1
00:00:05,910 --> 00:00:03,429
good afternoon everybody um

2
00:00:08,070 --> 00:00:05,920
my name is ron systerick i'm here today

3
00:00:10,070 --> 00:00:08,080
because i'm passionate about the martian

4
00:00:12,470 --> 00:00:10,080
i'm passionate about landing humans on

5
00:00:13,910 --> 00:00:12,480
mars and frankly i've volunteered before

6
00:00:15,110 --> 00:00:13,920
i had any idea what i was getting into

7
00:00:17,269 --> 00:00:15,120
so

8
00:00:18,870 --> 00:00:17,279
but seriously though i'm really glad to

9
00:00:20,950 --> 00:00:18,880
be able to join you and talk about mars

10
00:00:22,390 --> 00:00:20,960
it's it's it's fun stuff and it's the

11
00:00:24,230 --> 00:00:22,400
future so

12
00:00:26,550 --> 00:00:24,240
let's talk a little bit about uh let's

13
00:00:30,470 --> 00:00:26,560

talk about mars

14
00:00:32,389 --> 00:00:30,480
when i first came uh to nasa i always

15
00:00:33,990 --> 00:00:32,399
wanted to to

16
00:00:35,910 --> 00:00:34,000
when i was growing up i thought mars was

17
00:00:37,910 --> 00:00:35,920
great i wanted to go to mars right i

18
00:00:40,790 --> 00:00:37,920
want to send people to mars when i first

19
00:00:43,830 --> 00:00:40,800
came to nasa i got an opportunity to

20
00:00:45,110 --> 00:00:43,840
work as a co-op and at the time we were

21
00:00:48,630 --> 00:00:45,120
developing

22
00:00:52,389 --> 00:00:48,640
uh entry systems for humans to mars and

23
00:00:53,189 --> 00:00:52,399
the plan is 25 years humans to mars

24
00:00:55,189 --> 00:00:53,199
well

25
00:00:56,709 --> 00:00:55,199
about 20 years later i'm still here

26
00:00:59,590 --> 00:00:56,719
we're working entry systems for humans

27
00:01:01,189 --> 00:00:59,600
tomorrow the plan is 25 years humans to

28
00:01:02,069 --> 00:01:01,199
mars right

29
00:01:03,590 --> 00:01:02,079
okay

30
00:01:04,950 --> 00:01:03,600
so

31
00:01:07,670 --> 00:01:04,960
we want to get that closer right we want

32
00:01:09,590 --> 00:01:07,680
to bring that 25-year number down we

33
00:01:11,830 --> 00:01:09,600
want to we want to bring it get it down

34
00:01:14,870 --> 00:01:11,840
to funding cycles or something like that

35
00:01:16,630 --> 00:01:14,880
so close that gap if you will and so i'd

36
00:01:19,190 --> 00:01:16,640
like to tell you today about some of the

37
00:01:23,510 --> 00:01:19,200
things that i'm doing personally to try

38
00:01:28,870 --> 00:01:26,710

first let's talk about the martian so

39
00:01:30,069 --> 00:01:28,880
the martian and the book and for those

40
00:01:31,190 --> 00:01:30,079
who haven't read it don't worry i'm not

41
00:01:33,030 --> 00:01:31,200
going to spoil it this happens in the

42
00:01:35,749 --> 00:01:33,040
first five pages but

43
00:01:39,350 --> 00:01:35,759
in the book the crew lands on mars in

44
00:01:41,670 --> 00:01:39,360
the mars descent vehicle or the mdv

45
00:01:43,510 --> 00:01:41,680
and it's described as

46
00:01:44,389 --> 00:01:43,520
uh in one sentence

47
00:01:55,270 --> 00:01:44,399
a

48
00:01:57,190 --> 00:01:55,280
uh

49
00:01:58,870 --> 00:01:57,200
i hope andy aware doesn't mind too much

50
00:02:00,870 --> 00:01:58,880
maybe he can uh call me for his next

51
00:02:03,109 --> 00:02:00,880
book or something uh

52
00:02:04,550 --> 00:02:03,119
seriously though uh so let's let's talk

53
00:02:06,389 --> 00:02:04,560
about mars for real

54
00:02:08,389 --> 00:02:06,399
mars is different than earth as we know

55
00:02:10,389 --> 00:02:08,399
the atmosphere is different

56
00:02:12,630 --> 00:02:10,399
it's mostly co2 but what's really

57
00:02:14,070 --> 00:02:12,640
important for as far as we're concerned

58
00:02:16,070 --> 00:02:14,080
