
PAO

1
00:00:06,230 --> 00:00:04,950
hi we're here in the international space

2
00:00:08,390 --> 00:00:06,240
station flight control room at the

3
00:00:10,629 --> 00:00:08,400
johnson space center in houston texas

4
00:00:12,070 --> 00:00:10,639
and i'm joined here with mary saramelli

5
00:00:13,669 --> 00:00:12,080
who is the project manager with the

6
00:00:15,350 --> 00:00:13,679
johnson space center vacuum chamber

7
00:00:16,390 --> 00:00:15,360
thanks for joining us

8
00:00:17,990 --> 00:00:16,400
and we're gonna

9
00:00:19,590 --> 00:00:18,000
turn it over to the students there at

10
00:00:24,470 --> 00:00:19,600
the distance learning network event

11
00:00:24,480 --> 00:00:28,630
thank you

12
00:00:32,389 --> 00:00:30,150
all right now if we could have our first

13
00:00:34,229 --> 00:00:32,399

uh student ask their first question that

14
00:00:40,310 --> 00:00:34,239
would be great

15
00:00:44,069 --> 00:00:42,470
how do you make sure that the model used

16
00:00:45,990 --> 00:00:44,079
in the testing chamber does not get

17
00:00:48,630 --> 00:00:46,000
destroyed

18
00:00:51,590 --> 00:00:48,640
that's a really great question

19
00:00:53,910 --> 00:00:51,600
it's hard to it will be hard to destroy

20
00:00:55,270 --> 00:00:53,920
it by something like fire because

21
00:00:59,110 --> 00:00:55,280
there's not going to be any air in our

22
00:01:00,790 --> 00:00:59,120
test chamber um and we did very careful

23
00:01:02,790 --> 00:01:00,800
design to make sure nothing would fall

24
00:01:03,750 --> 00:01:02,800
on it and then in between now and when

25
00:01:09,190 --> 00:01:03,760
the

26
00:01:11,429 --> 00:01:09,200
we're going to be doing a series of

27
00:01:13,510 --> 00:01:11,439
practice tests to make sure that all of

28
00:01:14,870 --> 00:01:13,520
our operations are safe so that when it

29
00:01:16,550 --> 00:01:14,880
gets in there

30
00:01:19,429 --> 00:01:16,560
we are the last people that want to

31
00:01:31,510 --> 00:01:19,439
damage a telescope that cost billions of

32
00:01:35,350 --> 00:01:33,350
great thank you do you want us to go on

33
00:01:37,429 --> 00:01:35,360
to question number two

34
00:01:46,230 --> 00:01:37,439
yes please

35
00:01:50,469 --> 00:01:48,630
what material do you put on the web

36
00:01:53,109 --> 00:01:50,479
telescope that make sure it does not

37
00:01:57,510 --> 00:01:55,190
space materials are

38
00:01:59,350 --> 00:01:57,520

kind of different from earth materials

39
00:02:01,749 --> 00:01:59,360
because it's it's

40
00:02:04,230 --> 00:02:01,759
difficult to keep things the right

41
00:02:05,910 --> 00:02:04,240
temperature and space

42
00:02:08,469 --> 00:02:05,920
and to

43
00:02:10,389 --> 00:02:08,479
some things in when they're exposed to

44
00:02:12,390 --> 00:02:10,399
space tend to

45
00:02:14,150 --> 00:02:12,400
have things evaporate off of them so you

46
00:02:16,790 --> 00:02:14,160
really carefully pick materials for

47
00:02:18,790 --> 00:02:16,800
space so that's a good question

48
00:02:21,510 --> 00:02:18,800
luckily where the james webb telescope

49
00:02:23,910 --> 00:02:21,520
is going to be eventually is in a spot

50
00:02:26,390 --> 00:02:23,920
that's so cold that we don't won't have

51
00:02:29,750 --> 00:02:26,400
to worry about it burning up uh the only

52
00:02:31,350 --> 00:02:29,760
time when it'll be warm when it's in the

53
00:02:37,430 --> 00:02:31,360
on the launch vehicle

54
00:02:39,030 --> 00:02:37,440
it'll be enclosed by a metal cone that

55
00:02:41,910 --> 00:02:39,040
will protect it during the launch but

56
00:02:45,350 --> 00:02:41,920
then after it gets up there

57
00:02:46,869 --> 00:02:45,360
it's more a matter of keeping it warm

58
00:02:47,990 --> 00:02:46,879
rather than having to make sure we keep

59
00:02:50,309 --> 00:02:48,000
it cold

60
00:02:52,229 --> 00:02:50,319
until it gets to where it's going and

