task and not only are you

232
00:13:38,319 --> 00:13:36,680
coming into an area nobody's ever landed

233
00:13:40,660 --> 00:13:38,329
before but you've never seen it in

234
00:13:42,850 --> 00:13:40,670
detail before the photographs we out of

235
00:13:45,549 --> 00:13:42,860
our landing site were 15 meter

236
00:13:47,290 --> 00:13:45,559
resolution so and there are a lot of big

237
00:13:49,990 --> 00:13:47,300
craters it can put you in trouble at a

238
00:13:52,119 --> 00:13:50,000

30 feet across or 10 feet across and so

239
00:13:55,689 --> 00:13:52,129
we were coming in and who is seeing all

240
00:13:58,840 --> 00:13:55,699
of these these craters and we had to

241
00:14:01,629 --> 00:13:58,850
pick a landing spot but before that we

242
00:14:04,990 --> 00:14:01,639
were on the backside of the moon with

243
00:14:07,030 --> 00:14:05,000
Mattingly and he had to change his orbit

244
00:14:10,329 --> 00:14:07,040
in the command module and that required

245
00:14:12,840 --> 00:14:10,339
a major engine ignition with what we

246
00:14:15,369 --> 00:14:12,850
call the service propulsion system and

247
00:14:18,819 --> 00:14:15,379
as he tested this out before the

248
00:14:20,980 --> 00:14:18,829
ignition it was rattling a spacecraft a

249
00:14:24,309 --> 00:14:20,990
Pete to pieces he said and he said I

250
00:14:26,290 --> 00:14:24,319
can't burn well if your heart can sink

251
00:14:28,509 --> 00:14:26,300
in zero gravity to the bottom of your

252
00:14:31,900 --> 00:14:28,519
boots our sink to the bottom of our

253
00:14:35,230 --> 00:14:31,910
boots because that's an abort and so

254
00:14:37,600 --> 00:14:35,240
you'd come 250,000 miles you trained two

255
00:14:39,519 --> 00:14:37,610
years and eight miles down there was

256
00:14:41,679 --> 00:14:39,529
your landing site and they're about

257
00:14:42,730 --> 00:14:41,689
ready to tell you to come home so you

258
00:14:45,370 --> 00:14:42,740
can imagine I just

259
00:14:48,190 --> 00:14:45,380
when we were but the teamwork that we

260
00:14:51,310 --> 00:14:48,200
exhibited not only to get them to the

261
00:14:56,470 --> 00:14:51,320
land to Apollo 13 back safely and all

262
00:14:59,350 --> 00:14:56,480
the other problems came in focus and up

263
00:15:01,900 --> 00:14:59,360

to speed and six hours later they said

264
00:15:06,040 --> 00:15:01,910
you're go for landing so down we went

265
00:15:10,750 --> 00:15:06,050
and from then on it was it was fantastic

266
00:15:13,720 --> 00:15:10,760
so our heart went from here to here when

267
00:15:16,389 --> 00:15:13,730
we heard a cat I Capcom Jim Irwin said

268
00:15:18,460 --> 00:15:16,399
we gonna give you next time around you

269
00:15:20,350 --> 00:15:18,470
got to go for landing so and you were

270
00:15:25,240 --> 00:15:20,360
there for a long time we were there for

271
00:15:28,810 --> 00:15:25,250
71 hours and 14 minutes nasa put us in

272
00:15:32,170 --> 00:15:28,820
for the record record stay so we had to

273
00:15:34,329 --> 00:15:32,180
record for longest day until the next

274
00:15:37,870 --> 00:15:34,339
flight apollo 17 they actually stayed

275
00:15:40,210 --> 00:15:37,880
about 75 hours but i just respected me

276
00:15:43,120 --> 00:15:40,220
they did it just for spite yeah we

277
00:15:44,949 --> 00:15:43,130
pleaded for mission country two hours

278
00:15:47,110 --> 00:15:44,959
more guys just two hours more that's all

279
00:15:49,329 --> 00:15:47,120
we want and they said get back in it's

280
00:15:54,190 --> 00:15:49,339
time to come home what do you see is the

281
00:15:56,530 --> 00:15:54,200
future of manned space flight well I I

282
00:15:58,180 --> 00:15:56,540
would like to see us back into deep

283
00:15:59,980 --> 00:15:58,190
space we got a big investment in

284
00:16:03,790 --> 00:15:59,990
international space station we need to

285
00:16:05,230 --> 00:16:03,800
use that we've got and there's a lot of

286
00:16:09,670 --> 00:16:05,240
ways we can get a return on that

287
00:16:12,130 --> 00:16:09,680
investment going back into deep space I

288
00:16:16,870 --> 00:16:12,140

think Kendall's the human spirit of

289
00:16:18,760 --> 00:16:16,880
exploration buzz and I have a little

290
00:16:20,860 --> 00:16:18,770
disagreement about should we go to the

291
00:16:23,560 --> 00:16:20,870
moon with our resources I agree it

292
00:16:25,210 --> 00:16:23,570
should be international but a return to

293
00:16:28,180 --> 00:16:25,220
the moon I think would be also an

294
00:16:31,420 --> 00:16:28,190
opportunity to to develop some of these

295
00:16:34,269 --> 00:16:31,430
systems that we're going to have for a

296
00:16:37,630 --> 00:16:34,279
marsh day he wants to do it enter in ISS

297
00:16:40,420 --> 00:16:37,640
which is not a bad idea I'm think back

298
00:16:44,230 --> 00:16:40,430
to the moon but whichever way we do it

299
00:16:46,360 --> 00:16:44,240
it will just be a stepping stone on into

300
00:16:49,639 --> 00:16:46,370
out into the distance and I hope that

301
00:16:54,210 --> 00:16:49,649
I'm around to see

302
00:16:55,769 --> 00:16:54,220
those first footprints hone bars and i

303
00:16:59,130 --> 00:16:55,779
think that the technology that we

304
00:17:01,829 --> 00:16:59,140
developed for that as a capital

305
00:17:03,540 --> 00:17:01,839
expenditure for our country will great

306
00:17:05,429 --> 00:17:03,550
dividends for us and we'll have a great

307
00:17:08,220 --> 00:17:05,439
return on investment thank you charles

308
00:17:11,010 --> 00:17:08,230
bridge and i agree with you i hope time

309
00:17:13,710 --> 00:17:11,020
around to see it too I'll do not going

310
00:17:15,510 --> 00:17:13,720
to ask you mr. Lord before we get to you

311
00:17:18,179 --> 00:17:15,520
we have standing by right now with a

312
00:17:19,679 --> 00:17:18,189
question for buzz who as we say might be

313
00:17:21,660 --> 00:17:19,689

getting out of here pretty soon this is

314
00:17:23,520 --> 00:17:21,670
from the Museum of Science in Boston

315
00:17:26,850 --> 00:17:23,530
buzzes question is coming to you from

316
00:17:28,740 --> 00:17:26,860
eight year old Marcus from cohasset

317
00:17:32,610 --> 00:17:28,750
Massachusetts I'll take it easy on you

318
00:17:36,930 --> 00:17:32,620
Marcus okay hi but my name is Marcus I

319
00:17:40,950 --> 00:17:36,940
am eight years old I would like to go to

320
00:17:44,820 --> 00:17:40,960
Mars one day at an engineer or scientist

321
00:17:52,890 --> 00:17:44,830
what should I study what hobbies are

322
00:17:55,770 --> 00:17:52,900
good for him and astronaut when I was at

323
00:17:58,409 --> 00:17:55,780
MIT I lived in north scituate not too

324
00:18:04,680 --> 00:17:58,419
far from cohasset so I know right where

325
00:18:08,370 --> 00:18:04,690
you're coming from and you need patience

326
00:18:10,380 --> 00:18:08,380
you need to communicate with other

327
00:18:14,190 --> 00:18:10,390
people you need to have I think

328
00:18:19,400 --> 00:18:14,200
something that separates you from others

329
00:18:24,120 --> 00:18:19,410
you're going to have a an evaluation of

330
00:18:25,620 --> 00:18:24,130
considerable weeding out of other people

331
00:18:30,270 --> 00:18:25,630
that are trying to do the same thing

332
00:18:34,880 --> 00:18:30,280
you'd like to do let me ask you when you

333
00:18:37,560 --> 00:18:34,890
you say you want to go to Mars Marcus

334
00:18:43,549 --> 00:18:37,570
Marcus yeah yeah how long do you think

335
00:18:50,070 --> 00:18:47,940
how long you said stay yeah well that's

336
00:18:53,130 --> 00:18:50,080
that's a normal answer there was

337
00:18:55,860 --> 00:18:53,140
somebody at some event and they said my

338
00:18:57,030 --> 00:18:55,870

son is 8 he's going to go to Mars so I

339
00:18:59,690 --> 00:18:57,040
said how long do you think you're going

340
00:19:01,970 --> 00:18:59,700
to stay he said a couple of days

341
00:19:03,590 --> 00:19:01,980
and I said well it may take you a better

342
00:19:05,269 --> 00:19:03,600
part of a year just to get there why

343
00:19:09,230 --> 00:19:05,279
would you want to stay only a couple of

344
00:19:11,210 --> 00:19:09,240
days why would we want to invest all

345
00:19:12,710 --> 00:19:11,220
that money and sending you there and

346
00:19:14,570 --> 00:19:12,720
then bring you back you're not going to

347
00:19:17,269 --> 00:19:14,580
give us all that much science or that

348
00:19:19,460 --> 00:19:17,279
return as a matter of fact nobody's

349
00:19:21,200 --> 00:19:19,470
going to build a 50-person spacecraft to

350
00:19:23,240 --> 00:19:21,210
send the first people to the surface of

351
00:19:26,480 --> 00:19:23,250
Mars now there is a critical number of

352
00:19:29,330 --> 00:19:26,490
people that need to be there to do the

353
00:19:33,080 --> 00:19:29,340
things to make a sustaining group then

354
00:19:35,060 --> 00:19:33,090
it's bigger than sex it's maybe 50 or 60

355
00:19:39,980 --> 00:19:35,070
and you know how long it takes to

356
00:19:41,840 --> 00:19:39,990
accumulate 60 people every 26 months you

357
00:19:44,779 --> 00:19:41,850
can send another mission to Mars it

358
00:19:49,340 --> 00:19:44,789
takes 20 to 23 years to accumulate

359
00:19:54,620 --> 00:19:49,350
enough people we need to rethink a good

360
00:19:57,590 --> 00:19:54,630
bit about are we really ready to venture

361
00:20:02,779 --> 00:19:57,600
out that far and what does it really

362
00:20:05,330 --> 00:20:02,789
take i think we're we're ready to think

363
00:20:08,840 --> 00:20:05,340

about that but we have a pathway that

364
00:20:10,580 --> 00:20:08,850
can branch off to asteroids that can if

365
00:20:12,080 --> 00:20:10,590
somebody discovers something really

366
00:20:15,049 --> 00:20:12,090
important at the moon and i'm not sure

367
00:20:19,129 --> 00:20:15,059
what it is that justifies the investment

368
00:20:22,519 --> 00:20:19,139
in habitation for people of a nation

369
00:20:28,330 --> 00:20:22,529
that by that time we'll have stayed on

370
00:20:31,850 --> 00:20:28,340
the moon 50 years ago you realize that

371
00:20:36,710 --> 00:20:31,860
from Kitty Hawk to tranquility base with

372
00:20:41,029 --> 00:20:36,720
66 years now let's go 66 years into the

373
00:20:43,399 --> 00:20:41,039
future that's 2035 Marcus you'll be we

374
00:20:46,340 --> 00:20:43,409
don't want to be kicking up dust back on

375
00:20:48,649 --> 00:20:46,350
the moon now Marcus I think we'll we'll

376
00:20:51,250 --> 00:20:48,659
be doing some real man to man talking

377
00:20:53,509 --> 00:20:51,260
about how long you might want to stay

378
00:20:56,840 --> 00:20:53,519
whether you want to spend the rest of

379
00:20:59,750 --> 00:20:56,850
your life on Mars or until we come up

380
00:21:02,090 --> 00:20:59,760
with warp drive so we can bring you back

381
00:21:03,860 --> 00:21:02,100
in a couple of days thanks a lot Marcus

382
00:21:05,299 --> 00:21:03,870
and we appreciate the question just

383
00:21:08,000 --> 00:21:05,309
before we get to our next question which

384
00:21:09,529 --> 00:21:08,010
is going to be for you Charles but

385
00:21:10,500 --> 00:21:09,539
before we get that I want to I want to

386
00:21:12,870 --> 00:21:10,510
talk to Laura

387
00:21:14,040 --> 00:21:12,880
for a moment this proposed new man

388
00:21:16,590 --> 00:21:14,050

mission that most people are talking

389
00:21:18,330 --> 00:21:16,600