with mars landing

59
00:02:17,910 --> 00:02:16,080
is that the density is much less it's

60
00:02:19,830 --> 00:02:17,920
it's about one percent of the density of

61
00:02:22,390 --> 00:02:19,840
earth of earth

62
00:02:23,430 --> 00:02:22,400
so what that means think about that

63
00:02:30,550 --> 00:02:23,440

the

64
00:02:32,470 --> 00:02:30,560
earth

65
00:02:35,350 --> 00:02:32,480
which is over three times the height of

66
00:02:38,229 --> 00:02:35,360
mount everest there's just not a lot of

67
00:02:40,550 --> 00:02:38,239
air density sorry not air mars what not

68
00:02:42,630 --> 00:02:40,560
density to work with

69
00:02:44,710 --> 00:02:42,640
okay so most of you probably know but

70
00:02:46,710 --> 00:02:44,720
why do we care

71
00:02:49,270 --> 00:02:46,720
we use drag to slow down the spacecraft

72
00:02:51,190 --> 00:02:49,280
in mars and that drag force is

73
00:02:53,830 --> 00:02:51,200
proportional to the density so if the

74
00:02:55,990 --> 00:02:53,840
density goes down 100 times the drag

75
00:02:57,830 --> 00:02:56,000
force goes down 100 times so it's a

76
00:02:58,869 --> 00:02:57,840
challenge just to slow something down in

77
00:03:00,550 --> 00:02:58,879
mars

78
00:03:02,710 --> 00:03:00,560
at the same time there's still enough

79
00:03:04,470 --> 00:03:02,720
density to create significant heating so

80
00:03:06,070 --> 00:03:04,480
we have the same kind of thermal protect

81
00:03:07,430 --> 00:03:06,080
protection system concerns that you

82
00:03:10,149 --> 00:03:07,440
would have for an earth vehicle and we

83
00:03:11,190 --> 00:03:10,159
use a blade of tps to uh

84
00:03:13,110 --> 00:03:11,200
to keep the

85
00:03:15,990 --> 00:03:13,120
the payloads and the astronauts safe of

86
00:03:22,630 --> 00:03:20,630
get a feel for the density difference

87
00:03:25,509 --> 00:03:22,640
there's constructed example here so

88
00:03:28,390 --> 00:03:25,519

imagine in a skydiver

89
00:03:29,990 --> 00:03:28,400
at earth no parachute so they're going

90
00:03:31,670 --> 00:03:30,000
to have a bad day probably when they hit

91
00:03:34,149 --> 00:03:31,680
the ground but they'd only hit the

92
00:03:37,750 --> 00:03:34,159
ground at 120 miles per hour

93
00:03:39,190 --> 00:03:37,760
at mars it's a mach 1.5 so

94
00:03:40,550 --> 00:03:39,200
not only would they hit the ground

95
00:03:41,990 --> 00:03:40,560
really hard but you wouldn't even hear

96
00:03:45,190 --> 00:03:42,000
them scream until after they hit they

97
00:03:46,630 --> 00:03:45,200
cured the thump so you know it's it's a

98
00:03:48,550 --> 00:03:46,640
big challenge

99
00:03:50,229 --> 00:03:48,560
uh unless you get worried about the rest

100
00:03:52,470 --> 00:03:50,239
of the presentation this is not the

101
00:03:55,750 --> 00:03:52,480
proposed system for landing humans on

102
00:04:00,229 --> 00:03:58,070
okay i've convinced you probably that

103
00:04:02,550 --> 00:04:00,239
it's a challenge but we know how to land

104
00:04:05,509 --> 00:04:02,560
on mars right we've done it seven times

105
00:04:08,550 --> 00:04:05,519
uh most recently being the curiosity

106
00:04:10,390 --> 00:04:08,560
rover the mars science laboratory msl

107
00:04:12,470 --> 00:04:10,400
uh so while we're on the chart i have

108
00:04:14,390 --> 00:04:12,480
you note also that they're a relatively

109
00:04:16,069 --> 00:04:14,400
low elevation landing sites now these

110
00:04:17,670 --> 00:04:16,079
are in the southern highlands

111
00:04:19,430 --> 00:04:17,680
oh okay

112
00:04:21,110 --> 00:04:19,440
what have we landed there

113
00:04:23,270 --> 00:04:21,120

things that look some of them look like

114
00:04:24,150 --> 00:04:23,280
