
ARTEMIS

1
00:00:05,990 --> 00:00:03,030
whether you're joining us here in

2
00:00:08,070 --> 00:00:06,000
beautiful colorado springs or virtually

3
00:00:09,830 --> 00:00:08,080
welcome and thank you so much for

4
00:00:11,910 --> 00:00:09,840
joining us for today's panel titled

5
00:00:13,190 --> 00:00:11,920
artemis and industry building the space

6
00:00:15,509 --> 00:00:13,200
economy

7
00:00:17,990 --> 00:00:15,519
i am joined by a stellar group of nasa

8
00:00:19,750 --> 00:00:18,000
leaders for today's discussion

9
00:00:21,510 --> 00:00:19,760
we have jim free

10
00:00:22,950 --> 00:00:21,520
head of nasa exploration systems

11
00:00:25,509 --> 00:00:22,960
development

12
00:00:27,750 --> 00:00:25,519
ken bowersox who together with kathy

13
00:00:29,589 --> 00:00:27,760

leaders leads the space operations

14
00:00:33,190 --> 00:00:29,599
mission directorate

15
00:00:35,270 --> 00:00:33,200
dr thomas cerbukin head of nasa science

16
00:00:37,110 --> 00:00:35,280
and jim reuter head of nasa space

17
00:00:39,590 --> 00:00:37,120
technology

18
00:00:41,190 --> 00:00:39,600
now before we dive into our more focused

19
00:00:42,830 --> 00:00:41,200
artemis topic

20
00:00:45,350 --> 00:00:42,840
on the space economy and industry

21
00:00:47,110 --> 00:00:45,360
partnerships i'd like to provide a brief

22
00:00:49,590 --> 00:00:47,120
overview to ensure that our wonderful

23
00:00:51,270 --> 00:00:49,600
audience has all the fundamentals

24
00:00:53,670 --> 00:00:51,280
after that i'll transition it to each of

25
00:00:56,709 --> 00:00:53,680
our panelists for initial remarks so

26
00:00:58,950 --> 00:00:56,719
with that let's go ahead and get started

27
00:00:59,990 --> 00:00:58,960
artemis is nasa's lunar exploration

28
00:01:01,910 --> 00:01:00,000
program

29
00:01:04,310 --> 00:01:01,920
and it's important to understand that

30
00:01:05,990 --> 00:01:04,320
artemis isn't just one mission it's

31
00:01:08,550 --> 00:01:06,000
actually a series of increasingly

32
00:01:10,390 --> 00:01:08,560
complex missions paving the way for

33
00:01:12,070 --> 00:01:10,400
lunar surface missions

34
00:01:14,149 --> 00:01:12,080
with the first woman and the first

35
00:01:17,830 --> 00:01:14,159
person of color as well as future

36
00:01:19,910 --> 00:01:17,840
missions to send astronauts to mars

37
00:01:23,190 --> 00:01:19,920
artemis will turn science fiction into

38
00:01:24,870 --> 00:01:23,200

reality as we learn to live and work

39
00:01:26,710 --> 00:01:24,880
off-world

40
00:01:28,950 --> 00:01:26,720
there are several key elements to the

41
00:01:30,789 --> 00:01:28,960
artemis mission architecture

42
00:01:33,350 --> 00:01:30,799
artemis uses the space launch systems

43
00:01:35,429 --> 00:01:33,360
rocket which is the largest ever built

44
00:01:38,069 --> 00:01:35,439
the orion crew spacecraft

45
00:01:40,069 --> 00:01:38,079
a gateway spacecraft in lunar orbit

46
00:01:43,030 --> 00:01:40,079
and cutting edge exploration ground

47
00:01:44,950 --> 00:01:43,040
systems and astronaut landing systems

48
00:01:46,710 --> 00:01:44,960
and it's always important to talk about

49
00:01:49,350 --> 00:01:46,720
the why even in an audience of people

50
00:01:50,789 --> 00:01:49,360
who love space as much as we all do

51
00:01:53,830 --> 00:01:50,799
we're going back to the moon for

52
00:01:55,830 --> 00:01:53,840
scientific discovery economic benefits

53
00:01:57,830 --> 00:01:55,840
and inspiration

54
00:01:59,749 --> 00:01:57,840
for a new generation of explorers the

55
00:02:01,350 --> 00:01:59,759
artemis generation

56
00:02:04,069 --> 00:02:01,360
in collaboration with industry

57
00:02:05,990 --> 00:02:04,079
commercial and international partners

58
00:02:09,029 --> 00:02:06,000
we will establish the first long-term

59
00:02:10,869 --> 00:02:09,039
presence on the moon while maintaining