61
00:02:54,070 --> 00:02:52,239
when it gets where it's going we want

62
00:02:55,830 --> 00:02:54,080
things there to be so cold that they've

63
00:02:57,990 --> 00:02:55,840

gone to a lot of effort

64
00:03:01,750 --> 00:02:58,000
to try to keep the james webb telescope

65
00:03:06,630 --> 00:03:01,760
instruments very very cold minus 400

66
00:03:06,640 --> 00:03:16,149
thank you

67
00:03:21,430 --> 00:03:18,630
uh what are the limits to the weather

68
00:03:22,790 --> 00:03:21,440
itself how important it seems um you

69
00:03:24,070 --> 00:03:22,800
have to repeat that one somebody was

70
00:03:27,509 --> 00:03:24,080
laughing behind me and i couldn't hear

71
00:03:32,229 --> 00:03:29,270
what are the limits to the weather its

72
00:03:34,630 --> 00:03:32,239
telescope how far can it see

73
00:03:36,470 --> 00:03:34,640
um that's another really good question

74
00:03:40,630 --> 00:03:36,480
the webb telescope is going to be able

75
00:03:41,750 --> 00:03:40,640
to see between 10 and 100 times

76
00:03:44,470 --> 00:03:41,760
farther

77
00:03:46,789 --> 00:03:44,480
than the hubble telescope

78
00:03:47,910 --> 00:03:46,799
when we say how far can it see it's more

79
00:03:53,270 --> 00:03:47,920
of

80
00:03:55,670 --> 00:03:53,280
the more dim a light it can see

81
00:03:57,830 --> 00:03:55,680
that's farther back toward the start of

82
00:04:00,149 --> 00:03:57,840
the big bang than we've ever been able

83
00:04:02,309 --> 00:04:00,159
to see before so it's kind of like a

84
00:04:04,149 --> 00:04:02,319
time machine in a way because what by

85
00:04:05,030 --> 00:04:04,159
the time the

86
00:04:07,509 --> 00:04:05,040
the

87
00:04:10,149 --> 00:04:07,519
collecting

88
00:04:12,949 --> 00:04:10,159

gets to the telescope that light will

89
00:04:14,949 --> 00:04:12,959
have originated over 13 and a half

90
00:04:16,390 --> 00:04:14,959
billion years ago from its source and it

91
00:04:18,229 --> 00:04:16,400
just took that long to get to the

92
00:04:21,189 --> 00:04:18,239
telescope to read it so by the time the

93
00:04:24,230 --> 00:04:21,199
telescope gets that light to read it

94
00:04:26,310 --> 00:04:24,240
it's 13 and a half billion years old

95
00:04:28,469 --> 00:04:26,320
and because of that we'll be able to see

96
00:04:30,710 --> 00:04:28,479
the very first

97
00:04:32,070 --> 00:04:30,720
galaxy formations so far the hubble's

98
00:04:33,270 --> 00:04:32,080
been able to see

99
00:04:37,749 --> 00:04:33,280
galaxies

100
00:04:39,110 --> 00:04:37,759
but james webb telescope wants to see

101
00:04:40,790 --> 00:04:39,120
the galaxies

102
00:04:42,469 --> 00:04:40,800
as they're forming and before they're

103
00:04:45,270 --> 00:04:42,479
forming and that will be

104
00:04:46,870 --> 00:04:45,280
a whole new uh range of science that

105
00:04:48,870 --> 00:04:46,880
we've never been able to do before we're

106
00:04:50,550 --> 00:04:48,880
going to get very close back to the as

107
00:04:53,670 --> 00:04:50,560
close as we can back to the

108
00:04:53,680 --> 00:05:05,430
that's a good question too thank you

109
00:05:09,510 --> 00:05:07,670
will the webb telescope eventually fall

110
00:05:11,590 --> 00:05:09,520
down to earth and be replaced like the

111
00:05:13,029 --> 00:05:11,600
hubble

112
00:05:14,790 --> 00:05:13,039
yeah it's kind of sad that someday

113
00:05:15,670 --> 00:05:14,800

hubble will come back to earth isn't it

114
00:05:18,469 --> 00:05:15,680
um

115
00:05:20,469 --> 00:05:18,479
hubble's actually orbiting about 350

116
00:05:22,950 --> 00:05:20,479
miles above earth

117
00:05:25,830 --> 00:05:22,960
and because it's orbiting earth

118
00:05:28,310 --> 00:05:25,840
eventually when the fuel runs out and

119
00:05:30,550 --> 00:05:28,320
gravitational forces have their effect

120
00:05:32,150 --> 00:05:30,560
it will eventually come back but the

121