about the one going back to the moon is

390
00:21:20,220 --> 00:21:18,340
this sort of back to the future tell us

391
00:21:21,510 --> 00:21:20,230
what's going on is we're not using the

392
00:21:23,250 --> 00:21:21,520
shuttle technology are we using the

393
00:21:25,500 --> 00:21:23,260
Apollo technology this time it looks

394
00:21:27,330 --> 00:21:25,510
more similar to Apollo than that then

395
00:21:28,740 --> 00:21:27,340
like the Space Shuttle it's a capsule

396
00:21:31,230 --> 00:21:28,750
that people write in but this time we'll

397
00:21:33,390 --> 00:21:31,240
be sending at least four people back to

398
00:21:35,190 --> 00:21:33,400
the moon and they'll be riding in this

399
00:21:36,600 --> 00:21:35,200
point separately from their their

400
00:21:38,280 --> 00:21:36,610
descent capsule in Bell Brandi Boone

401
00:21:40,860 --> 00:21:38,290
Earth orbit and go down to the moon and

402
00:21:42,120 --> 00:21:40,870
right now with an orbiter an unmanned

403
00:21:43,470 --> 00:21:42,130
orbiter that's in orbit around the moon

404
00:21:45,390 --> 00:21:43,480
called the lunar reconnaissance orbiter

405
00:21:47,340 --> 00:21:45,400
we're taking pictures of prospective

406
00:21:49,410 --> 00:21:47,350
landing sites as Charlie said they only

407
00:21:50,850 --> 00:21:49,420
had very poor resolution images when we

408
00:21:52,620 --> 00:21:50,860
went there with Apollo we are going to

409
00:21:55,020 --> 00:21:52,630
make an incredible map of the moon with

410
00:21:57,690 --> 00:21:55,030
LRO you can go online and see some of

411
00:21:59,490 --> 00:21:57,700
those first pictures right now and know

412
00:22:01,080 --> 00:21:59,500
exactly the most interesting places to

413
00:22:02,520 --> 00:22:01,090

go the safest places to go and the

414
00:22:04,350 --> 00:22:02,530
places where there might be things we

415
00:22:05,970 --> 00:22:04,360
can use to live off the land once we get

416
00:22:09,780 --> 00:22:05,980
there I just learned this weekend that

417
00:22:11,760 --> 00:22:09,790
we have a much better maps of Mars than

418
00:22:13,260 --> 00:22:11,770
we do up the moon that's absolutely true

419
00:22:15,360 --> 00:22:13,270
right now the instruments that are in

420
00:22:17,160 --> 00:22:15,370
orbit around the moon on LRO it just got

421
00:22:18,480 --> 00:22:17,170
there a couple of weeks ago are going to

422
00:22:20,040 --> 00:22:18,490
change that they're going to make our

423
00:22:22,290 --> 00:22:20,050
maps of the moon just as good if not

424
00:22:23,910 --> 00:22:22,300
better than our maps of Mars Charles

425
00:22:25,410 --> 00:22:23,920
this question is coming to you from Anna

426
00:22:27,600 --> 00:22:25,420
this is from the American Museum of

427
00:22:38,570 --> 00:22:27,610
Natural History in New York this is for

428
00:22:46,850 --> 00:22:43,730
on the moon and time partner I miss that

429
00:22:49,580 --> 00:22:46,860
I'm sorry what is what do you think is

430
00:22:51,080 --> 00:22:49,590
the the possibility of living on the

431
00:22:52,519 --> 00:22:51,090
moon what kind of support would be

432
00:22:57,799 --> 00:22:52,529
needed to do that for extended periods

433
00:23:01,220 --> 00:22:57,809
of time hopefully we'll establish a base

434
00:23:03,110 --> 00:23:01,230
that if that's what we decide to do is

435
00:23:04,970 --> 00:23:03,120
return the moon we'd want to establish a

436
00:23:10,220 --> 00:23:04,980
base similar that we have in Antarctica

437
00:23:13,190 --> 00:23:10,230
so it will require supply modules and I

438
00:23:16,000 --> 00:23:13,200

think we can develop technologies that

439
00:23:19,480 --> 00:23:16,010
will use that we can use to attract

440
00:23:23,289 --> 00:23:19,490
oxygen hydrogen from the rocks and

441
00:23:31,519 --> 00:23:23,299
utilize the resources there eventually

442
00:23:35,029 --> 00:23:31,529
to help us to inhabit this area of the

443
00:23:36,860 --> 00:23:35,039
moon for a considerable time and and I

444
00:23:38,480 --> 00:23:36,870
think that's what science wants us to do

445
00:23:41,419 --> 00:23:38,490
is they go back and build a science

446
00:23:43,129 --> 00:23:41,429
there's a lot to learn about the lunar

447
00:23:45,860 --> 00:23:43,139
surface that we've just scratched the

448
00:23:48,049 --> 00:23:45,870
surface and so maybe it's not such a bad

449
00:23:50,120 --> 00:23:48,059
idea to look for that thanks so much

450
00:23:51,259 --> 00:23:50,130
Anna and Laura I really wanted to talk

451
00:23:53,029 --> 00:23:51,269
to you a little more about that later

452
00:23:56,389 --> 00:23:53,039
because that's one of your specialties

453
00:23:59,149 --> 00:23:56,399
of course searching for water and the

454
00:24:01,159 --> 00:23:59,159
water in and on various heavenly bodies

455
00:24:02,269 --> 00:24:01,169
in the solar system before I got to that

456
00:24:04,850 --> 00:24:02,279
I certainly want to talk to John

457
00:24:07,789 --> 00:24:04,860
Grunsfeld who gave us heart palpitations

458
00:24:10,720 --> 00:24:07,799
not so long ago I understand of course

459
00:24:13,100 --> 00:24:10,730
that you practice for all eventualities

460
00:24:16,730 --> 00:24:13,110
in trying to repair the Hubble telescope

461
00:24:20,750 --> 00:24:16,740
but for heaven's sake no matter what you

462
00:24:23,539 --> 00:24:20,760
rehearse for what surprises did you find

463
00:24:26,750 --> 00:24:23,549

that scared you as much as it scared us

464
00:24:28,450 --> 00:24:26,760
well as you said our team on sts-125

465
00:24:31,159 --> 00:24:28,460
atlantis commanded by Scott Altman

466
00:24:32,389 --> 00:24:31,169
trained for two and a half years a lot

467
00:24:33,889 --> 00:24:32,399
of that training was just you know the

468
00:24:35,779 --> 00:24:33,899
nuts and bolts of putting things in and

469
00:24:37,250 --> 00:24:35,789
out of Hubble but much of the training

470
00:24:38,960 --> 00:24:37,260
was what to do when things don't go well

471
00:24:41,419 --> 00:24:38,970
and so we trained hundreds of different

472
00:24:43,610 --> 00:24:41,429
scenarios where this wouldn't work quite

473
00:24:45,769 --> 00:24:43,620
right or that wouldn't go in and we had

474
00:24:47,690 --> 00:24:45,779
116 tools that we developed just for

475
00:24:49,460 --> 00:24:47,700
this mission over 400 different tools

476
00:24:52,159 --> 00:24:49,470
power drives and wrenches and

477
00:24:54,289 --> 00:24:52,169
screwdrivers and things like this we got

478
00:24:56,180 --> 00:24:54,299
out the door with the first spacewalk

479
00:24:58,430 --> 00:24:56,190
and went to the first major task which

480
00:25:00,379 --> 00:24:58,440
was to replace an old camera with a

481
00:25:02,360 --> 00:25:00,389
brand-new amazing camera that's up on

482
00:25:05,060 --> 00:25:02,370
Hubble right now the wide field camera 3

483
00:25:06,560 --> 00:25:05,070
and to remove the old camera we just had

484
00:25:09,200 --> 00:25:06,570
one big bolt to turn and that bolt

485
00:25:12,019 --> 00:25:09,210
didn't turn you know with all the force

486
00:25:13,820 --> 00:25:12,029
we could put on it with the initial set

487
00:25:15,799 --> 00:25:13,830
of tools and there was a pretty good

488
00:25:17,379 --> 00:25:15,809

risk that that bolt would break and that

489
00:25:19,460 --> 00:25:17,389
would be the end of this camera

490
00:25:21,470 --> 00:25:19,470
fortunately just a little bit of extra

491
00:25:23,330 --> 00:25:21,480
elbow grease and another tool and we got

492
00:25:25,129 --> 00:25:23,340
it but you know we talked about hard

493
00:25:27,379 --> 00:25:25,139
sinking you know this was the primary

494
00:25:29,389 --> 00:25:27,389
highest priority science on the mission

495
00:25:30,980 --> 00:25:29,399
and the very first thing we did and that

496
00:25:32,389 --> 00:25:30,990
first bolt didn't turn my heart was

497
00:25:35,720 --> 00:25:32,399
pretty low in my boots even though we're

498
00:25:37,760 --> 00:25:35,730
in weightlessness I think I think

499
00:25:39,080 --> 00:25:37,770
there's a point at which I say you know

500
00:25:41,629 --> 00:25:39,090
before we do this potentially

501
00:25:43,490 --> 00:25:41,639
game-ending event let's think about

502
00:25:45,470 --> 00:25:43,500
every alternative and we did and we

503
00:25:46,760 --> 00:25:45,480
found a way to get around it in fact we

504
00:25:49,220 --> 00:25:46,770
have a question for you this one is

505
00:25:50,690 --> 00:25:49,230
coming from the Museum of Science and

506
00:25:54,049 --> 00:25:50,700
Industry in Chicago I think we have a

507
00:26:02,060 --> 00:25:54,059
moderator there don't we yes we do go

508
00:26:04,730 --> 00:26:02,070
right ahead okay this is for job hello

509
00:26:08,029 --> 00:26:04,740
my name is Sasha Blakely from Vancouver

510
00:26:10,100 --> 00:26:08,039
Canada and 13 my question is what do you

511
00:26:11,720 --> 00:26:10,110
think is the next main technological

512
00:26:13,879 --> 00:26:11,730
breakthroughs that is essential for the

513
00:26:17,659 --> 00:26:13,889

success of the next phase of long-term

514
00:26:18,769 --> 00:26:17,669
space travel to the Moon or Mars so the

515
00:26:23,810 --> 00:26:18,779
question is what's the next

516
00:26:27,049 --> 00:26:23,820
technological breakthrough for exploring

517
00:26:29,869 --> 00:26:27,059
Moon and Mars I think there are so many

518
00:26:31,879 --> 00:26:29,879
challenges that we have to overcome to

519
00:26:34,490 --> 00:26:31,889
be able to develop a colony to live on

520
00:26:36,440 --> 00:26:34,500
the moon I think the using resources

521
00:26:38,930 --> 00:26:36,450
that you find every time explorers have

522
00:26:41,090 --> 00:26:38,940
gone out in terrestrial exploring the

523
00:26:42,680 --> 00:26:41,100
earth exploration that had utilize

524
00:26:44,659 --> 00:26:42,690
resources that they find when they get

525
00:26:47,149 --> 00:26:44,669
there so I think utilizing those

526
00:26:49,820 --> 00:26:47,159
resources on the moon to generate oxygen

527
00:26:51,350 --> 00:26:49,830
that we breathe going to Mars and being

528
00:26:53,029 --> 00:26:51,360
able to develop rocket fuel that will

529
00:26:55,279 --> 00:26:53,039
allow us to come back so we don't take

530
00:26:56,960 --> 00:26:55,289
so much rocket fuel with us to get there

531
00:26:58,940 --> 00:26:56,970
you know those are some some big

532
00:27:01,600 --> 00:26:58,950
examples I think being able to build

533
00:27:04,430 --> 00:27:01,610
life support that in a contained

534
00:27:05,030 --> 00:27:04,440
environment such as a module that you

535
00:27:06,590 --> 00:27:05,040
would live in

536
00:27:08,360 --> 00:27:06,600
to be able to recycle everything and

537
00:27:10,850 --> 00:27:08,370
keep it clean so that you're breathing

538
00:27:13,130 --> 00:27:10,860

clean air those technologies we haven't

539
00:27:15,530 --> 00:27:13,140
refined yet we can do it for short

540
00:27:17,480 --> 00:27:15,540
periods of time on the space shuttle now

541
00:27:19,010 --> 00:27:17,490
we're learning how to do it for longer

542
00:27:21,890 --> 00:27:19,020
periods of time on the International

543
00:27:23,960 --> 00:27:21,900
Space Station as we entered this

544
00:27:25,580 --> 00:27:23,970
conversation we talked about urine

545
00:27:27,200 --> 00:27:25,590
collection device well we actually are

546
00:27:29,660 --> 00:27:27,210
taking urine on the International Space

547
00:27:34,060 --> 00:27:29,670