this mars pathfinder is the small rover

115
00:04:27,270 --> 00:04:24,160
you see

116
00:04:29,270 --> 00:04:27,280
the medium size golf cart type of rovers

117
00:04:32,390 --> 00:04:29,280
are a spirit and opportunity and

118
00:04:34,550 --> 00:04:32,400
curiosity is the large one there so

119
00:04:38,070 --> 00:04:34,560
that's about how big curiosity is next

120
00:04:40,390 --> 00:04:38,080
to some people so that gives you a feel

121
00:04:42,870 --> 00:04:40,400
the entry vehicles that we put those

122
00:04:44,629 --> 00:04:42,880
rovers in are depicted here in the on

123
00:04:46,950 --> 00:04:44,639
the plot and so

124
00:04:49,510 --> 00:04:46,960
you can kind of see

125
00:04:51,749 --> 00:04:49,520
roughly how what the size is

126
00:04:53,510 --> 00:04:51,759
and they've used the same basic

127
00:04:56,469 --> 00:04:53,520
technologies that were first developed

128
00:04:59,350 --> 00:04:56,479
for viking program and that's the 70

129
00:05:02,230 --> 00:04:59,360
degree sphere cone aeroshell shape

130
00:05:03,670 --> 00:05:02,240
and the mars supersonic disc gap band

131
00:05:06,070 --> 00:05:03,680
parachute

132
00:05:08,230 --> 00:05:06,080
those technologies are not the ones that

133
00:05:09,749 --> 00:05:08,240
will scale well for the kinds of human

134
00:05:12,150 --> 00:05:09,759
missions we need to send to mars let me

135
00:05:16,469 --> 00:05:12,160
tell you a bit about why

136
00:05:18,230 --> 00:05:16,479
imagine the curiosity rover as a unit

137
00:05:19,830 --> 00:05:18,240
and the closest thing i could find

138
00:05:20,629 --> 00:05:19,840

through an internet search was a smart

139
00:05:25,110 --> 00:05:20,639
car

140
00:05:27,029 --> 00:05:25,120
for our human missions they're much

141
00:05:29,590 --> 00:05:27,039
larger right we're talking about 20 to

142
00:05:31,909 --> 00:05:29,600
40 times the payload mass that's

143
00:05:34,550 --> 00:05:31,919
required

144
00:05:37,029 --> 00:05:34,560
so that's 20 to 40 smart cars each time

145
00:05:40,710 --> 00:05:37,039
we land so that gives you a feel for the

146
00:05:45,749 --> 00:05:42,390
also to give you a feel

147
00:05:48,310 --> 00:05:45,759
imagine now this is roughly two scale so

148
00:05:50,870 --> 00:05:48,320
you've got a 4.7 meter

149
00:05:54,150 --> 00:05:50,880
mars science laboratory msl there

150
00:05:56,150 --> 00:05:54,160
and a 20 to 30 meter long uh

151
00:05:58,710 --> 00:05:56,160
entry vehicle for humans so they're much

152
00:06:00,710 --> 00:05:58,720
much bigger

153
00:06:02,390 --> 00:06:00,720
at this point you're probably going well

154
00:06:04,790 --> 00:06:02,400
wait a minute why do i want to land

155
00:06:07,830 --> 00:06:04,800
something big why don't i just land a

156
00:06:08,950 --> 00:06:07,840
bunch of small stuff right instead

157
00:06:10,629 --> 00:06:08,960
and

158
00:06:11,990 --> 00:06:10,639
i don't have time to

159
00:06:13,749 --> 00:06:12,000
kind of go through all the different

160
00:06:15,830 --> 00:06:13,759
reasons but i wanted to at least address

161
00:06:17,350 --> 00:06:15,840
the landing accuracy part of the part of

162
00:06:19,430 --> 00:06:17,360
that

163
00:06:21,830 --> 00:06:19,440

landing accuracy

164
00:06:22,950 --> 00:06:21,840
for mars has steadily improved as you

165
00:06:24,710 --> 00:06:22,960
can see

166
00:06:26,790 --> 00:06:24,720
viking had a fairly large landing

167
00:06:28,790 --> 00:06:26,800
ellipse and it's gotten better

168
00:06:30,150 --> 00:06:28,800
smaller folks worked hard on this

169
00:06:33,670 --> 00:06:30,160
getting it down to the size and

170
00:06:37,990 --> 00:06:33,680
curiosity but it's still here 12 by 4