00:05:34,550 --> 00:05:32,160
james webb telescope isn't going to be

122
00:05:37,189 --> 00:05:34,560
orbiting earth it's going to be a

123
00:05:39,510 --> 00:05:37,199
million miles away from earth

124
00:05:41,670 --> 00:05:39,520
in just a point of space and it's not so

125
00:05:43,590 --> 00:05:41,680
it won't be orbiting us it won't

126
00:05:45,830 --> 00:05:43,600
um it's it's going to be in a point in

127
00:05:47,749 --> 00:05:45,840
space where

128
00:05:49,270 --> 00:05:47,759
the effects of the gravity on earth and

129
00:05:51,189 --> 00:05:49,280
the effects of gravity on the sun kind

130
00:05:52,710 --> 00:05:51,199
of cancel each other out so that neither

131
00:05:54,469 --> 00:05:52,720
one's pulling on the other and since

132
00:05:55,830 --> 00:05:54,479
it's a million miles away

133
00:05:58,150 --> 00:05:55,840
and it's not orbiting earth there's

134
00:06:00,710 --> 00:05:58,160
nothing to pull it into earth so that it

135
00:06:01,830 --> 00:06:00,720
will burn up eventually when it runs out

136
00:06:03,110 --> 00:06:01,840
of fuel

137
00:06:05,029 --> 00:06:03,120
it's

138
00:06:06,950 --> 00:06:05,039

and it isn't able to stay in in the

139
00:06:08,870 --> 00:06:06,960
right spot anymore it will eventually

140
00:06:11,670 --> 00:06:08,880
drift off into the solar system and

141
00:06:11,680 --> 00:06:22,950
but it won't be coming back to earth

142
00:06:29,510 --> 00:06:25,350
um how many hours does it take to test

143
00:06:34,790 --> 00:06:31,510
i really like this question because you

144
00:06:37,430 --> 00:06:34,800
asked me that question in hours and i

145
00:06:39,990 --> 00:06:37,440
have to give you the answer in days

146
00:06:42,070 --> 00:06:40,000
it's going to take us 90 days to do the

147
00:06:44,790 --> 00:06:42,080
test in our chamber

148
00:06:46,950 --> 00:06:44,800
once we get to the final test

149
00:06:48,230 --> 00:06:46,960
and the first three weeks of that test

150
00:06:49,749 --> 00:06:48,240
are going to be more boring than

151
00:06:51,110 --> 00:06:49,759
watching paint dry

152
00:06:53,110 --> 00:06:51,120
because the only thing it's going to be

153
00:06:55,270 --> 00:06:53,120
doing is trying to get as cold as it's

154
00:06:57,350 --> 00:06:55,280
going to be when it eventually gets to

155
00:07:00,150 --> 00:06:57,360
its spot

156
00:07:01,350 --> 00:07:00,160
out in space and then the next

157
00:07:02,710 --> 00:07:01,360
few weeks

158
00:07:04,550 --> 00:07:02,720
will be spent

159
00:07:06,790 --> 00:07:04,560
taking data to make sure all of its

160
00:07:08,469 --> 00:07:06,800
instruments work and the mirrors work

161
00:07:09,909 --> 00:07:08,479
and all that

162
00:07:11,589 --> 00:07:09,919
and then the last couple weeks are going

163
00:07:13,350 --> 00:07:11,599

to be really boring too because then we

164
00:07:14,710 --> 00:07:13,360
just have to warm the thing back up so

165
00:07:15,749 --> 00:07:14,720
that we can bring it back out of the

166
00:07:17,589 --> 00:07:15,759
chamber

167
00:07:22,390 --> 00:07:17,599
but yes it's meant it will end up being

168
00:07:27,270 --> 00:07:25,350
how cold does it get in the chamber

169
00:07:30,150 --> 00:07:27,280
exactly we

170
00:07:30,950 --> 00:07:30,160
we're actually really proud of this

171
00:07:38,150 --> 00:07:30,960
the

172
00:07:39,350 --> 00:07:38,160
minus 440 degrees right now

173
00:07:40,390 --> 00:07:39,360
we may be able to get a couple of

174
00:07:41,749 --> 00:07:40,400
degrees

175
00:07:44,869 --> 00:07:41,759
colder than that

176
00:07:45,749 --> 00:07:44,879
if we put a little more effort into it

177
00:07:47,510 --> 00:07:45,759
but

178
00:07:50,150 --> 00:07:47,520
the james webb telescope since it's

179
00:07:51,990 --> 00:07:50,160
supposed to work at -400

180
00:07:54,230 --> 00:07:52,000
the test chamber has to be colder than

181
00:07:56,629 --> 00:07:54,240