60
00:02:13,430 --> 00:02:10,879
american leadership and exploration we

61
00:02:16,150 --> 00:02:13,440
will build a global alliance and explore

62
00:02:18,390 --> 00:02:16,160
deep space for the benefit of all

63
00:02:20,229 --> 00:02:18,400

humanity's historic return to the moon

64
00:02:21,589 --> 00:02:20,239
takes flight this year with the artemis

65
00:02:24,309 --> 00:02:21,599
one launch

66
00:02:26,470 --> 00:02:24,319
artemis one is an uncrewed flight test

67
00:02:28,150 --> 00:02:26,480
targeted for no earlier than late may

68
00:02:30,150 --> 00:02:28,160
which will allow nasa to check out

69
00:02:33,830 --> 00:02:30,160
rocket and spacecraft systems before

70
00:02:37,190 --> 00:02:33,840
they before crew fly aboard artemis ii

71
00:02:39,430 --> 00:02:37,200
artemis one uncrewed artemis ii crude

72
00:02:41,350 --> 00:02:39,440
and future uncrewed lander demonstration

73
00:02:43,110 --> 00:02:41,360
missions with spacex

74
00:02:45,990 --> 00:02:43,120
will precede the artemis iii mission

75
00:02:47,670 --> 00:02:46,000
when astronauts will land on the moon

76
00:02:50,390 --> 00:02:47,680
we'll use what we learn on and around

77
00:02:53,110 --> 00:02:50,400
the moon to take that next giant leap

78
00:02:55,350 --> 00:02:53,120
sending astronauts to mars

79
00:02:57,190 --> 00:02:55,360
with that i will conclude artemis 101 i

80
00:02:58,630 --> 00:02:57,200
hope that you're all still awake and

81
00:03:01,110 --> 00:02:58,640
turn it over to our nasa leaders

82
00:03:02,710 --> 00:03:01,120
beginning with jim free

83
00:03:05,830 --> 00:03:02,720
thanks lauren i feel like you just gave

84
00:03:07,589 --> 00:03:05,840
my talk so what lauren said um

85
00:03:10,390 --> 00:03:07,599
let's see uh thank you for the

86
00:03:13,589 --> 00:03:10,400
opportunity to be here with um my my

87
00:03:16,229 --> 00:03:13,599
nasa colleagues and uh i guess i'll just

88
00:03:17,589 --> 00:03:16,239

give a quick minute on artemis one since

89
00:03:19,990 --> 00:03:17,599
that seems to be the elephant in the

90
00:03:22,070 --> 00:03:20,000
room um

91
00:03:25,110 --> 00:03:22,080
it's been tremendous uh to watch the

92
00:03:28,309 --> 00:03:25,120
team i was at ksc till late yesterday

93
00:03:30,390 --> 00:03:28,319
and flew here last night and

94
00:03:31,830 --> 00:03:30,400
working through a lot of issues of

95
00:03:32,949 --> 00:03:31,840
bringing the vehicle together for the

96
00:03:35,190 --> 00:03:32,959
first time

97
00:03:37,589 --> 00:03:35,200
um dealing with interesting commodities

98
00:03:39,589 --> 00:03:37,599
and large quantities like lox and

99
00:03:41,589 --> 00:03:39,599
hydrogen learning about how all these

100
00:03:44,789 --> 00:03:41,599
systems come together so

101
00:03:46,710 --> 00:03:44,799
um the the the test yesterday

102
00:03:48,550 --> 00:03:46,720
we did get

103
00:03:51,030 --> 00:03:48,560
get some locks

104
00:03:51,990 --> 00:03:51,040
flow into the into the tank on the core

105
00:03:53,910 --> 00:03:52,000
stage

106
00:03:56,390 --> 00:03:53,920
and and that was all due to the team

107
00:03:57,589 --> 00:03:56,400
really figuring out real time what was

108
00:03:58,949 --> 00:03:57,599
happening

109
00:04:01,350 --> 00:03:58,959
on the vehicle

110
00:04:02,070 --> 00:04:01,360
adjusting and getting that that flowing

111
00:04:04,309 --> 00:04:02,080
so

112
00:04:05,589 --> 00:04:04,319
we didn't get through everything we want

113
00:04:07,589 --> 00:04:05,599

wanted

114
00:04:09,830 --> 00:04:07,599
but certainly learned a great deal that

115
00:04:13,110 --> 00:04:09,840
we'll take into our next attempt

116
00:04:15,270 --> 00:04:13,120
we will follow axiom on the range

117
00:04:17,509 --> 00:04:15,280
pam talked about that cooperation that's

118
00:04:19,430 --> 00:04:17,519
that's another uh cooperation that we