Station purifying it into into really

548
00:27:38,930 --> 00:27:37,520
and ending in the astronauts and

549
00:27:40,030 --> 00:27:38,940
cosmonauts onboard the International

550
00:27:42,710 --> 00:27:40,040
Space Station with drinking that water

551
00:27:44,900 --> 00:27:42,720
those are some small examples I think in

552
00:27:47,870 --> 00:27:44,910
the big examples we're really not going

553
00:27:50,840 --> 00:27:47,880
to go explore the solar system where we

554
00:27:52,730 --> 00:27:50,850
can go to Mars in a period of days until

555
00:27:54,800 --> 00:27:52,740
we have some new form of propulsion

556
00:27:57,980 --> 00:27:54,810
chemical propulsion can only get us so

557
00:28:00,260 --> 00:27:57,990
far if we really want to to explore our

558
00:28:02,210 --> 00:28:00,270
future and our future is out there in

559
00:28:04,760 --> 00:28:02,220
the cosmos we're really going to need

560
00:28:06,770 --> 00:28:04,770
you know a fusion-powered drive or

561
00:28:08,600 --> 00:28:06,780
something like that that's technology

562
00:28:10,460 --> 00:28:08,610
that's totally accessible to us but

563
00:28:13,310 --> 00:28:10,470

involves an investment and some time and

564
00:28:15,770 --> 00:28:13,320
some really creative young engineers and

565
00:28:17,690 --> 00:28:15,780
scientists thank you very much for that

566
00:28:19,940 --> 00:28:17,700
question appreciate it I I did want to

567
00:28:21,770 --> 00:28:19,950
get back to the the question of water in

568
00:28:23,870 --> 00:28:21,780
the solar system is their empirical

569
00:28:26,270 --> 00:28:23,880
evidence that there is water elsewhere

570
00:28:30,050 --> 00:28:26,280
in the solar system yes and I'm drinking

571
00:28:32,810 --> 00:28:30,060
some of it right here in fact I spent

572
00:28:34,730 --> 00:28:32,820
most of my science career heating up

573
00:28:36,740 --> 00:28:34,740
samples of other planets and extracting

574
00:28:38,330 --> 00:28:36,750
water from them like like Mars so we've

575
00:28:40,070 --> 00:28:38,340
actually analyzed water molecules from

576
00:28:42,050 --> 00:28:40,080
Mars right here on earth so we know that

577
00:28:44,060 --> 00:28:42,060
there's water on Mars the moon is a big

578
00:28:46,160 --> 00:28:44,070
mystery when it comes to water there are

579
00:28:49,040 --> 00:28:46,170
craters near the poles of the moon where

580
00:28:51,200 --> 00:28:49,050
it's dark all of the time and so it's

581
00:28:52,940 --> 00:28:51,210
very very cold and there's some evidence

582
00:28:54,830 --> 00:28:52,950
from spacecraft that have orbited the

583
00:28:57,470 --> 00:28:54,840
moon but there could be frozen water

584
00:28:59,030 --> 00:28:57,480
trapped in those dark places and again

585
00:29:00,290 --> 00:28:59,040
one of the objectives of the missions

586
00:29:02,270 --> 00:29:00,300
that are going to the moon right now is

587
00:29:03,740 --> 00:29:02,280
to see whether that's really true and if

588
00:29:06,080 --> 00:29:03,750

there really is water in those dark

589
00:29:07,610 --> 00:29:06,090
craters what a fantastic resource for

590
00:29:09,080 --> 00:29:07,620
the people who could go back to live and

591
00:29:11,630 --> 00:29:09,090
work on the moon so that's a huge

592
00:29:13,100 --> 00:29:11,640
question still and of course water is so

593
00:29:14,840 --> 00:29:13,110
critical if you want to think about life

594
00:29:15,750 --> 00:29:14,850
on other worlds liquid water is really

595
00:29:17,760 --> 00:29:15,760
what you need not

596
00:29:19,740 --> 00:29:17,770
and water so places like Mars where it

597
00:29:21,780 --> 00:29:19,750
could be liquid places like the moons of

598
00:29:23,970 --> 00:29:21,790
Jupiter where below and icy crust could

599
00:29:26,250 --> 00:29:23,980
be a liquid water ocean our places that

600
00:29:28,050 --> 00:29:26,260
we want to explore initially with robots

601
00:29:29,670 --> 00:29:28,060
and maybe eventually with humans to try

602
00:29:33,090 --> 00:29:29,680
and answer that most fundamental

603
00:29:34,950 --> 00:29:33,100
question are we alone yeah I wonder if

604
00:29:37,080 --> 00:29:34,960
that question will come from Denver

605
00:29:39,450 --> 00:29:37,090
because the question is for you Laura

606
00:29:41,910 --> 00:29:39,460
this is from the Denver Museum of Nature

607
00:29:45,090 --> 00:29:41,920
and Science and we're standing by for

608
00:29:48,150 --> 00:29:45,100
the question go right ahead please hi

609
00:29:52,920 --> 00:29:48,160
dr. lesson we have a question from from

610
00:29:54,900 --> 00:29:52,930
Shelly at the Denver Museum dr. Hutchins

611
00:29:56,790 --> 00:29:54,910
I've heard the idea that the moon was

612
00:29:58,170 --> 00:29:56,800
formed by something hitting the earth

613
00:30:00,720 --> 00:29:58,180

early in the solar system's formation

614
00:30:01,920 --> 00:30:00,730
and I'm just wondering if material

615
00:30:05,040 --> 00:30:01,930
brought back from the Apollo missions

616
00:30:06,600 --> 00:30:05,050
has helped to prove that hypothesis yes

617
00:30:08,100 --> 00:30:06,610
very good question excellent so you've

618
00:30:09,600 --> 00:30:08,110
all heard of the big bang theory of the

619
00:30:13,200 --> 00:30:09,610
origin of the universe we call this one

620
00:30:15,210 --> 00:30:13,210
the big whack this is the leading theory

621
00:30:17,160 --> 00:30:15,220
the leading hypothesis for the origin of

622
00:30:19,500 --> 00:30:17,170
the moon is something called the giant

623
00:30:21,270 --> 00:30:19,510
impact hypothesis where an object that's

624
00:30:23,220 --> 00:30:21,280
about the size of Mars Mars is about

625
00:30:25,440 --> 00:30:23,230
half the size of the earth hit the earth

626
00:30:27,270 --> 00:30:25,450
very early in its history and the

627
00:30:30,180 --> 00:30:27,280
material that was spewed off in that

628
00:30:32,220 --> 00:30:30,190
giant impact actually then agglomerated

629
00:30:35,010 --> 00:30:32,230
accreted together to form our moon

630
00:30:36,660 --> 00:30:35,020
sounds crazy I know but in fact it's the

631
00:30:39,630 --> 00:30:36,670
leading theory for the formation of the

632
00:30:40,980 --> 00:30:39,640
moon now when we went back to them when

633
00:30:42,510 --> 00:30:40,990
we went to the moon with Apollo there

634
00:30:44,760 --> 00:30:42,520
were actually three leading theories

635
00:30:46,680 --> 00:30:44,770
about the origin of the moon and the big

636
00:30:48,060 --> 00:30:46,690
goal of Apollo was to sort out which one

637
00:30:49,320 --> 00:30:48,070
of these three theories was right and

638
00:30:51,030 --> 00:30:49,330

the scientists would get together and

639
00:30:52,680 --> 00:30:51,040
they'd are you and they'd fight well

640
00:30:54,870 --> 00:30:52,690
they brought back over 800 pounds of

641
00:30:57,300 --> 00:30:54,880
rocks from Apollo when we analyzed them

642
00:30:59,340 --> 00:30:57,310
we found out that none of those three

643
00:31:01,230 --> 00:30:59,350
series were actually right and actually

644
00:31:03,510 --> 00:31:01,240
from the information that we measured

645
00:31:05,880 --> 00:31:03,520
with a with the Apollo samples and other

646
00:31:08,090 --> 00:31:05,890
missions to the moon the giant impact

647
00:31:09,960 --> 00:31:08,100
theory has emerged as the most credible

648
00:31:12,030 --> 00:31:09,970
hypothesis for the origin of the moon

649
00:31:13,530 --> 00:31:12,040
it's not perfect yet though we still

650
00:31:15,420 --> 00:31:13,540
have some things that we need to tweak

651
00:31:17,600 --> 00:31:15,430
and understand so going back to the moon

652
00:31:20,160 --> 00:31:17,610
getting more in different rocks

653
00:31:22,080 --> 00:31:20,170
measuring the interior structure of the

654
00:31:23,700 --> 00:31:22,090
moon or all things we need to do to

655
00:31:26,010 --> 00:31:23,710
really nail down whether the moon formed

656
00:31:27,570 --> 00:31:26,020
in a giant impact I haven't thank you

657
00:31:29,600 --> 00:31:27,580
very much for that question really

658
00:31:31,880 --> 00:31:29,610
appreciate it I have a homely

659
00:31:34,220 --> 00:31:31,890
question about the material on the moon

660
00:31:37,700 --> 00:31:34,230
I wanted to talk to you about it ask the

661
00:31:40,070 --> 00:31:37,710
question what is there about the science

662
00:31:44,539 --> 00:31:40,080
on the moon that we really cannot do

663
00:31:46,700 --> 00:31:44,549

with robots why and especially some

664
00:31:49,490 --> 00:31:46,710
international people who may be there

665
00:31:52,010 --> 00:31:49,500
who can help the rope help fix the

666
00:31:55,100 --> 00:31:52,020
robots why is it that the United States

667
00:31:58,220 --> 00:31:55,110
has to make that major investment we

668
00:32:01,630 --> 00:31:58,230
talked to Charlie before and and we can

669
00:32:05,690 --> 00:32:01,640
certainly look at this long duration

670
00:32:06,950 --> 00:32:05,700
systems that we are working on we can

671
00:32:11,630 --> 00:32:06,960
look at those at the space station

672
00:32:13,280 --> 00:32:11,640
beginning in 2015 2016 and prolong the

673
00:32:15,860 --> 00:32:13,290
life of the space station which many

674
00:32:19,159 --> 00:32:15,870
people would like far simpler than we

675
00:32:22,460 --> 00:32:19,169
can waiting until 2020 2025 oddly enough

676
00:32:24,590 --> 00:32:22,470
that was my question is out on the moon

677
00:32:26,630 --> 00:32:24,600
much easier that you know as a matter of

678
00:32:30,409 --> 00:32:26,640
fact we could we could put a human at

679
00:32:32,600 --> 00:32:30,419
Earth Moon l1 much safer than on the

680
00:32:35,090 --> 00:32:32,610
surface of the Moon and he could control

681
00:32:37,539 --> 00:32:35,100
the robots on the surface because that's

682
00:32:41,720 --> 00:32:37,549
what we want to do at the moon of Mars

683
00:32:45,169 --> 00:32:41,730
fobus much more efficient than people

684
00:32:48,049 --> 00:32:45,179
that send to Mars one day's worth of

685
00:32:51,020 --> 00:32:48,059
instructions that are conservative so

686
00:32:53,060 --> 00:32:51,030
that if the robot there runs into any

687
00:32:55,580 --> 00:32:53,070
trouble stop stop don't do anything

688
00:32:57,440 --> 00:32:55,590

we'll get back to you in a day and tell

689
00:33:01,250 --> 00:32:57,450
you what to do Spirit and Opportunity

690
00:33:05,390 --> 00:33:01,260
have very nicely lived for five years

691
00:33:09,169 --> 00:33:05,400
instead of 90 days but if we had a human

692
00:33:12,560 --> 00:33:09,179
being at vobis orbiting every seven

693
00:33:14,530 --> 00:33:12,570
hours what could that person do he could

694
00:33:17,180 --> 00:33:14,540
be controlling that robot in real time

695
00:33:21,950 --> 00:33:17,190
that's pretty excellent the moon is

696
00:33:25,370 --> 00:33:21,960
automation Mars requires being there and

697
00:33:26,750 --> 00:33:25,380
the supply chain you set up it doesn't

698
00:33:28,610 --> 00:33:26,760
let you go there and come back right

699
00:33:30,169 --> 00:33:28,620
away laura is this a debate is that

700
00:33:31,370 --> 00:33:30,179
what's going on here no actually I what

701
00:33:33,049 --> 00:33:31,380
I was going to say is from a science

702
00:33:34,669 --> 00:33:33,059
perspective what I can tell you that we

703
00:33:36,860 --> 00:33:34,679
that we need to really unravel these

704
00:33:39,440 --> 00:33:36,870