that so that it can

182
00:07:59,029 --> 00:07:56,639
operate like it's going to be in space

183
00:08:02,469 --> 00:07:59,039
and so we can get down we'll have the

184
00:08:05,029 --> 00:08:02,479
coldest place on earth in texas

185
00:08:08,390 --> 00:08:05,039
uh in august when when we end up testing

186
00:08:20,790 --> 00:08:09,589
thank you

187
00:08:35,750 --> 00:08:30,869
could the vacuum chamber

188
00:08:37,269 --> 00:08:35,760

hypothetically be used to uh give

189
00:08:40,149 --> 00:08:37,279
astronauts a

190
00:08:44,070 --> 00:08:40,159
more realistic experience of a space

191
00:08:46,790 --> 00:08:44,080
simulation than the training pool

192
00:08:49,030 --> 00:08:46,800
uh yes as a matter of fact in fact we

193
00:08:51,269 --> 00:08:49,040
have a few vacuum chambers at johnson

194
00:08:54,470 --> 00:08:51,279
space center that we do use to give the

195
00:08:56,630 --> 00:08:54,480
astronauts a sense of how

196
00:08:58,790 --> 00:08:56,640
equipment will work in a vacuum and how

197
00:08:59,910 --> 00:08:58,800
their spacesuits will work in a vacuum

198
00:09:01,350 --> 00:08:59,920
in fact

199
00:09:03,110 --> 00:09:01,360
chamber a the one that's going to be

200
00:09:04,949 --> 00:09:03,120
testing the james webb telescope was one

201
00:09:07,430 --> 00:09:04,959
of the first vacuum chambers we used and

202
00:09:09,269 --> 00:09:07,440
the apollo astronauts spent two weeks

203
00:09:12,389 --> 00:09:09,279
inside of their

204
00:09:15,750 --> 00:09:12,399
space capsule in that chamber

205
00:09:19,590 --> 00:09:15,760
checking out how the capsule worked

206
00:09:21,269 --> 00:09:19,600
so yes it has been used for that it

207
00:09:23,110 --> 00:09:21,279
will probably be used for that again

208
00:09:24,949 --> 00:09:23,120
after the james webb but in the

209
00:09:27,190 --> 00:09:24,959
meanwhile we have other

210
00:09:29,430 --> 00:09:27,200
somewhat smaller more human sized

211
00:09:31,110 --> 00:09:29,440
chambers that we used and we can put

212
00:09:35,430 --> 00:09:31,120
people in there so they can get an

213
00:09:39,110 --> 00:09:37,910

however i probably should add to that

214
00:09:40,790 --> 00:09:39,120
that um

215
00:09:42,710 --> 00:09:40,800
once we put a vacuum in there the

216
00:09:44,470 --> 00:09:42,720
gravity stays so that's one of the

217
00:09:45,350 --> 00:09:44,480
things that the pool does for us is the

218
00:09:46,949 --> 00:09:45,360
pool

219
00:09:48,310 --> 00:09:46,959
kind of simulates what it's like to live

220
00:09:50,710 --> 00:09:48,320
without gravity

221
00:09:52,870 --> 00:09:50,720
and the vacuum chamber stimuli simulates

222
00:09:54,550 --> 00:09:52,880
what it's like to live without air

223
00:09:55,990 --> 00:09:54,560
so we really need to have both of those

224
00:10:01,269 --> 00:09:56,000
because we can't do one at the same time

225
00:10:01,279 --> 00:10:09,910
thank you

226
00:10:15,350 --> 00:10:11,670
what is the most

227
00:10:17,430 --> 00:10:15,360
want to talk to

228
00:10:21,269 --> 00:10:17,440
i heard what is the most important test

229
00:10:24,870 --> 00:10:23,269
i thought you run on the top

230
00:10:27,750 --> 00:10:24,880
the most important test we're going to

231
00:10:29,910 --> 00:10:27,760
be running on the telescope here on

232
00:10:32,470 --> 00:10:29,920
earth in the chamber is we're going to

233
00:10:33,750 --> 00:10:32,480
be operating all of its instruments

234
00:10:36,230 --> 00:10:33,760
to make sure

235
00:10:39,030 --> 00:10:36,240
that they are able to see a we're going

236
00:10:41,030 --> 00:10:39,040
to put kind of a test universe

237
00:10:42,710 --> 00:10:41,040
out there for it to look to see if it's

238
00:10:45,030 --> 00:10:42,720

picking up the the lights in the right

239
00:10:47,350 --> 00:10:45,040
wavelength if if it's able to be pointed

240
00:10:49,269 --> 00:10:47,360