171
00:06:39,590 --> 00:06:38,000
miles right so imagine instead of

172
00:06:41,990 --> 00:06:39,600
sending all the smart cars all at once

173
00:06:43,270 --> 00:06:42,000
we're going to send 20 to 40 smart cars

174
00:06:45,510 --> 00:06:43,280
in fact that's not the total mass we

175
00:06:47,990 --> 00:06:45,520
need for the mission but you get you get

176
00:06:50,790 --> 00:06:48,000
the picture and then we'll send people

177
00:06:52,629 --> 00:06:50,800
to go and collect all the supplies

178
00:06:53,670 --> 00:06:52,639
and gather them up and and bring them

179
00:06:55,189 --> 00:06:53,680
back

180
00:06:58,070 --> 00:06:55,199
okay so imagine that's a mission

181
00:07:00,070 --> 00:06:58,080
scenario well when we send the crew

182
00:07:01,909 --> 00:07:00,080
they're going to need all the things

183
00:07:03,589 --> 00:07:01,919
to go get all that all those supplies

184
00:07:05,350 --> 00:07:03,599
right they're going to need life support

185
00:07:07,830 --> 00:07:05,360
and a hab and a

186
00:07:09,430 --> 00:07:07,840
really really capable rover to go over

187
00:07:12,870 --> 00:07:09,440
such a large area

188
00:07:14,469 --> 00:07:12,880

not to mention the other concern with um

189
00:07:18,309 --> 00:07:14,479
you know some of those supplies might

190
00:07:21,510 --> 00:07:20,550
the system that's going to have to send

191
00:07:26,390 --> 00:07:21,520
the

192
00:07:28,230 --> 00:07:26,400
to be safe is going to be fairly large

193
00:07:29,589 --> 00:07:28,240
because of all the large components that

194
00:07:31,830 --> 00:07:29,599
need to come with it

195
00:07:33,350 --> 00:07:31,840
and so the smart folks who work the edl

196
00:07:34,790 --> 00:07:33,360
architecture trades figured out that the

197
00:07:37,430 --> 00:07:34,800
sweet spot for the total number of

198
00:07:39,189 --> 00:07:37,440
landings is two to four and that's what

199
00:07:44,390 --> 00:07:39,199
drives the large masses i've been i've

200
00:07:48,629 --> 00:07:46,230
nasa is not sitting idle we're hard at

201
00:07:50,070 --> 00:07:48,639
work on some different technologies that

202
00:07:51,749 --> 00:07:50,080
uh help

203
00:07:52,790 --> 00:07:51,759
address each of the things i've talked

204
00:07:55,510 --> 00:07:52,800
to you about

205
00:07:56,950 --> 00:07:55,520
the first one is low density supersonic

206
00:07:59,430 --> 00:07:56,960
decelerator so if you've heard of the

207
00:08:01,830 --> 00:07:59,440
flying saucer test that's this

208
00:08:03,670 --> 00:08:01,840
this is about incremental capability

209
00:08:05,909 --> 00:08:03,680
improvements to current robotic mission

210
00:08:07,670 --> 00:08:05,919
capabilities so instead of landing one

211
00:08:09,510 --> 00:08:07,680
metric sun on mars we'll land two metric

212
00:08:11,670 --> 00:08:09,520
tons on mars or we'll go land at the

213
00:08:13,430 --> 00:08:11,680

southern highlands

214
00:08:15,589 --> 00:08:13,440
all hat near and dear to my heart i

215
00:08:17,670 --> 00:08:15,599
worked on it for six years great project

216
00:08:20,390 --> 00:08:17,680
it's the autonomous landing and hazard

217
00:08:22,790 --> 00:08:20,400
avoidance technology project

218
00:08:24,230 --> 00:08:22,800
all hats addressing the landing accuracy

219
00:08:26,390 --> 00:08:24,240
that i talked about

220
00:08:28,390 --> 00:08:26,400
and it's also it's about it's about kind

221
00:08:30,869 --> 00:08:28,400
of two things the other aspect

222
00:08:32,630 --> 00:08:30,879
is knowing what's at the landing area

223
00:08:34,230 --> 00:08:32,640
knowing the landing site are there

224
00:08:36,070 --> 00:08:34,240
hazards are there assets that are