mysteries is we need a network of places

705
00:33:40,880 --> 00:33:39,450
around the moon to do like a seismic

706
00:33:41,539 --> 00:33:40,890
station like you measure earthquakes on

707
00:33:45,409 --> 00:33:41,549
on

708
00:33:46,820 --> 00:33:45,419
you could do that robotically you could

709
00:33:49,159 --> 00:33:46,830
also deploy it with people it's a choice

710
00:33:51,200 --> 00:33:49,169
but we also need rocks back from a wider

711
00:33:53,210 --> 00:33:51,210
variety of terrains on the moon you all

712
00:33:55,340 --> 00:33:53,220
explored amazing you know the highlands

713
00:33:57,109 --> 00:33:55,350

is incredible and of course the Mari but

714
00:33:58,159 --> 00:33:57,119
we've only explored a very small part of

715
00:33:59,869 --> 00:33:58,169
the moon and to really answer the

716
00:34:01,759 --> 00:33:59,879
questions we actually need to go some

717
00:34:04,009 --> 00:34:01,769
other places again you could do that

718
00:34:05,690 --> 00:34:04,019
robotically I think people especially in

719
00:34:07,850 --> 00:34:05,700
the selection of really interesting and

720
00:34:09,859 --> 00:34:07,860
important samples become more important

721
00:34:11,210 --> 00:34:09,869
but again it is a choice we can make all

722
00:34:16,460 --> 00:34:11,220
along the way we've got to do is learn

723
00:34:18,379 --> 00:34:16,470
Chinese and asking to finally well and

724
00:34:20,299 --> 00:34:18,389
of course I I agree with you on Mars I

725
00:34:23,720 --> 00:34:20,309
think I don't have to speak Chinese at

726
00:34:25,909 --> 00:34:23,730
bovis or Mars you speak American yeah I

727
00:34:27,710 --> 00:34:25,919
think I think our first Mars Walker

728
00:34:32,990 --> 00:34:27,720
could be out here what she raised her

729
00:34:34,549 --> 00:34:33,000
hand whoever she's gonna do buzz it's my

730
00:34:36,589 --> 00:34:34,559
understanding that the moment has come

731
00:34:39,349 --> 00:34:36,599
for you to go to lunch is that right I

732
00:34:41,000 --> 00:34:39,359
think so that's why you're ester their

733
00:34:43,789 --> 00:34:41,010
ways with preparation I always have

734
00:34:47,180 --> 00:34:43,799
already had a nice sandwich just in case

735
00:34:50,059 --> 00:34:47,190
I don't get you like a white house yeah

736
00:34:51,980 --> 00:34:50,069
like remember well remember while you're

737
00:34:57,349 --> 00:34:51,990
eating that lunch we all paid for it on

738
00:35:01,000 --> 00:34:57,359

to the thing okay go go go thank you

739
00:35:13,060 --> 00:35:10,570
hey you know that's great I I was I had

740
00:35:14,920 --> 00:35:13,070
one other question to ask buzz because i

741
00:35:16,840 --> 00:35:14,930
was reading an old life magazine I mean

742
00:35:19,360 --> 00:35:16,850
whole life magazine I collect them and

743
00:35:22,210 --> 00:35:19,370
there was a story about the lunar

744
00:35:25,450 --> 00:35:22,220
landing I can ask you Charles buzz was

745
00:35:27,460 --> 00:35:25,460
quoted as saying then 40 years ago that

746
00:35:31,270 --> 00:35:27,470
the material he brought backup from the

747
00:35:33,280 --> 00:35:31,280
moon had a distinctive odor did did you

748
00:35:36,360 --> 00:35:33,290
notice that as well is that true sure

749
00:35:40,150 --> 00:35:36,370
did it was a real surprise to me that

750
00:35:43,630 --> 00:35:40,160
when we got back inside we had not only

751
00:35:45,340 --> 00:35:43,640
the samples but also the dust that we

752
00:35:48,580 --> 00:35:45,350
brought back in with us on our moon

753
00:35:51,730 --> 00:35:48,590
boots and suits and stuff and I took off

754
00:35:56,020 --> 00:35:51,740
my helmet my gloves and picked up some

755
00:35:58,360 --> 00:35:56,030
and the stuff is as dry as toast of

756
00:35:59,920 --> 00:35:58,370
course because there's nothing no water

757
00:36:03,270 --> 00:35:59,930
there that we know at least where we

758
00:36:06,760 --> 00:36:03,280
landed but it picked up the oils of your

759
00:36:09,610 --> 00:36:06,770
your skin and it felt like graphite and

760
00:36:13,480 --> 00:36:09,620
you could smell it and it had a gun

761
00:36:15,430 --> 00:36:13,490
powder smell to it maybe Lori analyzed

762
00:36:19,720 --> 00:36:15,440
them maybe she can tell you why but I

763
00:36:21,190 --> 00:36:19,730

can't tell you why but it did she's

764
00:36:24,190 --> 00:36:21,200
shaking her head so I'm not going to

765
00:36:26,320 --> 00:36:24,200
laugh but we do have a question coming

766
00:36:28,390 --> 00:36:26,330
in and this one let me see this is for

767
00:36:31,840 --> 00:36:28,400
you Charles and it is from the st. Louis

768
00:36:34,180 --> 00:36:31,850
Science Center a question for you and it

769
00:36:39,010 --> 00:36:34,190
is from I think we have a moderator do

770
00:36:44,350 --> 00:36:41,950
I think we have a moderator can we hear

771
00:37:01,360 --> 00:36:44,360
it out from st. Louis she's been to

772
00:37:03,310 --> 00:37:01,370
space camp she's 13 years old we're

773
00:37:04,960 --> 00:37:03,320
having we're having obviously some

774
00:37:07,000 --> 00:37:04,970
feedback problems with did you hear the

775
00:37:09,330 --> 00:37:07,010
question okay the question was what was

776
00:37:14,320 --> 00:37:09,340
the hardest part emotionally and

777
00:37:17,770 --> 00:37:14,330
technically and space travel for me I

778
00:37:20,410 --> 00:37:17,780
think the hardest part was the landing

779
00:37:23,500 --> 00:37:20,420
on the moon as I tried to share with you

780
00:37:28,090 --> 00:37:23,510
earlier we were coming in an area that

781
00:37:30,120 --> 00:37:28,100
was unknown basically at least from a

782
00:37:32,950 --> 00:37:30,130
landing standpoint we could identify

783
00:37:36,250 --> 00:37:32,960
stone mountain and smoky mountain and

784
00:37:38,020 --> 00:37:36,260
the major craters as we came in from an

785
00:37:41,140 --> 00:37:38,030
altitude of about a mile above the

786
00:37:44,770 --> 00:37:41,150
surface but as we got closer we had to

787
00:37:47,830 --> 00:37:44,780
maneuver and to an area that would allow

788
00:37:50,980 --> 00:37:47,840

us to be almost as level as possible so

789
00:37:53,340 --> 00:37:50,990
that we could work the LRO is just sent

790
00:37:56,080 --> 00:37:53,350
back some photos of our landing spot

791
00:38:00,280 --> 00:37:56,090
with a low Sun angle and you see this

792
00:38:02,730 --> 00:38:00,290
big crater behind our spacecraft and we

793
00:38:05,110 --> 00:38:02,740
didn't even see it fortunately

794
00:38:08,890 --> 00:38:05,120
fortunately we got over it by about 3

795
00:38:11,620 --> 00:38:08,900
meters and landed and and then we're

796
00:38:15,040 --> 00:38:11,630
looking out to the west it was just a

797
00:38:17,680 --> 00:38:15,050
fantastic scene but then we came around

798
00:38:20,290 --> 00:38:17,690
I got out and went around to retrieve

799
00:38:22,510 --> 00:38:20,300
the Apollo lunar surface experiments

800
00:38:25,300 --> 00:38:22,520
package and I looked at said John look

801
00:38:27,370 --> 00:38:25,310
at this and it was a big crater that if

802
00:38:29,200 --> 00:38:27,380
wheedle anted there it would have not

803
00:38:31,930 --> 00:38:29,210
turned us over but have been very very

804
00:38:34,090 --> 00:38:31,940
difficult to retrieve the experiments

805
00:38:40,240 --> 00:38:34,100
and things out so it was that was the

806
00:38:42,220 --> 00:38:40,250
hardest part and emotionally it wasn't

807
00:38:44,070 --> 00:38:42,230
hard to I wouldn't even trying to

808
00:38:46,480 --> 00:38:44,080
control my emotions I was so excited

809
00:38:49,210 --> 00:38:46,490
like a little kid at Christmas you know

810
00:38:50,680 --> 00:38:49,220
and so and that's the way John and I

811
00:38:54,099 --> 00:38:50,690
trained to have

812
00:38:57,460 --> 00:38:54,109
fun but to do the job and to be animated

813
00:38:59,970 --> 00:38:57,470

about it all and it turned out to be the

814
00:39:03,190 --> 00:38:59,980
best for us because we work together

815
00:39:06,780 --> 00:39:03,200
that way better and so emotionally it

816
00:39:09,670 --> 00:39:06,790
was just too high for 71 hours and

817
00:39:12,760 --> 00:39:09,680
anything any residue after you got back

818
00:39:15,670 --> 00:39:12,770
any anyway we have heard that some

819
00:39:18,910 --> 00:39:15,680
including buzzes has spoken openly about

820
00:39:24,730 --> 00:39:18,920
it that there were some emotional after

821
00:39:26,800 --> 00:39:24,740
drafts not for me they're worse as a

822
00:39:30,030 --> 00:39:26,810
direct reside on't think anybody as a

823
00:39:34,390 --> 00:39:30,040
direct result of moon flight had a

824
00:39:37,150 --> 00:39:34,400
physical or psychological problem but

825
00:39:39,309 --> 00:39:37,160
after you come down from that high and

826
00:39:43,960 --> 00:39:39,319
yes now what am I going to do that's

827
00:39:48,780 --> 00:39:43,970
where the things can cause you to go off

828
00:39:52,300 --> 00:39:48,790
and buzzes acknowledge that in his book

829
00:39:56,170 --> 00:39:52,310
and all of us decided that we needed to

830
00:39:58,870 --> 00:39:56,180
do something else John Young who was my

831
00:40:04,210 --> 00:39:58,880
commander stayed on at NASA finally

832
00:40:10,329 --> 00:40:04,220
retired in 1995 at 40 like 44 years as

833
00:40:14,819 --> 00:40:10,339
an astronaut 2005 I'm sorry and so I

834
00:40:21,970 --> 00:40:20,500
so it it was the after part of John you

835
00:40:23,710 --> 00:40:21,980
might probably going to have the same

836
00:40:25,839 --> 00:40:23,720
problem you know after that thrilling

837
00:40:27,250 --> 00:40:25,849
adventure of repairing at hubbell now

838
00:40:28,870 --> 00:40:27,260

what are you going to do hopefully they

839
00:40:31,900 --> 00:40:28,880
got a good mission for you coming up

840
00:40:34,420 --> 00:40:31,910
with telecom that drive it takes you

841
00:40:36,819 --> 00:40:34,430
there still there you see and so how do

842
00:40:38,589 --> 00:40:36,829
you channel that drive and and that's

843
00:40:41,920 --> 00:40:38,599
the human spirit you know we've got to

844
00:40:44,319 --> 00:40:41,930
go explore question coming up now this

845
00:40:47,200 --> 00:40:44,329
time it's a from the California Academy

846
00:40:50,570 --> 00:40:47,210
of Sciences and I believe we have a

847
00:40:55,010 --> 00:40:50,580
moderator standing by for the question

848
00:40:59,320 --> 00:40:55,020
oh yes I was just wondering experience

849
00:41:05,930 --> 00:41:03,620
scary humans or inspiring the question

850
00:41:09,170 --> 00:41:05,940
as if I understand correctly what do you

851
00:41:11,030 --> 00:41:09,180
would you describe the adventure that

852
00:41:16,310 --> 00:41:11,040
you just gave us a little outline as

853
00:41:20,180 --> 00:41:16,320
more inspiring more humorous or more

854
00:41:22,910 --> 00:41:20,190
scary it would first my first choice

855
00:41:26,570 --> 00:41:22,920
would be inspiring not only do us

856
00:41:33,260 --> 00:41:26,580
individually but I think too especially

857
00:41:35,570 --> 00:41:33,270
the kids of the world they dream when I

858
00:41:37,850 --> 00:41:35,580
was a kid 12 years old it wasn't a space

859
00:41:39,680 --> 00:41:37,860
program and I didn't go out in the

860
00:41:42,290 --> 00:41:39,690
backyard and look up into the heavens

861
00:41:45,470 --> 00:41:42,300
and say mama I'm gonna walk on the moon

862