in the right direction

241
00:10:51,269 --> 00:10:49,279
and then to make sure that the mirrors

242
00:10:53,990 --> 00:10:51,279
all stay aligned with each other it the

243
00:10:55,430 --> 00:10:54,000
thing has 18 mirrors it's so big

244
00:10:57,750 --> 00:10:55,440
that it can't launch without being

245
00:10:58,870 --> 00:10:57,760
folded up so when it launches it folds

246
00:11:00,630 --> 00:10:58,880
up like

247
00:11:02,790 --> 00:11:00,640
like a transformer

248
00:11:05,110 --> 00:11:02,800
and it unfolds while it's heading on its

249
00:11:09,030 --> 00:11:05,120
way out to the moon

250
00:11:11,430 --> 00:11:09,040
wow past the moon i should say and so

251
00:11:13,750 --> 00:11:11,440
when it unfolds all these mirror pieces

252
00:11:15,509 --> 00:11:13,760
the 18 mirror segments have to line up

253
00:11:17,030 --> 00:11:15,519
with each other

254
00:11:18,150 --> 00:11:17,040
and they all have to work together so

255
00:11:19,990 --> 00:11:18,160
that's one of the things we'll be

256
00:11:21,750 --> 00:11:20,000
testing there is will all these work

257
00:11:23,269 --> 00:11:21,760
together when they get as cold as

258
00:11:28,949 --> 00:11:23,279
they're supposed to get

259
00:11:28,959 --> 00:11:40,470
thank you

260
00:11:43,590 --> 00:11:42,470
how do you test the equipment in the

261
00:11:47,829 --> 00:11:43,600
chamber

262
00:11:49,990 --> 00:11:47,839
and what kind of test do you have to run

263
00:11:52,870 --> 00:11:50,000

how do we test the the james webb

264
00:11:53,829 --> 00:11:52,880
telescope in the chamber

265
00:11:56,310 --> 00:11:53,839
yes

266
00:11:58,470 --> 00:11:56,320
well we're going to put it into the

267
00:11:59,910 --> 00:11:58,480
chamber while the chamber has air in it

268
00:12:00,949 --> 00:11:59,920
of course and then the

269
00:12:02,470 --> 00:12:00,959
first thing we're going to do is we're

270
00:12:05,269 --> 00:12:02,480
going to remove all the air from the

271
00:12:06,470 --> 00:12:05,279
chamber and then start to make it very

272
00:12:08,230 --> 00:12:06,480
very cold

273
00:12:11,110 --> 00:12:08,240
from there we'll start turning on the

274
00:12:13,190 --> 00:12:11,120
infrared sensors

275
00:12:15,750 --> 00:12:13,200
which the james webb telescope has four

276
00:12:17,430 --> 00:12:15,760
different kinds of infrared sensors and

277
00:12:19,590 --> 00:12:17,440
we're going to

278
00:12:22,790 --> 00:12:19,600
turn on a source as if it was looking

279
00:12:25,430 --> 00:12:22,800
for a very faint galaxy 13 billion years

280
00:12:27,590 --> 00:12:25,440
ago and see if those sensors pick up on

281
00:12:29,430 --> 00:12:27,600
that source

282
00:12:30,550 --> 00:12:29,440
did that answer your question okay and

283
00:12:37,990 --> 00:12:30,560
then

284
00:12:41,590 --> 00:12:38,000
space does the chamber hold

285
00:12:44,790 --> 00:12:41,600
oh the chamber holds um

286
00:12:47,910 --> 00:12:44,800
400 000 cubic feet

287
00:12:51,230 --> 00:12:47,920
it's big you can fit uh

288
00:12:53,509 --> 00:12:51,240

several buses inside this chamber it's

289
00:12:57,190 --> 00:12:53,519
120 feet tall

290
00:12:58,949 --> 00:12:57,200
by 65 feet in diameter

291
00:12:59,829 --> 00:12:58,959
and the door on it

292
00:13:01,590 --> 00:12:59,839
uh

293
00:13:03,670 --> 00:13:01,600
is 40 feet in diameter it's a big

294
00:13:04,870 --> 00:13:03,680
circular door sort of like a giant

295
00:13:08,310 --> 00:13:04,880
hobbit hole

296
00:13:10,230 --> 00:13:08,320
and the the that's how we get things in

297
00:13:13,670 --> 00:13:10,240
and out of the chamber but it's it's

298
00:13:13,680 --> 00:13:20,949
thank you

299
00:13:25,750 --> 00:13:22,949
how did you get to be in the position

300
00:13:28,310 --> 00:13:25,760
you're in and what is your degree

301
00:13:30,389 --> 00:13:28,320
oh i have a couple degrees one is

302
00:13:33,910 --> 00:13:30,399