225
00:08:37,990 --> 00:08:36,080
already there and then going and landing

226
00:08:39,269 --> 00:08:38,000
and avoiding those so all that's working

227
00:08:41,029 --> 00:08:39,279
on that

228
00:08:43,990 --> 00:08:41,039
and you probably know it was flown on

229
00:08:46,150 --> 00:08:44,000
morpheus as well so made great progress

230
00:08:46,949 --> 00:08:46,160
on all hat

231
00:08:49,670 --> 00:08:46,959
for

232
00:08:51,430 --> 00:08:49,680
entry hypersonic entry there's basically

233
00:08:54,790 --> 00:08:51,440
two categories that nasa is

234
00:08:57,590 --> 00:08:54,800
investigating and that's these um one is

235
00:08:59,110 --> 00:08:57,600
the large blunt body shape so the defl

236
00:09:00,949 --> 00:08:59,120
deployables and inflatables and the

237
00:09:04,389 --> 00:09:00,959
basic idea here

238
00:09:06,070 --> 00:09:04,399

is and it's different from doug's

239
00:09:09,190 --> 00:09:06,080
type of application but it may relate on

240
00:09:11,590 --> 00:09:09,200
that but the idea here is you'd package

241
00:09:13,910 --> 00:09:11,600
the spacecraft in the launch vehicle in

242
00:09:16,310 --> 00:09:13,920
the shroud and then

243
00:09:17,990 --> 00:09:16,320
on the way to mars inflate or deploy

244
00:09:21,110 --> 00:09:18,000
something that would allow you to get a

245
00:09:24,389 --> 00:09:22,389
drag area

246
00:09:26,389 --> 00:09:24,399
then you could otherwise stuff into a

247
00:09:29,030 --> 00:09:26,399
launch route

248
00:09:31,350 --> 00:09:29,040
the last one is also near and dear to me

249
00:09:32,870 --> 00:09:31,360
is the mid lifted drag aeroshell

250
00:09:35,190 --> 00:09:32,880
technology work and i'm personally

251
00:09:38,630 --> 00:09:35,200
working on this so here you see two of

252
00:09:38,640 --> 00:09:43,430
the idea here is

253
00:09:46,550 --> 00:09:44,389
to get

254
00:09:48,630 --> 00:09:46,560
extra lift to drag ratio to do some

255
00:09:51,190 --> 00:09:48,640
useful things for the mission

256
00:09:52,949 --> 00:09:51,200
as compared to uh this is why we call it

257
00:09:56,470 --> 00:09:52,959
mid is because this is compared to the

258
00:09:58,470 --> 00:09:56,480
low lrvd blunt bodies or capsules

259
00:10:00,550 --> 00:09:58,480
but the the mid-already is not as high

260
00:10:02,230 --> 00:10:00,560
already as say something

261
00:10:04,790 --> 00:10:02,240
like a wing vehicle like the shuttle

262
00:10:07,750 --> 00:10:04,800
shuttle is about a 1.0 l over d the

263
00:10:10,790 --> 00:10:07,760

delivery is about 0.5 to 0.6 so why do

264
00:10:12,389 --> 00:10:10,800
we want the lrd there's three things

265
00:10:14,150 --> 00:10:12,399
about the lrvd that was really helpful

266
00:10:15,829 --> 00:10:14,160
for us

267
00:10:18,470 --> 00:10:15,839
uh one

268
00:10:21,430 --> 00:10:18,480
is that it will help manage uh better

269
00:10:22,949 --> 00:10:21,440
manage the landing the entry loads so

270
00:10:25,509 --> 00:10:22,959
the entry g's

271
00:10:27,509 --> 00:10:25,519
uh better cross range capability and the

272
00:10:32,949 --> 00:10:27,519
third thing is landing accuracy more

273
00:10:37,509 --> 00:10:35,590
what might it look like for an actual

274
00:10:39,350 --> 00:10:37,519
human mars edl

275
00:10:40,470 --> 00:10:39,360
so this is a concept

276
00:10:42,470 --> 00:10:40,480
uh

277
00:10:43,910 --> 00:10:42,480
there are many concepts under

278
00:10:46,710 --> 00:10:43,920
investigation but i'd like to just talk

279
00:10:48,550 --> 00:10:46,720
you through one so you get a sense of of

280
00:10:50,470 --> 00:10:48,560
what edl looks like entry descent

281
00:10:52,710 --> 00:10:50,480
landing looks like so you'd fly the