00:41:51,190 --> 00:41:45,480
one day mama would have dropped a net on

863
00:41:54,380 --> 00:41:51,200

me and Sidney the psychiatric hospital

864
00:41:56,360 --> 00:41:54,390
but I did have heroes and it were the in

865
00:42:01,460 --> 00:41:56,370
the great generation of World War two

866
00:42:05,390 --> 00:42:01,470
and so now we have that opportunity to

867
00:42:11,380 --> 00:42:05,400
inspire the kids of the world to dream

868
00:42:14,440 --> 00:42:11,390
and to aim high the second would be the

869
00:42:18,050 --> 00:42:14,450
let's see that was the scary inspiring

870
00:42:19,730 --> 00:42:18,060
inspiring was humorous humorous I think

871
00:42:21,440 --> 00:42:19,740
the second for us would be the humorous

872
00:42:25,130 --> 00:42:21,450
part because John and I had a good time

873
00:42:27,970 --> 00:42:25,140
and he's a great humorist my third would

874
00:42:34,700 --> 00:42:27,980
be scary and there was only one moment

875
00:42:36,290 --> 00:42:34,710
when I had a scary incident and it was

876
00:42:41,630 --> 00:42:36,300
doing something I shouldn't have been

877
00:42:43,070 --> 00:42:41,640
doing and so kids hear this you always

878
00:42:44,510 --> 00:42:43,080
get in trouble when you do something

879
00:42:47,210 --> 00:42:44,520
you're not supposed to be doing or you

880
00:42:49,349 --> 00:42:47,220
had practice for it and so we were going

881
00:42:56,670 --> 00:42:49,359
to set the high jump record on the moon

882
00:42:59,190 --> 00:42:56,680
uh and my my backpack weighed 155 pounds

883
00:43:00,870 --> 00:42:59,200
that's what I wait back then and so when

884
00:43:02,759 --> 00:43:00,880
I jumped I straightened up well my

885
00:43:06,989 --> 00:43:02,769
center gravity went backwards and over i

886
00:43:08,670 --> 00:43:06,999
win yes and I had really a moment of

887
00:43:11,339 --> 00:43:08,680
fear there because I was fallin on my

888
00:43:14,190 --> 00:43:11,349

back and his backpacks not designed for

889
00:43:16,859 --> 00:43:14,200
that moisture and I was able to roll

890
00:43:23,009 --> 00:43:16,869
round and break my fall but let me tell

891
00:43:26,940 --> 00:43:23,019
you that ended the moon Olympics ya

892
00:43:30,749 --> 00:43:26,950
later that's right Mission Control was

893
00:43:33,809 --> 00:43:30,759
very upset by the way they thought

894
00:43:35,339 --> 00:43:33,819
they'd lost somebody and she's turnin

895
00:43:39,450 --> 00:43:35,349
didn't try to break your record right

896
00:43:42,660 --> 00:43:39,460
good night driving the rover well the

897
00:43:46,950 --> 00:43:42,670
rover was i I was really the navigator

898
00:43:50,130 --> 00:43:46,960
John was the driver that's the right and

899
00:43:52,049 --> 00:43:50,140
riding with John I called him for those

900
00:43:54,120 --> 00:43:52,059
of you here one of the old race drivers

901
00:43:56,729 --> 00:43:54,130
Barney Oldfield I said here comes Barney

902
00:43:58,829 --> 00:43:56,739
Oldfield again man he was really flat

903
00:44:01,620 --> 00:43:58,839
out on the moon and we set to moon speed

904
00:44:03,870 --> 00:44:01,630
record at the time 11 miles an hour and

905
00:44:05,789 --> 00:44:03,880
we were and we were bouncing like this

906
00:44:09,120 --> 00:44:05,799
I'm glad I had my seat belt on boy

907
00:44:11,430 --> 00:44:09,130
because the lunar rover only weight 80

908
00:44:14,279 --> 00:44:11,440
pounds on the moon and so with the

909
00:44:16,229 --> 00:44:14,289
springiness and it would hit the bumps

910
00:44:18,509 --> 00:44:16,239
and the rocks and a little gullies and

911
00:44:20,519 --> 00:44:18,519
the small craters and we just bounced

912
00:44:21,930 --> 00:44:20,529
all over this great stuff this is great

913
00:44:23,640 --> 00:44:21,940

listen I wanted to give you all the

914
00:44:25,589 --> 00:44:23,650
chance here in the studio audience this

915
00:44:26,700 --> 00:44:25,599
is your big chance if you have questions

916
00:44:28,680 --> 00:44:26,710
you would like to ask for these

917
00:44:31,170 --> 00:44:28,690
wonderful people we're going to have to

918
00:44:33,089 --> 00:44:31,180
ask you to come to that microphone right

919
00:44:34,380 --> 00:44:33,099
over there and while you're making your

920
00:44:38,249 --> 00:44:34,390
way I can tell you that there was a

921
00:44:41,999 --> 00:44:38,259
question from newseum dot-org via google

922
00:44:43,920 --> 00:44:42,009
moderator and it is let's see there is

923
00:44:45,960 --> 00:44:43,930
it's a toss-up it's for all of you so

924
00:44:49,890 --> 00:44:45,970
let's start with you John how far do you

925
00:44:53,249 --> 00:44:49,900
think the United States should go with

926
00:44:55,440 --> 00:44:53,259
space exploration do you set limits I

927
00:44:57,089 --> 00:44:55,450
gather is what the question is I think

928
00:44:59,069 --> 00:44:57,099
there's always limits that you have to

929
00:45:01,170 --> 00:44:59,079
set in terms of funding what can you

930
00:45:03,030 --> 00:45:01,180
afford but I would say that and of

931
00:45:04,410 --> 00:45:03,040
course I've dedicated my life to it

932
00:45:06,360 --> 00:45:04,420
that it's the most important thing we do

933
00:45:08,070 --> 00:45:06,370
exploration is the most important thing

934
00:45:10,260 --> 00:45:08,080
we do it brings all of the new

935
00:45:12,570 --> 00:45:10,270
innovations and technology that make you

936
00:45:15,600 --> 00:45:12,580
know our lives worthwhile that's that's

937
00:45:19,590 --> 00:45:15,610
what I believe okay let's let's take it

938
00:45:21,900 --> 00:45:19,600

on down low I think great things happen

939
00:45:24,420 --> 00:45:21,910
when we set impossible audacious goals

940
00:45:25,920 --> 00:45:24,430
and I think that space exploration is

941
00:45:28,100 --> 00:45:25,930
one of the things that allows us to do

942
00:45:30,960 --> 00:45:28,110
that to dream beyond what's possible and

943
00:45:32,490 --> 00:45:30,970
so that we shouldn't think about it in

944
00:45:35,100 --> 00:45:32,500
terms of limits we should think about it

945
00:45:37,110 --> 00:45:35,110
in terms of striving for that next

946
00:45:39,120 --> 00:45:37,120
incredible thing that we can't even

947
00:45:41,220 --> 00:45:39,130
imagine that we can do but we go after

948
00:45:42,810 --> 00:45:41,230
in one famous phrase we don't do it

949
00:45:44,730 --> 00:45:42,820
because it's easy but we do it because

950
00:45:46,980 --> 00:45:44,740
it's hard that's right try with John

951
00:45:49,980 --> 00:45:46,990
Kennedy's statement and that's true and

952
00:45:52,760 --> 00:45:49,990
I think the human spirit is the spirit

953
00:45:55,470 --> 00:45:52,770
of exploration that's why I volunteered

954
00:45:58,830 --> 00:45:55,480
because I wanted to be an explorer of

955
00:46:01,620 --> 00:45:58,840
the first order and I think in the

956
00:46:06,050 --> 00:46:01,630
future we that spirit is still here with

957
00:46:08,280 --> 00:46:06,060
us and will lead us on to two more

958
00:46:11,940 --> 00:46:08,290
knowledge of the Moon and then on to

959
00:46:14,250 --> 00:46:11,950
Mars eventually we'll get there I don't

960
00:46:16,830 --> 00:46:14,260
know in my lifetime but i would

961
00:46:21,210 --> 00:46:16,840
encourage everybody to that are studying

962
00:46:23,520 --> 00:46:21,220
now the kids to do their best and to

963
00:46:26,850 --> 00:46:23,530

look out into the future the mountains

964
00:46:29,490 --> 00:46:26,860
we climb will allow you to see farther

965
00:46:32,010 --> 00:46:29,500
on with a new technology that we would

966
00:46:33,740 --> 00:46:32,020
not imagine I think I hear the voice of

967
00:46:36,350 --> 00:46:33,750
the next astronaut

968
00:46:38,870 --> 00:46:36,360
we have some questioners standing by

969
00:46:41,630 --> 00:46:38,880
right now ready mr. Duke I was wondering

970
00:46:43,880 --> 00:46:41,640
was it more nerve-racking you for you to

971
00:46:45,590 --> 00:46:43,890
watch the astronauts that landed before

972
00:46:47,450 --> 00:46:45,600
you wondering whether or not they were

973
00:46:51,080 --> 00:46:47,460
gonna be able to successfully land and

974
00:46:53,270 --> 00:46:51,090
then come back or was it more than Iraq

975
00:46:56,470 --> 00:46:53,280
and actually being the one there that

976
00:47:00,710 --> 00:46:56,480
was landing and then coming back

977
00:47:03,470 --> 00:47:00,720
probably the latter it's more sitting in

978
00:47:06,920 --> 00:47:03,480
Mission Control either as Capcom or back

979
00:47:09,680 --> 00:47:06,930
up and just monitoring its nerve-racked

980
00:47:14,510 --> 00:47:09,690
it's more nerve-wracking to listen to it

981
00:47:17,990 --> 00:47:14,520
and to wring your hands because you're

982
00:47:19,850 --> 00:47:18,000
not in that dynamic situation once

983
00:47:22,400 --> 00:47:19,860
you're there and you get to do it you're

984
00:47:25,400 --> 00:47:22,410
so focused on the operational side of it

985
00:47:28,490 --> 00:47:25,410
you don't really you don't really have

986
00:47:29,960 --> 00:47:28,500
time to worry about on my Lords what am

987
00:47:32,840 --> 00:47:29,970
I going to do if this thing doesn't work

988
00:47:35,630 --> 00:47:32,850

you know I mean you wouldn't be there if

989
00:47:38,420 --> 00:47:35,640
that were your situation but listening

990
00:47:40,730 --> 00:47:38,430
and watching in Mission Control is you

991
00:47:44,810 --> 00:47:40,740
get anxious you want them to succeed so

992
00:47:47,030 --> 00:47:44,820
much that you get anxious about it i

993
00:47:48,200 --> 00:47:47,040
will say can i just add i was in Mission

994
00:47:50,360 --> 00:47:48,210
Control when they were trying to turn

995
00:47:52,130 --> 00:47:50,370
that bolt on the Hubble mission I'll

996
00:47:53,990 --> 00:47:52,140
tell you people think that scientists

997
00:47:56,000 --> 00:47:54,000
are you know we wear lab coats we were

998
00:47:57,680 --> 00:47:56,010
not emotional people were crying because

999
00:47:59,120 --> 00:47:57,690
they had devoted 10 years of their life

1000
00:48:01,580 --> 00:47:59,130
to building this camera that might not

1001
00:48:03,350 --> 00:48:01,590
get in if this bolt broke and yeah it's

1002
00:48:06,620 --> 00:48:03,360
it's nerve-wracking we're all wanted to

1003
00:48:08,720 --> 00:48:06,630
turn that wrench for you yes another

1004
00:48:10,310 --> 00:48:08,730
question my name is AR Hogan I'm a

1005
00:48:11,810 --> 00:48:10,320
science journalist and I'm also a

1006
00:48:13,130 --> 00:48:11,820
graduate student you were see Maryland

1007
00:48:14,870 --> 00:48:13,140
doing a doctoral dissertation on the

1008
00:48:17,170 --> 00:48:14,880
history of television radio coverage of

1009
00:48:21,770 --> 00:48:17,180
the space program and I wanted to ask

1010
00:48:24,650 --> 00:48:21,780
your reaction to what impact the amazing

1011
00:48:27,440 --> 00:48:24,660
coverage on television of the Apollo

1012
00:48:29,360 --> 00:48:27,450
lunar explorations some of it at CBS

1013
00:48:30,970 --> 00:48:29,370

News of course produced by Robert J

1014
00:48:33,520 --> 00:48:30,980
wessler directed by joe Bono and

1015
00:48:36,110 --> 00:48:33,530
anchored so wonderfully enabling by

1016
00:48:38,240 --> 00:48:36,120
Walter Cronkite I can't bring myself to

1017
00:48:42,080 --> 00:48:38,250
say the late Walter Cronkite so it's so

1018
00:48:44,030 --> 00:48:42,090
tragically lost him last Friday but