aerospace engineering

303
00:13:36,870 --> 00:13:33,920
and then i got a master's in mechanical

304
00:13:39,430 --> 00:13:36,880
engineering as well

305
00:13:40,790 --> 00:13:39,440
and how i got in the position i am in

306
00:13:42,230 --> 00:13:40,800
wow that's a

307
00:13:43,269 --> 00:13:42,240
really hard question really good

308
00:13:45,110 --> 00:13:43,279
question

309
00:13:46,470 --> 00:13:45,120
um

310
00:13:48,389 --> 00:13:46,480
i was

311
00:13:50,069 --> 00:13:48,399
i found something i really liked to do

312
00:13:52,310 --> 00:13:50,079
here at nasa

313
00:13:54,550 --> 00:13:52,320

i really liked working with the the test

314
00:13:57,110 --> 00:13:54,560
chambers and vacuum and

315
00:13:59,350 --> 00:13:57,120
and the astronauts and their spacesuits

316
00:14:01,269 --> 00:13:59,360
and um

317
00:14:04,230 --> 00:14:01,279
just started working my way up through

318
00:14:07,110 --> 00:14:04,240
levels of responsibility once i got here

319
00:14:09,350 --> 00:14:07,120
and so eventually we came upon this huge

320
00:14:12,230 --> 00:14:09,360
project where we needed to get a chamber

321
00:14:13,509 --> 00:14:12,240
ready for this next great telescope

322
00:14:15,269 --> 00:14:13,519
adventure

323
00:14:17,189 --> 00:14:15,279
and i'd already

324
00:14:19,750 --> 00:14:17,199
had a lot of 15 years of experience in

325
00:14:24,790 --> 00:14:19,760
working with chambers so i was ready to

326
00:14:27,829 --> 00:14:25,750
um

327
00:14:30,629 --> 00:14:27,839
why do why are the mirrors on the

328
00:14:32,710 --> 00:14:30,639
telescope hexagons

329
00:14:34,389 --> 00:14:32,720
you know i saw this question because i

330
00:14:36,629 --> 00:14:34,399
saw some of the questions ahead of time

331
00:14:39,189 --> 00:14:36,639
and i saw this question i said wow that

332
00:14:41,430 --> 00:14:39,199
one kind of stumped me

333
00:14:42,069 --> 00:14:41,440
so i went and looked up the answer for

334
00:14:48,069 --> 00:14:42,079
it

335
00:14:49,829 --> 00:14:48,079
as the fact that since the telescope the

336
00:14:52,550 --> 00:14:49,839
since the primary mirror is made up of

337
00:14:54,870 --> 00:14:52,560
18 segments and it has to be so big

338
00:14:57,269 --> 00:14:54,880

that it has to be folded

339
00:14:59,670 --> 00:14:57,279
that meant that they couldn't create one

340
00:15:01,430 --> 00:14:59,680
giant single piece mirror like the

341
00:15:03,430 --> 00:15:01,440
hubble was they had they had to break it

342
00:15:05,189 --> 00:15:03,440
up into segments the easiest way to

343
00:15:06,949 --> 00:15:05,199
break it up into segments and still have

344
00:15:08,949 --> 00:15:06,959
all the pieces

345
00:15:10,870 --> 00:15:08,959
able to touch each other to create one

346
00:15:11,590 --> 00:15:10,880
solid mirror surface

347
00:15:13,430 --> 00:15:11,600
is

348
00:15:15,829 --> 00:15:13,440
hexagon shapes that's the easiest

349
00:15:19,110 --> 00:15:15,839
packaging where all the edges will line

350
00:15:22,150 --> 00:15:20,790
all the way i'm sorry i clicked off

351
00:15:26,550 --> 00:15:22,160
where all the edges will line up with

352
00:15:28,949 --> 00:15:26,560
each other without gaps in between them

353
00:15:30,389 --> 00:15:28,959
and how long or how many years did it

354
00:15:32,710 --> 00:15:30,399
take you to get to the point you're at

355
00:15:34,470 --> 00:15:32,720
right now

356
00:15:36,629 --> 00:15:34,480
the the james webb telescope they

357
00:15:40,710 --> 00:15:36,639
started talking about the telescope

358
00:15:43,749 --> 00:15:40,720
itself around the year 2000

359
00:15:46,310 --> 00:15:43,759
it got named the james webb telescope in

360
00:15:47,509 --> 00:15:46,320
2002 and they've really started working

361
00:15:48,870 --> 00:15:47,519
on it

362
00:15:53,030 --> 00:15:48,880
in earnest

363
00:15:56,150 --> 00:15:53,040

since about 2000 and to 2003.