282
00:10:54,949 --> 00:10:52,720
hypersonic entry with the vehicle

283
00:10:58,550 --> 00:10:54,959
and as it gets closer to the ground this

284
00:11:04,389 --> 00:11:01,910
this concept shows a transition in which

285
00:11:08,150 --> 00:11:04,399
the aeroshell splits and a lander

286
00:11:10,150 --> 00:11:08,160
emerges and the lander would do a power

287
00:11:12,630 --> 00:11:10,160
descent burn beginning from a supersonic

288
00:11:15,829 --> 00:11:12,640

condition and come down and land the

289
00:11:19,110 --> 00:11:15,839
payload or crew

290
00:11:20,310 --> 00:11:19,120
all the concepts are under investigation

291
00:11:22,710 --> 00:11:20,320
almost all the concepts under

292
00:11:25,030 --> 00:11:22,720
investigation have us have an initiation

293
00:11:26,710 --> 00:11:25,040
point for this powered burn a supersonic

294
00:11:29,190 --> 00:11:26,720
mach number

295
00:11:30,870 --> 00:11:29,200
there are a few that can get it to

296
00:11:33,590 --> 00:11:30,880
subsonic but they're we're talking

297
00:11:35,190 --> 00:11:33,600
really large probably in feasible types

298
00:11:37,030 --> 00:11:35,200
of

299
00:11:42,870 --> 00:11:37,040
drag areas so

300
00:11:47,030 --> 00:11:45,030
hopefully i've given you a feel for the

301
00:11:49,110 --> 00:11:47,040
challenge of mars

302
00:11:50,150 --> 00:11:49,120
but we didn't talk about how to close

303
00:11:51,590 --> 00:11:50,160
the gap

304
00:11:53,670 --> 00:11:51,600
and so that's what i'd like to talk

305
00:11:55,509 --> 00:11:53,680
about next so

306
00:11:57,509 --> 00:11:55,519
before we test anything or fly it at

307
00:11:59,350 --> 00:11:57,519
mars or use it we would we would develop

308
00:12:01,590 --> 00:11:59,360
it and test it here on earth

309
00:12:02,389 --> 00:12:01,600
and i've been involved in doing some of

310
00:12:07,030 --> 00:12:02,399
that

311
00:12:09,670 --> 00:12:07,040
i've described to you and joined forces

312
00:12:13,350 --> 00:12:09,680
with the mariah capsule project to do

313
00:12:16,870 --> 00:12:13,360

subsystem development and testing

314
00:12:17,990 --> 00:12:16,880
for um that would be applicable to

315
00:12:53,269 --> 00:12:18,000
a

316
00:12:54,949 --> 00:12:53,279
bunch of testing here we're getting

317
00:12:56,870 --> 00:12:54,959
ready for a test

318
00:13:00,389 --> 00:12:56,880
this picture cracks me up so i included

319
00:13:05,509 --> 00:13:03,670
got the data on that one good day

320
00:13:07,190 --> 00:13:05,519
recovered that one as well

321
00:13:09,990 --> 00:13:07,200
some shoe testing

322
00:13:11,670 --> 00:13:10,000
and high altitude balloon tests

323
00:13:14,310 --> 00:13:11,680
which takes us to

324
00:13:16,790 --> 00:13:14,320
the the trv the terrestrial return

325
00:13:18,949 --> 00:13:16,800
vehicle which is the earth demonstration

326
00:13:21,030 --> 00:13:18,959
version of our middle level d shape

327
00:13:22,790 --> 00:13:21,040
so i'm really excited about what the

328
00:13:25,509 --> 00:13:22,800
work that i'm getting to do on this it's

329
00:13:27,750 --> 00:13:25,519
fantastic uh

330
00:13:31,110 --> 00:13:27,760
this is this will be a four foot version

331
00:13:34,389 --> 00:13:31,120
of that 20 to 30 meter uh long air shell

332
00:13:35,269 --> 00:13:34,399
that i described to you it will fly uh

333
00:13:37,670 --> 00:13:35,279
late

334
00:13:38,470 --> 00:13:37,680
next year so we're developing right now

335
00:13:40,389 --> 00:13:38,480
it's

336
00:13:41,750 --> 00:13:40,399
it would go up onto the space station to

337
00:13:44,069 --> 00:13:41,760
pull out the gem airlock as i mentioned

338
00:13:45,990 --> 00:13:44,079