1019
00:48:45,590 --> 00:48:44,040
could you talk about the impacts of this

1020
00:48:47,540 --> 00:48:45,600
television coverage on the public and

1021
00:48:50,180 --> 00:48:47,550
also those of us who I

1022
00:48:51,530 --> 00:48:50,190
Walter Cronkite and probably most people

1023
00:48:54,290 --> 00:48:51,540
in this room who our space enthusiasts

1024
00:48:56,810 --> 00:48:54,300
how can we manage to get those who are

1025
00:48:58,820 --> 00:48:56,820
inexplicably not how can we get them to

1026
00:49:00,920 --> 00:48:58,830
get it why this is compellingly

1027
00:49:03,470 --> 00:49:00,930
important for our human species to do

1028
00:49:06,020 --> 00:49:03,480
please John what would you like to start

1029
00:49:08,180 --> 00:49:06,030
I just like to lead off because Charlie

1030
00:49:10,760 --> 00:49:08,190
talked about inspiring and there's

1031
00:49:13,540 --> 00:49:10,770
absolutely no question that Charlie Duke

1032
00:49:15,920 --> 00:49:13,550
and John Young were my heroes as a kid I

1033
00:49:17,630 --> 00:49:15,930
did tell my mom I wanted to go walk on

1034
00:49:19,490 --> 00:49:17,640
the moon and while I haven't walked on

1035
00:49:21,560 --> 00:49:19,500
the moon you know going up to Hubble

1036
00:49:23,840 --> 00:49:21,570
three times as an astronomer has been my

1037
00:49:25,340 --> 00:49:23,850
holy grail in space and there's no

1038
00:49:27,920 --> 00:49:25,350

question that that inspired me and I

1039
00:49:30,470 --> 00:49:27,930
grew up in those 1960s when the two

1040
00:49:32,570 --> 00:49:30,480
major events in my life were the space

1041
00:49:34,730 --> 00:49:32,580
program and televisions appearing in

1042
00:49:37,730 --> 00:49:34,740
American homes and so I think it was

1043
00:49:40,490 --> 00:49:37,740
that sort of serendipitous conjunction

1044
00:49:43,070 --> 00:49:40,500
of television and my seen these very

1045
00:49:45,680 --> 00:49:43,080
important very exciting explorers go off

1046
00:49:47,780 --> 00:49:45,690
and do something truly great that that

1047
00:49:51,800 --> 00:49:47,790
set me off on a lifetime of discovery so

1048
00:49:53,990 --> 00:49:51,810
the coverage was intrinsic to your to

1049
00:49:57,560 --> 00:49:54,000
your interest yeah and was that also

1050
00:49:59,960 --> 00:49:57,570
true what impact do you think that all

1051
00:50:03,740 --> 00:49:59,970
of that coverage including I think the

1052
00:50:07,370 --> 00:50:03,750
coverage is very very important and the

1053
00:50:10,820 --> 00:50:07,380
early earlier flights every minute every

1054
00:50:14,270 --> 00:50:10,830
second was covered on TV by the time we

1055
00:50:17,060 --> 00:50:14,280
flew hardly any of it was on TV so that

1056
00:50:19,970 --> 00:50:17,070
my family my parents and my my wife and

1057
00:50:22,250 --> 00:50:19,980
kids went to Mission Control and sat in

1058
00:50:25,880 --> 00:50:22,260
a visitor's viewing room so that they

1059
00:50:29,630 --> 00:50:25,890
could watch us on the moon and to me

1060
00:50:32,630 --> 00:50:29,640
that's okay it's an evolution of

1061
00:50:35,300 --> 00:50:32,640
knowledge and experience that we get

1062
00:50:37,310 --> 00:50:35,310
that sort of fades away in the public

1063
00:50:40,450 --> 00:50:37,320

knowledge but doesn't take away from the

1064
00:50:42,860 --> 00:50:40,460
importance of what we were doing

1065
00:50:45,200 --> 00:50:42,870
Lindbergh flew the Atlantic everybody

1066
00:50:50,270 --> 00:50:45,210
remembers that nobody can say number two

1067
00:50:52,490 --> 00:50:50,280
who flew the first 747 now we got 747

1068
00:50:55,340 --> 00:50:52,500
flying back all over the world thousands

1069
00:50:58,760 --> 00:50:55,350
of people doesn't make the news unless

1070
00:51:08,310 --> 00:51:04,490
anyway it's it's that what we do doesn't

1071
00:51:10,500 --> 00:51:08,320
distract and from what we accomplish

1072
00:51:12,240 --> 00:51:10,510
amazing I don't say that right no I know

1073
00:51:14,010 --> 00:51:12,250
exactly what you mean but I wanted to

1074
00:51:16,560 --> 00:51:14,020
ask you this question that doesn't the

1075
00:51:21,090 --> 00:51:16,570
celebrity didn't the celebrity of those

1076
00:51:24,300 --> 00:51:21,100
early astronauts did that not help to to

1077
00:51:26,880 --> 00:51:24,310
gird Congress and all of the rest of us

1078
00:51:29,430 --> 00:51:26,890
to for the very difficult and expensive

1079
00:51:31,590 --> 00:51:29,440
cast that lay ahead and that's they did

1080
00:51:34,110 --> 00:51:31,600
and that's why I've spent a lot of my

1081
00:51:36,840 --> 00:51:34,120
time now going around and speaking to

1082
00:51:40,230 --> 00:51:36,850
groups to try to encourage him to try to

1083
00:51:43,050 --> 00:51:40,240
rekindle that adventure because the

1084
00:51:47,670 --> 00:51:43,060
future is the future and we need to get

1085
00:51:49,830 --> 00:51:47,680
excited about it and and and invest some

1086
00:51:52,320 --> 00:51:49,840
of our resources and to make that

1087
00:51:55,380 --> 00:51:52,330
capital investment into the future for a

1088
00:51:57,000 --> 00:51:55,390

return another question yes Rita Carl

1089
00:51:58,860 --> 00:51:57,010
director of education for challenger

1090
00:52:01,140 --> 00:51:58,870
Center for space science education and

1091
00:52:03,180 --> 00:52:01,150
we fly students to the moon all the time

1092
00:52:04,830 --> 00:52:03,190
and we have a student from our

1093
00:52:07,680 --> 00:52:04,840
Challenger Learning Center in Richmond

1094
00:52:10,320 --> 00:52:07,690
Virginia hi I'm navia Higgins and my

1095
00:52:12,810 --> 00:52:10,330
question is what are some things that we

1096
00:52:15,810 --> 00:52:12,820
have learned from space exploration that

1097
00:52:18,540 --> 00:52:15,820
we can use to help our own planet oh

1098
00:52:20,220 --> 00:52:18,550
great question most people don't know

1099
00:52:22,890 --> 00:52:20,230
this but right now nASA has about 15

1100
00:52:24,840 --> 00:52:22,900
spacecraft orbiting the Earth watching

1101
00:52:28,350 --> 00:52:24,850
the pulse of our planet as it's changing

1102
00:52:30,150 --> 00:52:28,360
and studying the basic physics that

1103
00:52:31,860 --> 00:52:30,160
drive our climate in our weather to help

1104
00:52:33,750 --> 00:52:31,870
us predict better how it's going to be

1105
00:52:35,730 --> 00:52:33,760
changing in the future also things we

1106
00:52:37,980 --> 00:52:35,740
send to other planets Venus and Mars can

1107
00:52:40,500 --> 00:52:37,990
help us better understand how planets

1108
00:52:42,060 --> 00:52:40,510
like ours can change and evolve so from

1109
00:52:43,800 --> 00:52:42,070
a science perspective we've learned a

1110
00:52:45,420 --> 00:52:43,810
whole bunch about the history of our

1111
00:52:47,340 --> 00:52:45,430
planet and how it's going to change in

1112
00:52:49,200 --> 00:52:47,350
the future but there's technology things

1113
00:52:50,280 --> 00:52:49,210

that we get from NASA as well that help

1114
00:52:51,450 --> 00:52:50,290
us and I don't know if either one of you

1115
00:52:53,790 --> 00:52:51,460
want to talk some about some of those

1116
00:52:55,710 --> 00:52:53,800
spin-offs like from the Hubble imaging

1117
00:52:58,620 --> 00:52:55,720
for example the Hubble Space Telescope

1118
00:53:00,420 --> 00:52:58,630
helped pioneer the use of C CDs in

1119
00:53:04,350 --> 00:53:00,430
cameras and I don't know how many people

1120
00:53:05,370 --> 00:53:04,360
out here have a digital camera okay well

1121
00:53:07,220 --> 00:53:05,380
there's a little bit of hubble space

1122
00:53:08,030 --> 00:53:07,230
telescope technology and every single

1123
00:53:11,359 --> 00:53:08,040
one of those cameras that's

1124
00:53:14,390 --> 00:53:11,369
revolutionized the media and and and the

1125
00:53:15,920 --> 00:53:14,400
news because they're ubiquitous they're

1126
00:53:18,910 --> 00:53:15,930
everywhere so people can take pictures

1127
00:53:21,020 --> 00:53:18,920
of news as it happens and send it in the

1128
00:53:23,599 --> 00:53:21,030
technology that used to make those

1129
00:53:24,920 --> 00:53:23,609
detectors the semiconductor technology

1130
00:53:26,359 --> 00:53:24,930
some of the techniques that we've

1131
00:53:28,630 --> 00:53:26,369
learned on how to build instruments from

1132
00:53:30,859 --> 00:53:28,640
Hubble and the imaging have gone into

1133
00:53:32,840 --> 00:53:30,869
the manufacturing of those

1134
00:53:34,040 --> 00:53:32,850
semiconductors and of course you know

1135
00:53:37,130 --> 00:53:34,050
we're all concerned about health care

1136
00:53:38,960 --> 00:53:37,140
and and our own health and some of the

1137
00:53:41,990 --> 00:53:38,970
techniques that astronomers have used to

1138
00:53:44,300 --> 00:53:42,000

see planets and start star forming

1139
00:53:45,740 --> 00:53:44,310
regions new planetary systems being

1140
00:53:47,950 --> 00:53:45,750
formed baby planets and stellar

1141
00:53:50,359 --> 00:53:47,960
nurseries the technology to identify

1142
00:53:52,220 --> 00:53:50,369
those spots have also been used in

1143
00:53:53,930 --> 00:53:52,230
medical imaging to help detect cancer in

1144
00:53:56,300 --> 00:53:53,940
the human body and so it's really a wide

1145
00:53:59,270 --> 00:53:56,310
range of things from you know the hard

1146
00:54:01,340 --> 00:53:59,280
tech to the soft tech us that that just

1147
00:54:03,290 --> 00:54:01,350
Hubble alone amongst all the many

1148
00:54:06,859 --> 00:54:03,300
missions that NASA does that have helped

1149
00:54:09,430 --> 00:54:06,869
us thank you for that yes sir yeah would

1150
00:54:12,020 --> 00:54:09,440
it be easier or harder to find

1151
00:54:15,650 --> 00:54:12,030
astronauts after the incident in an

1152
00:54:17,720 --> 00:54:15,660
apollo 13 for them to wear that come

1153
00:54:19,130 --> 00:54:17,730
forward you mean was yeah like she was

1154
00:54:21,740 --> 00:54:19,140
it but they want to be astronauts know

1155
00:54:26,060 --> 00:54:21,750
we're there it's just as many volunteers

1156
00:54:28,640 --> 00:54:26,070
after Apollo 13 as before there's as far

1157
00:54:31,099 --> 00:54:28,650
as who wanted to go huh you bet we were

1158
00:54:34,790 --> 00:54:31,109
beating the door down you know I'm ready

1159
00:54:37,700 --> 00:54:34,800
to go that's just the nature of an

1160
00:54:41,000 --> 00:54:37,710
explorer he's Apollo 16 you know just

1161
00:54:44,000 --> 00:54:41,010
you go after and I did go after we fix

1162
00:54:46,460 --> 00:54:44,010
that problem and we didn't think it was

1163
00:54:50,540 --> 00:54:46,470

going to happen again it hasn't the

1164
00:54:52,099 --> 00:54:50,550
Challenger explosion there was the crew

1165
00:54:55,000 --> 00:54:52,109
that followed on after that after

1166
00:54:57,680 --> 00:54:55,010
Columbia and that's the nature of

1167
00:55:00,920 --> 00:54:57,690
spaceflight the risk that we take and

1168
00:55:02,900 --> 00:55:00,930
not there's not an astronaut there that

1169
00:55:05,359 --> 00:55:02,910
understand that risk and it's willing to

1170
00:55:08,330 --> 00:55:05,369
take that risk for that next adventure

1171
00:55:10,880 --> 00:55:08,340
oh these are great questions just how

1172
00:55:15,080 --> 00:55:10,890
far are we from achieving earth gravity

1173
00:55:18,710 --> 00:55:15,090
in space is earth gravity in a space

1174
00:55:20,810 --> 00:55:18,720