364
00:15:58,470 --> 00:15:56,160
we at jsc got involved

365
00:16:00,150 --> 00:15:58,480
in 2005 when they came and said you know

366
00:16:01,990 --> 00:16:00,160
we're going to need to test this thing

367
00:16:04,230 --> 00:16:02,000
somewhere and it's so big i think yours

368
00:16:06,389 --> 00:16:04,240
is the only place we can really do this

369
00:16:09,350 --> 00:16:06,399
and still have it be cold enough

370
00:16:10,790 --> 00:16:09,360
and so we started in 2005 to rearrange

371
00:16:13,430 --> 00:16:10,800
the whole chamber so that it could get

372
00:16:14,790 --> 00:16:13,440
cold enough for the james webb telescope

373
00:16:16,949 --> 00:16:14,800
but we've really most of the work has

374
00:16:20,870 --> 00:16:16,959
been in the last three years last three

375
00:16:20,880 --> 00:16:30,150
thank you

376
00:16:34,069 --> 00:16:32,230
what was the most dangerous thing that

377
00:16:36,150 --> 00:16:34,079
has ever come close to the earth and

378
00:16:38,150 --> 00:16:36,160
what can the james sweat space

379
00:16:39,990 --> 00:16:38,160
healthcare do to prevent that or prepare

380
00:16:41,829 --> 00:16:40,000
us for that

381
00:16:43,430 --> 00:16:41,839
uh well the james webb telescope will be

382
00:16:45,110 --> 00:16:43,440
able not it's not just going to be able

383
00:16:46,629 --> 00:16:45,120
to look for galaxies that are very

384
00:16:48,230 --> 00:16:46,639
distant but it's also going to be able

385
00:16:50,550 --> 00:16:48,240
to look at our planets in our solar

386
00:16:53,670 --> 00:16:50,560
system and look at asteroids that are

387
00:16:55,829 --> 00:16:53,680
floating around and the i'd say the most

388
00:16:57,110 --> 00:16:55,839

dangerous thing that's come to earth has

389
00:16:59,269 --> 00:16:57,120
probably been

390
00:17:00,790 --> 00:16:59,279
a couple of large asteroids most recent

391
00:17:02,230 --> 00:17:00,800
one well

392
00:17:04,230 --> 00:17:02,240
i mean the one tens of millions of years

393
00:17:07,029 --> 00:17:04,240
ago that they theorize killed off the

394
00:17:08,630 --> 00:17:07,039
dinosaurs but 100 years ago there was

395
00:17:11,189 --> 00:17:08,640
one that was 10 times the size of the

396
00:17:14,069 --> 00:17:11,199
titanic that landed in a remote area of

397
00:17:17,110 --> 00:17:14,079
russia and pretty much flattened an area

398
00:17:18,870 --> 00:17:17,120
the size of dallas fort worth

399
00:17:20,549 --> 00:17:18,880
luckily there was just 80 million trees

400
00:17:23,350 --> 00:17:20,559
in the way but those 80 million trees

401
00:17:24,870 --> 00:17:23,360
suffered so a giant asteroid i'd say is

402
00:17:26,710 --> 00:17:24,880
probably the most

403
00:17:28,470 --> 00:17:26,720
dangerous thing that has come to earth

404
00:17:33,029 --> 00:17:28,480
in the past

405
00:17:38,950 --> 00:17:33,039
and we will be able to track uh asteroid

406
00:17:55,350 --> 00:17:42,070
we have one more question for you

407
00:18:00,870 --> 00:17:57,350
how oft does it take to get something

408
00:18:02,950 --> 00:18:00,880
approved before you test it oh i didn't

409
00:18:05,669 --> 00:18:02,960
catch all that can you say it again a

410
00:18:07,750 --> 00:18:05,679
little louder a little louder

411
00:18:08,870 --> 00:18:07,760
how long did it take to get something

412
00:18:10,230 --> 00:18:08,880
approved

413
00:18:13,190 --> 00:18:10,240

oh how long does it take to get

414
00:18:15,669 --> 00:18:13,200
something approved wow that is a really

415
00:18:17,190 --> 00:18:15,679
that's an excellent and tough question

416
00:18:19,830 --> 00:18:17,200
um

417
00:18:22,470 --> 00:18:19,840
generally a new idea

418
00:18:24,310 --> 00:18:22,480
uh will take a couple of years to get

419
00:18:25,750 --> 00:18:24,320
approved because all the all of our new

420
00:18:26,950 --> 00:18:25,760
projects have to be approved through