like the mariah capsule but passive

339
00:13:48,150 --> 00:13:46,000
deploy

340
00:13:50,230 --> 00:13:48,160
does a separation passively gets a safe

341
00:13:53,509 --> 00:13:50,240
distance away

342
00:13:56,230 --> 00:13:53,519
does a deorbit burn uh enters and lands

343
00:13:58,069 --> 00:13:56,240
on a pair foil for an accurate landing

344
00:13:59,750 --> 00:13:58,079
so super exciting project uh we're

345
00:14:02,069 --> 00:13:59,760
working we're working on it right now

346
00:14:04,470 --> 00:14:02,079
and uh we're we're really excited about

347
00:14:10,069 --> 00:14:06,550
so i'd like to close with a personal

348
00:14:11,590 --> 00:14:10,079
story if i can get the slide to change

349
00:14:14,230 --> 00:14:11,600
and

350
00:14:16,870 --> 00:14:14,240
this picture is

351
00:14:18,230 --> 00:14:16,880
near and dear to me of all the testing

352
00:14:20,710 --> 00:14:18,240
we've done

353
00:14:22,629 --> 00:14:20,720
and development testing this one is

354
00:14:25,350 --> 00:14:22,639
just my favorite

355
00:14:27,269 --> 00:14:25,360
it's from our very first test so

356
00:14:29,189 --> 00:14:27,279
we're high altitude balloon test we're

357
00:14:31,430 --> 00:14:29,199
doing so i was doing some prototype work

358
00:14:33,670 --> 00:14:31,440
out at the sandbox here

359
00:14:35,670 --> 00:14:33,680
to develop this system and then working

360
00:14:37,990 --> 00:14:35,680
with a couple of the co-ops who are

361
00:14:40,310 --> 00:14:38,000
willing to do this crazy thing with me

362
00:14:42,150 --> 00:14:40,320
and

363
00:14:43,750 --> 00:14:42,160

we've done some testing here i took it

364
00:14:45,990 --> 00:14:43,760
home

365
00:14:48,230 --> 00:14:46,000
painted it this ugly orange color that

366
00:14:50,949 --> 00:14:48,240
was not my choice it was for recovery

367
00:14:55,430 --> 00:14:53,189
in my garage at home

368
00:14:56,949 --> 00:14:55,440
stuck in my freezer did a cold soak test

369
00:14:58,470 --> 00:14:56,959
and my wife was telling people there's a

370
00:15:00,310 --> 00:14:58,480
spaceship in my freezer it wasn't a

371
00:15:01,990 --> 00:15:00,320
spaceship yet but it became one this

372
00:15:04,710 --> 00:15:02,000
picture is evidence right

373
00:15:06,629 --> 00:15:04,720
uh but the the best thing about it i got

374
00:15:08,790 --> 00:15:06,639
to involve my then three-year-old son

375
00:15:11,269 --> 00:15:08,800
and so we we took the system in the

376
00:15:13,670 --> 00:15:11,279
backyard and we were very safe

377
00:15:15,350 --> 00:15:13,680
but we did parachute deployment testing

378
00:15:18,389 --> 00:15:15,360
and so

379
00:15:19,509 --> 00:15:18,399
i had him and he and i did a countdown

380
00:15:21,430 --> 00:15:19,519
from 10

381
00:15:23,350 --> 00:15:21,440
and he hit the button and the parachute

382
00:15:25,030 --> 00:15:23,360
would pop out and at first it

383
00:15:27,509 --> 00:15:25,040
only went this far it wasn't very

384
00:15:29,269 --> 00:15:27,519
impressive but with some design tweaks

385
00:15:30,870 --> 00:15:29,279
and changes i got the thing to work

386
00:15:31,910 --> 00:15:30,880
pretty well and it worked great in

387
00:15:34,310 --> 00:15:31,920
flight

388
00:15:36,629 --> 00:15:34,320

uh and i got to bring this picture home

389
00:15:37,990 --> 00:15:36,639
and show my son and say look what you

390
00:15:39,749 --> 00:15:38,000
helped make happen

391
00:15:43,110 --> 00:15:39,759
so it was just it was just a great

392
00:15:45,189 --> 00:15:43,120
experience so i i hope that um

393
00:15:46,710 --> 00:15:45,199
someday we can say that the same kinds

394
00:15:47,829 --> 00:15:46,720
of things

395
00:15:49,509 --> 00:15:47,839
about