vehicle a prerequisite for traveling to

1175
00:55:23,600 --> 00:55:20,820
Mars what do we talk about anybody

1176
00:55:25,700 --> 00:55:23,610
for that the question really is when

1177
00:55:27,800 --> 00:55:25,710
we're in space we're weightless because

1178
00:55:29,270 --> 00:55:27,810
we're in constant freefall as we orbit

1179
00:55:30,950 --> 00:55:29,280
the Earth or when you're on your way to

1180
00:55:33,620 --> 00:55:30,960
the moon when you get on the moon then

1181
00:55:36,620 --> 00:55:33,630
of course you have 16 the same poll that

1182
00:55:38,570 --> 00:55:36,630
we feel here on earth the great

1183
00:55:41,450 --> 00:55:38,580
advantage of that is it's just a joy to

1184
00:55:43,610 --> 00:55:41,460
to float in space it's truly magical and

1185
00:55:45,920 --> 00:55:43,620
it just changes the whole experience of

1186
00:55:49,010 --> 00:55:45,930
being human that's the good news the bad

1187
00:55:51,080 --> 00:55:49,020
news is that one of the reasons that we

1188
00:55:52,700 --> 00:55:51,090

stay healthy is because we get up in the

1189
00:55:54,410 --> 00:55:52,710
morning when we go out and we exercise

1190
00:55:56,660 --> 00:55:54,420
and we walk around and that makes our

1191
00:55:59,090 --> 00:55:56,670
muscles and our bones and our heart our

1192
00:56:01,310 --> 00:55:59,100
cardiovascular system strong in

1193
00:56:02,810 --> 00:56:01,320
weightlessness our bones and our muscles

1194
00:56:04,850 --> 00:56:02,820
in our heart don't get enough exercise

1195
00:56:07,820 --> 00:56:04,860
and so our bones get weak and our

1196
00:56:10,190 --> 00:56:07,830
muscles get weak and so one approach to

1197
00:56:13,010 --> 00:56:10,200
these long flights to Mars six-month

1198
00:56:14,690 --> 00:56:13,020
cruises to Mars would be to build you

1199
00:56:17,060 --> 00:56:14,700
know some kind of a circular spacecraft

1200
00:56:19,880 --> 00:56:17,070
that rotates for instance so that the

1201
00:56:21,410 --> 00:56:19,890
acceleration that you feel is the same

1202
00:56:24,170 --> 00:56:21,420
or some fraction of what you feel on

1203
00:56:25,520 --> 00:56:24,180
earth and that's one approach and that's

1204
00:56:27,350 --> 00:56:25,530
an engineering problem and that's

1205
00:56:29,630 --> 00:56:27,360
something we could solve another

1206
00:56:32,720 --> 00:56:29,640
approach would be to find ways and

1207
00:56:33,890 --> 00:56:32,730
machinery essentially gym equipment that

1208
00:56:36,800 --> 00:56:33,900
allows you to get enough exercise

1209
00:56:39,470 --> 00:56:36,810
working against elastic cords or springs

1210
00:56:41,330 --> 00:56:39,480
or other mechanisms to get enough

1211
00:56:44,000 --> 00:56:41,340
exercise what you need to do anyway just

1212
00:56:46,010 --> 00:56:44,010
to keep saying over six months you know

1213
00:56:47,420 --> 00:56:46,020

most astronauts like to be gym rats like

1214
00:56:51,380 --> 00:56:47,430
this is the first job I've gotten paid

1215
00:56:52,490 --> 00:56:51,390
to go to the gym every day like that but

1216
00:56:53,750 --> 00:56:52,500
that's another approach and that's the

1217
00:56:55,670 --> 00:56:53,760
one we're using on the International

1218
00:56:57,350 --> 00:56:55,680
Space Station so one of the big goals of

1219
00:56:58,760 --> 00:56:57,360
the International Space Station is to

1220
00:57:01,250 --> 00:56:58,770
learn how to keep our bodies healthy

1221
00:57:02,630 --> 00:57:01,260
over those long cruises but artificial

1222
00:57:05,210 --> 00:57:02,640
gravity so to speak is one other

1223
00:57:06,680 --> 00:57:05,220
approach just heard if I understand

1224
00:57:08,720 --> 00:57:06,690
correctly what the person is speaking in

1225
00:57:11,660 --> 00:57:08,730
my ear told me you want me to go this

1226
00:57:15,770 --> 00:57:11,670
program will be repeated on NASA TV

1227
00:57:18,800 --> 00:57:15,780
immediately after this broadcast is over

1228
00:57:21,350 --> 00:57:18,810
and oh and also I think at all of the

1229
00:57:23,270 --> 00:57:21,360
science centers which are hooked up with

1230
00:57:24,770 --> 00:57:23,280
us as well if that I think that's what

1231
00:57:26,510 --> 00:57:24,780
they said got another question hi my

1232
00:57:29,050 --> 00:57:26,520
name is Matthew n one day I hope to be

1233
00:57:34,180 --> 00:57:29,060
an astronaut my question is for you John

1234
00:57:35,860 --> 00:57:34,190
what was the your reaction when

1235
00:57:38,530 --> 00:57:35,870
you were the last person to grab on to

1236
00:57:40,870 --> 00:57:38,540
Hubble for the final time good question

1237
00:57:43,660 --> 00:57:40,880
so so the last moment I grabbed onto

1238
00:57:45,100 --> 00:57:43,670

Hubble of course said no he's got almond

1239
00:57:49,980 --> 00:57:45,110
probably wanted to come out and pry my

1240
00:57:52,150 --> 00:57:49,990
hands off no seriously uh we made Hubble

1241
00:57:54,790 --> 00:57:52,160
brand new essentially this was a

1242
00:57:56,860 --> 00:57:54,800
complete Hubble makeover we put in this

1243
00:57:58,210 --> 00:57:56,870
new wide field camera with new detectors

1244
00:58:00,880 --> 00:57:58,220
that are just going to blow everybody

1245
00:58:03,070 --> 00:58:00,890
away when we see those pictures we put

1246
00:58:04,630 --> 00:58:03,080
in a cosmic origins spectrograph that's

1247
00:58:08,410 --> 00:58:04,640
going to really look into the deep

1248
00:58:10,180 --> 00:58:08,420
physics spectrograph breaks up the light

1249
00:58:12,160 --> 00:58:10,190
coming from distant galaxies into its

1250
00:58:13,780 --> 00:58:12,170
colors allows us to do the physics and

1251
00:58:16,390 --> 00:58:13,790
astrophysics understand the structure of

1252
00:58:19,150 --> 00:58:16,400
the universe maybe said light on dark

1253
00:58:20,890 --> 00:58:19,160
matter we brought two cameras back to

1254
00:58:22,780 --> 00:58:20,900
life and we put life-extending

1255
00:58:25,470 --> 00:58:22,790
capability into Hubble such that it

1256
00:58:27,610 --> 00:58:25,480
really is almost a brand new telescope I

1257
00:58:29,380 --> 00:58:27,620
feel so good about that that when

1258
00:58:32,530 --> 00:58:29,390
finally I gave Hubble a last little pat

1259
00:58:33,910 --> 00:58:32,540
and a salute I sort of said to myself

1260
00:58:37,870 --> 00:58:33,920
inside the spacesuit you know you're the

1261
00:58:40,450 --> 00:58:37,880
man of course it's a satellite you know

1262
00:58:43,050 --> 00:58:40,460
and good luck on the voyages and I felt

1263
00:58:44,980 --> 00:58:43,060

not sadness at that but really

1264
00:58:46,570 --> 00:58:44,990
incredible satisfaction that we'd

1265
00:58:48,430 --> 00:58:46,580
achieved all of those challenges and

1266
00:58:56,020 --> 00:58:48,440
that we were sending Hubble off on what

1267
00:59:03,360 --> 00:58:59,470
I have a question uh it's actually

1268
00:59:06,160 --> 00:59:03,370
possible reach absolute zero in space no

1269
00:59:08,770 --> 00:59:06,170
it's not and that's what really turns

1270
00:59:11,710 --> 00:59:08,780
out that's a really deep question it's

1271
00:59:14,770 --> 00:59:11,720
not a simple question but it's one that

1272
00:59:16,600 --> 00:59:14,780
involves physics that's totally outside

1273
00:59:18,580 --> 00:59:16,610
of our own experience it's the very

1274
00:59:21,100 --> 00:59:18,590
smallest scales and it really gets down

1275
00:59:23,530 --> 00:59:21,110
to the question of what is space time

1276
00:59:25,690 --> 00:59:23,540
and matter and although we don't have a

1277
00:59:27,220 --> 00:59:25,700
great understanding of that the real

1278
00:59:29,650 --> 00:59:27,230
answer is that you can't ever really

1279
00:59:31,420 --> 00:59:29,660
achieve a steady state of absolute zero

1280
00:59:35,650 --> 00:59:31,430
nothing comes from nothing yeah but it's

1281
00:59:38,260 --> 00:59:35,660
still darn cold out there my first

1282
00:59:40,540 --> 00:59:38,270
questions for John John you never spoke

1283
00:59:43,450 --> 00:59:40,550
about what that second tool was to get

1284
00:59:47,140 --> 00:59:43,460
the bolt off to get the camera out could

1285
00:59:48,430 --> 00:59:47,150
have been wd-40 by any chance well you

1286
00:59:50,320 --> 00:59:48,440
know I was thinking about that while we

1287
00:59:52,510 --> 00:59:50,330
were out there because those bolts are

1288
00:59:56,440 --> 00:59:52,520

lubricated to prevent them from getting

1289
00:59:57,700 --> 00:59:56,450
stuck like that then the number one rule

1290
00:59:59,620 --> 00:59:57,710
that I always teach the other

1291
01:00:00,910 --> 00:59:59,630
spacewalkers that I'm leading on these

1292
01:00:02,650 --> 01:00:00,920
Hubble flights I've been up there three

1293
01:00:05,320 --> 01:00:02,660
times and I learned from a master Steve

1294
01:00:07,360 --> 01:00:05,330
Smith on that what was the third

1295
01:00:10,870 --> 01:00:07,370
servicing mission is number one rule

1296
01:00:13,210 --> 01:00:10,880
don't break the Hubble and so when we

1297
01:00:14,830 --> 01:00:13,220
put a wrench on a bolt we actually have

1298
01:00:17,650 --> 01:00:14,840
a little device that has springs in it

1299
01:00:19,600 --> 01:00:17,660
that prevent us from over torquing it so

1300
01:00:21,880 --> 01:00:19,610
if you go to too much for suddenly that

1301
01:00:24,400 --> 01:00:21,890
will slip so that you know the wrench

1302
01:00:26,860 --> 01:00:24,410
slips instead of breaking the Hubble and

1303
01:00:28,960 --> 01:00:26,870
so we had that wrench set in there and

1304
01:00:30,880 --> 01:00:28,970
we actually in this case drew was

1305
01:00:33,430 --> 01:00:30,890
cranking at it and suddenly that thing

1306
01:00:34,960 --> 01:00:33,440
slipped well we can increase the torque

1307
01:00:36,430 --> 01:00:34,970
a little bit in steps and we did that

1308
01:00:39,160 --> 01:00:36,440
all the way up to the end of what we

1309
01:00:41,410 --> 01:00:39,170
could do and it happens to be 45 foot

1310
01:00:43,120 --> 01:00:41,420
pounds or so and so what we had to do in

1311
01:00:44,620 --> 01:00:43,130
the end was and we tried a couple of

1312
01:00:46,300 --> 01:00:44,630
different sockets and wrenches and

1313
01:00:48,940 --> 01:00:46,310

finally we have to take that out of the

1314
01:00:50,710 --> 01:00:48,950
loop we just pulled that out and put the

1315
01:00:52,720 --> 01:00:50,720
wrench straight on the bolt that means

1316
01:00:54,280 --> 01:00:52,730
you know if you pull too hard the bolts

1317
01:00:56,050 --> 01:00:54,290
going to snap off and then that's the

1318
01:00:58,630 --> 01:00:56,060
end you can't get the instrument out and

1319
01:01:01,120 --> 01:00:58,640
so we had to go to that extreme and

1320
01:01:04,480 --> 01:01:01,130
fortunately it broke loose so to speak

1321
01:01:06,550 --> 01:01:04,490
it came loose just above where that

1322
01:01:06,790 --> 01:01:06,560
torque limiter was operating and so we

1323
01:01:09,310 --> 01:01:06,800
just

1324
01:01:11,440 --> 01:01:09,320
lucky of course then later on I had a

1325
01:01:13,540 --> 01:01:11,450
similar one that had been installed with

1326
01:01:15,160 --> 01:01:13,550
the same tool and when I went to do it

1327
01:01:17,530 --> 01:01:15,170
the same thing happen but this time we

1328
01:01:20,560 --> 01:01:17,540
knew at least what the procedures would

1329
01:01:22,780 --> 01:01:20,570
be to get it unstuck still that moment