421
00:18:29,350 --> 00:18:26,960
congress

422
00:18:31,669 --> 00:18:29,360
and if it involves building something we

423
00:18:33,590 --> 00:18:31,679
need about a three-year

424
00:18:36,230 --> 00:18:33,600
advance warning before we were able to

425
00:18:37,430 --> 00:18:36,240
start build building something so

426
00:18:39,430 --> 00:18:37,440
like they started talking about the

427
00:18:43,029 --> 00:18:39,440
james webb telescope and around the year

428
00:18:45,990 --> 00:18:43,039
2000 it will launch in 2018

429
00:18:47,669 --> 00:18:46,000
so that kind of gives you an idea of the

430
00:18:49,909 --> 00:18:47,679
time between

431
00:18:52,390 --> 00:18:49,919
thinking of the idea and actually making

432
00:18:53,990 --> 00:18:52,400
it happen so a long time so you got to

433
00:18:55,110 --> 00:18:54,000
think about what it is you want to have

434
00:18:56,870 --> 00:18:55,120
happen now

435
00:18:58,789 --> 00:18:56,880
because 20 years from now you might be

436
00:19:00,390 --> 00:18:58,799
making it happen so you can write your

437
00:19:04,310 --> 00:19:00,400
congressman now for what you want to see

438
00:19:04,320 --> 00:19:08,310

thank you

439
00:19:14,950 --> 00:19:11,029
okay we have one last question for you

440
00:19:18,230 --> 00:19:16,789
how do you get the chamber to get so

441
00:19:19,669 --> 00:19:18,240
cold

442
00:19:21,110 --> 00:19:19,679
oh gosh

443
00:19:24,230 --> 00:19:21,120
um

444
00:19:27,270 --> 00:19:24,240
the the chamber has

445
00:19:30,789 --> 00:19:27,280
a series of walls inside of it

446
00:19:32,549 --> 00:19:30,799
it's got one it's inside layer of walls

447
00:19:35,029 --> 00:19:32,559
actually has tubes running through it

448
00:19:37,510 --> 00:19:35,039
that carry liquid nitrogen and liquid

449
00:19:40,150 --> 00:19:37,520
nitrogen makes those walls about minus

450
00:19:41,990 --> 00:19:40,160
300 degrees fahrenheit

451
00:19:42,789 --> 00:19:42,000
but that wasn't cold enough for james

452
00:19:45,350 --> 00:19:42,799
webb

453
00:19:47,510 --> 00:19:45,360
the telescope so we put in another layer

454
00:19:49,510 --> 00:19:47,520
of walls inside of that

455
00:19:52,310 --> 00:19:49,520
and that one is going to

456
00:19:55,029 --> 00:19:52,320
it has tubes running through it too and

457
00:19:57,510 --> 00:19:55,039
those those walls are going to carry

458
00:19:59,510 --> 00:19:57,520
gaseous helium that we've refrigerated

459
00:20:02,630 --> 00:19:59,520
the heck out of and we've gotten the

460
00:20:05,510 --> 00:20:02,640
helium so cold that it's only

461
00:20:07,430 --> 00:20:05,520
10 degrees above absolute zero and

462
00:20:08,710 --> 00:20:07,440
absolute zero is something that's a

463
00:20:10,789 --> 00:20:08,720

theoretical

464
00:20:11,750 --> 00:20:10,799
uh temperature

465
00:20:14,310 --> 00:20:11,760
that

466
00:20:15,110 --> 00:20:14,320
nothing achieves so this is

467
00:20:19,270 --> 00:20:15,120
10

468
00:20:21,909 --> 00:20:19,280
a theoretical lowest temperature in the

469
00:20:23,990 --> 00:20:21,919
universe and so once we get the walls

470
00:20:25,430 --> 00:20:24,000
that cold the whole chamber

471
00:20:26,950 --> 00:20:25,440
inside will get that cold but

472
00:20:28,710 --> 00:20:26,960
interestingly enough

473
00:20:30,710 --> 00:20:28,720
the wall if you leaned up against the

474
00:20:32,710 --> 00:20:30,720
walls on the outside of the chamber

475
00:20:34,630 --> 00:20:32,720
which are about two inches thick it

476
00:20:37,430 --> 00:20:34,640
would just be a nice

477
00:20:43,750 --> 00:20:37,440
65 degrees but the inside of the chamber

478
00:20:51,029 --> 00:20:47,430
thank you

479
00:20:52,230 --> 00:20:51,039
their questions i know um through this

480
00:20:54,149 --> 00:20:52,240
they've learned a lot and really

481
00:21:01,990 --> 00:20:54,159
appreciate your time today i think that