1330
01:01:25,360 --> 01:01:22,790
when you're about to okay is it going to

1331
01:01:27,040 --> 01:01:25,370
break the line is first do no harm is

1332
01:01:28,570 --> 01:01:27,050
that that's right don't break now and I

1333
01:01:32,800 --> 01:01:28,580
have one more a philosophical question

1334
01:01:35,830 --> 01:01:32,810
you know I think everyone here values

1335
01:01:37,360 --> 01:01:35,840
space Lex exploration and the value of

1336
01:01:40,320 --> 01:01:37,370
that we all understand they were or we

1337
01:01:45,100 --> 01:01:40,330
wouldn't be here but can you talk about

1338
01:01:47,940 --> 01:01:45,110

in an era of tight budgets the value of

1339
01:01:50,620 --> 01:01:47,950
manned space versus more robotic and

1340
01:01:52,000 --> 01:01:50,630
unmanned space exploration yeah we have

1341
01:01:55,270 --> 01:01:52,010
part of that debate up here earlier

1342
01:01:57,160 --> 01:01:55,280
didn't when buzz was still here I don't

1343
01:01:59,140 --> 01:01:57,170
think you ever got to address it let me

1344
01:02:00,520 --> 01:01:59,150
give a couple of quick comments about it

1345
01:02:02,110 --> 01:02:00,530
I mean I think it's a little bit of a

1346
01:02:05,130 --> 01:02:02,120
false debate I think they're the truth

1347
01:02:07,390 --> 01:02:05,140
is that there's room and need for both

1348
01:02:09,550 --> 01:02:07,400
robots can go right now places that

1349
01:02:11,560 --> 01:02:09,560
humans can't and humans can do things

1350
01:02:12,940 --> 01:02:11,570
that robots can't at the moment or at

1351
01:02:15,400 --> 01:02:12,950
least much more efficiently and here's

1352
01:02:17,050 --> 01:02:15,410
the example i like to use if my friend

1353
01:02:18,910 --> 01:02:17,060
steve squyres who's the lead scientist

1354
01:02:20,380 --> 01:02:18,920
for the Mars rovers for an opportunity

1355
01:02:22,180 --> 01:02:20,390
that are still five years later the

1356
01:02:24,880 --> 01:02:22,190
energizer bunnies on Mars I keep going

1357
01:02:26,920 --> 01:02:24,890
and going if you actually have asked him

1358
01:02:28,570 --> 01:02:26,930
this question okay if you or a geologist

1359
01:02:30,430 --> 01:02:28,580
which he is and I am on the surface of

1360
01:02:31,840 --> 01:02:30,440
Mars how long would it take you to do

1361
01:02:33,100 --> 01:02:31,850
what the rover does in a day and what

1362
01:02:34,960 --> 01:02:33,110
the rover doesn't our day is maybe it

1363
01:02:36,670 --> 01:02:34,970

drives 50 meters or something it it

1364
01:02:38,020 --> 01:02:36,680
looks at a rock it might dig into that

1365
01:02:39,250 --> 01:02:38,030
rock a little bit and it tries to figure

1366
01:02:42,070 --> 01:02:39,260
out what kind of rock it is that's

1367
01:02:43,660 --> 01:02:42,080
basically what a geologist does how long

1368
01:02:45,970 --> 01:02:43,670
would it take a human to do that that

1369
01:02:47,470 --> 01:02:45,980
does it take some over a day he said

1370
01:02:49,270 --> 01:02:47,480
I've timed it I've taken my science team

1371
01:02:53,800 --> 01:02:49,280
out in the field and I've timed it 45

1372
01:02:55,210 --> 01:02:53,810
seconds so you can imagine that it's

1373
01:02:57,190 --> 01:02:55,220
just there's a heck of a lot of

1374
01:02:59,890 --> 01:02:57,200
efficiency that you get out of having

1375
01:03:03,130 --> 01:02:59,900
humans there in addition human eyes and

1376
01:03:05,020 --> 01:03:03,140
hands and ears can can give us the

1377
01:03:06,550 --> 01:03:05,030
observations that frankly we don't yet

1378
01:03:08,020 --> 01:03:06,560
have the capability to get with robots

1379
01:03:09,610 --> 01:03:08,030
there's an incredible amount that

1380
01:03:11,470 --> 01:03:09,620
robotic exploration does and most the

1381
01:03:13,540 --> 01:03:11,480
missions we do it got our robotic

1382
01:03:15,130 --> 01:03:13,550
exploration it's amazing but i think

1383
01:03:16,990 --> 01:03:15,140
there's absolutely room for humans in

1384
01:03:18,460 --> 01:03:17,000
that loop as well

1385
01:03:21,070 --> 01:03:18,470
you very much i would just wanted to let

1386
01:03:22,630 --> 01:03:21,080
you know we have time for I think I'm I

1387
01:03:25,360 --> 01:03:22,640
think a couple of more questions and

1388
01:03:27,460 --> 01:03:25,370

you're one of them hi my name is Erica

1389
01:03:29,920 --> 01:03:27,470
um and my little brother hopes to be an

1390
01:03:32,320 --> 01:03:29,930
astrophysicist when he grows up when you

1391
01:03:37,420 --> 01:03:32,330
all were little did you ever dream about

1392
01:03:42,750 --> 01:03:37,430
doing what you're doing now well I did

1393
01:03:50,500 --> 01:03:48,160
and I didn't but I wanted to follow in

1394
01:03:53,860 --> 01:03:50,510
the footsteps of my heroes as I said

1395
01:03:55,540 --> 01:03:53,870
early which was the military those that

1396
01:03:57,910 --> 01:03:55,550
served in the military in World War two

1397
01:04:00,940 --> 01:03:57,920
and so I decided as a junior in high

1398
01:04:04,120 --> 01:04:00,950
school a sophomore in high school that I

1399
01:04:06,550 --> 01:04:04,130
wanted to go the Naval Academy and so I

1400
01:04:08,410 --> 01:04:06,560
started pointing for that and I made it

1401
01:04:10,150 --> 01:04:08,420
there and when I got to the Naval

1402
01:04:12,670 --> 01:04:10,160
Academy I fell in love with airplanes

1403
01:04:15,850 --> 01:04:12,680
instead of ships and so I became a pilot

1404
01:04:19,540 --> 01:04:15,860
and so it's just a progression of one

1405
01:04:23,140 --> 01:04:19,550
sort of step after another if you will

1406
01:04:28,600 --> 01:04:23,150
that leads us to to your final final

1407
01:04:32,050 --> 01:04:28,610
careers and so I just tell everybody to

1408
01:04:34,770 --> 01:04:32,060
dream whether you can be a physicist an

1409
01:04:37,540 --> 01:04:34,780
engineer of scientists of some sort or a

1410
01:04:39,190 --> 01:04:37,550
medical doctor all of those disciplines

1411
01:04:41,590 --> 01:04:39,200
are needed in the space program and if

1412
01:04:43,720 --> 01:04:41,600
you desires to be a astronaut or

1413
01:04:46,240 --> 01:04:43,730

involved in space you can be just about

1414
01:04:48,640 --> 01:04:46,250
anything you want we have lawyers and

1415
01:04:51,580 --> 01:04:48,650
business people to at NASA Center so

1416
01:04:55,480 --> 01:04:51,590
absolutely more question hello my mother

1417
01:04:58,120 --> 01:04:55,490
has called be barney oldfield but i am

1418
01:05:01,330 --> 01:04:58,130
looking at all the arguments for

1419
01:05:03,430 --> 01:05:01,340
continuing space exploration and we are

1420
01:05:06,730 --> 01:05:03,440
getting to the end of the shuttle

1421
01:05:09,730 --> 01:05:06,740
program and of course budget is one of

1422
01:05:12,310 --> 01:05:09,740
the big mantras what do we see in the

1423
01:05:14,740 --> 01:05:12,320
international community in support

1424
01:05:17,460 --> 01:05:14,750
either with technology or continuing

1425
01:05:22,870 --> 01:05:17,470
support with the intellectual science

1426
01:05:25,870 --> 01:05:22,880
fields and money well let me let me

1427
01:05:27,370 --> 01:05:25,880
start an unlit Laurie join in my belief

1428
01:05:29,650 --> 01:05:27,380
is that science is the international

1429
01:05:30,940 --> 01:05:29,660
language of peace quite frankly I think

1430
01:05:33,069 --> 01:05:30,950
when we join on scientific

1431
01:05:36,370 --> 01:05:33,079
endeavour's when we join on endeavors of

1432
01:05:39,460 --> 01:05:36,380
great exploration that that is a

1433
01:05:41,140 --> 01:05:39,470
unifying theme amongst peoples on planet

1434
01:05:45,190 --> 01:05:41,150
earth and it's been shown time and time

1435
01:05:47,079 --> 01:05:45,200
again you know budgets are tight but I

1436
01:05:50,650 --> 01:05:47,089
really believe that exploration is this

1437
01:05:53,470 --> 01:05:50,660
grand adventure that is such an integral

1438
01:05:58,089 --> 01:05:53,480

part of us being human that we have to

1439
01:06:00,670 --> 01:05:58,099
do it great nations are nations of great

1440
01:06:02,230 --> 01:06:00,680
explorers the there's no question you

1441
01:06:04,569 --> 01:06:02,240
look at the Armada of spacecraft that

1442
01:06:06,220 --> 01:06:04,579
are around the moon we've had chinese

1443
01:06:08,230 --> 01:06:06,230
spacecraft exploring the moon in indian

1444
01:06:10,569 --> 01:06:08,240
spacecraft united states spacecraft on

1445
01:06:13,450 --> 01:06:10,579
each of the spacecraft their

1446
01:06:17,530 --> 01:06:13,460
international participation Alyssa

1447
01:06:19,030 --> 01:06:17,540
patien corporation so if there's no

1448
01:06:21,069 --> 01:06:19,040
question in my mind that if we don't

1449
01:06:23,829 --> 01:06:21,079
explore and if we don't lead exploration

1450
01:06:27,960 --> 01:06:23,839
in this great country somebody else will

1451
01:06:30,250 --> 01:06:27,970
and I like it that were the leaders

1452
01:06:32,410 --> 01:06:30,260
almost every mission we do at NASA is

1453
01:06:35,380 --> 01:06:32,420
international these days I mean you can

1454
01:06:37,510 --> 01:06:35,390
harken back to the apollo-soyuz back

1455
01:06:38,800 --> 01:06:37,520
when the US and Russians weren't getting

1456
01:06:40,870 --> 01:06:38,810
along very well we were exploring

1457
01:06:42,640 --> 01:06:40,880
together in space and I think again we

1458
01:06:45,490 --> 01:06:42,650
can be trailblazers Four Nations

1459
01:06:48,460 --> 01:06:45,500
building bridges through space

1460
01:06:50,260 --> 01:06:48,470
exploration with science with human

1461
01:06:52,270 --> 01:06:50,270
spaceflight and we are doing that today

1462
01:06:53,950 --> 01:06:52,280
almost every mission we fly as

1463
01:07:06,290 --> 01:06:53,960

international and that's something we're

1464
01:07:10,760 --> 01:07:09,000
11 name was mentioned here earlier today

1465
01:07:13,319 --> 01:07:10,770
and it turns out that late in life

1466
01:07:16,020 --> 01:07:13,329
Walter Cronkite and I became very good

1467
01:07:18,510 --> 01:07:16,030
friends and saw one another regularly

1468
01:07:19,920 --> 01:07:18,520
one of the things I remember most was a

1469
01:07:21,089 --> 01:07:19,930
conversation I had with him in a

1470
01:07:23,059 --> 01:07:21,099
restaurant in New York where he was

1471
01:07:25,530 --> 01:07:23,069
talking about you he was talking about

1472
01:07:27,270 --> 01:07:25,540
space and he always called it the

1473
01:07:29,190 --> 01:07:27,280
biggest story that he ever covered the

1474
01:07:32,790 --> 01:07:29,200
most important story of these two

1475
01:07:34,290 --> 01:07:32,800
centuries he also put it in a way that I

1476
01:07:36,059 --> 01:07:34,300
hadn't heard before he said you know all

1477
01:07:38,640 --> 01:07:36,069
the news i was doing it was Watergate

1478
01:07:41,670 --> 01:07:38,650
there was Vietnam liberal we were down

1479
01:07:43,349 --> 01:07:41,680
cast we as a nation and maybe the world

1480
01:07:45,990 --> 01:07:43,359
was downcast he says I'm not sure

1481
01:07:48,900 --> 01:07:46,000
there's a word that I'm going to use he

1482
01:07:53,790 --> 01:07:48,910
said but space space travel in the space

1483
01:07:57,260 --> 01:07:53,800
programs are up cast he said you had us

1484
01:08:00,540 --> 01:07:57,270
you had us looking up beyond ourselves

1485
01:08:03,150 --> 01:08:00,550
reach exceeding our grasp and that's