119
00:04:22,390 --> 00:04:19,440
have we need to get the axiom mission

120
00:04:24,710 --> 00:04:22,400
done so we can get crew 4 and

121
00:04:26,950 --> 00:04:24,720
you know we waited for transporter 4 to

122
00:04:28,790 --> 00:04:26,960
launch on friday in order to do our

123
00:04:32,150 --> 00:04:28,800
tests so great

124
00:04:33,990 --> 00:04:32,160
i'll say synergies across there um

125
00:04:36,230 --> 00:04:34,000
you know there's a press conference

126
00:04:37,590 --> 00:04:36,240
later today with uh with some of the

127
00:04:39,830 --> 00:04:37,600
folks that kind of walk through a little

128
00:04:41,749 --> 00:04:39,840
bit more detail and they'll they'll give

129
00:04:43,189 --> 00:04:41,759
you our possibilities

130
00:04:45,030 --> 00:04:43,199
i'll address the other elephant in the

131
00:04:46,310 --> 00:04:45,040
room we are working on having launch

132
00:04:48,790 --> 00:04:46,320
commentary

133
00:04:50,629 --> 00:04:48,800
um i know that's been something that

134
00:04:52,390 --> 00:04:50,639
that folks really want and i understand

135
00:04:53,830 --> 00:04:52,400
that we're gonna we're working towards

136
00:04:56,310 --> 00:04:53,840
that for launch

137
00:04:59,749 --> 00:04:56,320
actively working it even even yesterday

138
00:05:02,070 --> 00:04:59,759

with our public affairs folks

139
00:05:04,469 --> 00:05:02,080
our mission is to work across

140
00:05:06,310 --> 00:05:04,479
all of nasa pam talked about that

141
00:05:08,870 --> 00:05:06,320
working all five mission directorates we

142
00:05:12,070 --> 00:05:08,880
obviously have a strong partnership with

143
00:05:14,629 --> 00:05:12,080
somb as we develop hardware and hand it

144
00:05:17,029 --> 00:05:14,639
over to them for operations

145
00:05:20,230 --> 00:05:17,039
our artemis architecture is built on

146
00:05:21,430 --> 00:05:20,240
science um to get science back

147
00:05:24,070 --> 00:05:21,440
i told

148
00:05:26,230 --> 00:05:24,080
our congressional folks the other day uh

149
00:05:29,029 --> 00:05:26,240
you know thomas opened the last sample

150
00:05:31,029 --> 00:05:29,039
from apollo a couple weeks ago so the

151
00:05:32,790 --> 00:05:31,039
pressure's on us now to get some more

152
00:05:34,390 --> 00:05:32,800
some more back

153
00:05:37,909 --> 00:05:34,400
and then obviously we work closely with

154
00:05:39,830 --> 00:05:37,919
space tech to integrate ourselves and

155
00:05:41,350 --> 00:05:39,840
and use the technology that is being

156
00:05:43,830 --> 00:05:41,360
brought to bear you know there's

157
00:05:46,150 --> 00:05:43,840
economic opportunities across the board

158
00:05:49,430 --> 00:05:46,160
from our perspective uh we're about to

159
00:05:52,469 --> 00:05:49,440
award a suits contract that was uh based

160
00:05:55,670 --> 00:05:52,479
on services from other people

161
00:05:58,150 --> 00:05:55,680
using spacesuits in in the future

162
00:06:00,629 --> 00:05:58,160
the lander contract that pam uh

163
00:06:02,629 --> 00:06:00,639

mentioned that where we're developing

164
00:06:04,710 --> 00:06:02,639
the next set of landers that can then be

165
00:06:06,710 --> 00:06:04,720
a services contract where other people

166
00:06:08,950 --> 00:06:06,720
can use those landers

167
00:06:11,350 --> 00:06:08,960
for their own purposes and and we have

168
00:06:14,150 --> 00:06:11,360
gateway where we have logistics to

169
00:06:16,390 --> 00:06:14,160
gateway as a service we we just put out

170
00:06:18,070 --> 00:06:16,400
an rfi for additional gateway

171
00:06:20,390 --> 00:06:18,080
opportunities so for me economic

172
00:06:22,550 --> 00:06:20,400
opportunities are are all over

173
00:06:25,830 --> 00:06:22,560
um our architecture leverages private

174
00:06:26,710 --> 00:06:25,840
investment um now and in the future

175
00:06:28,550 --> 00:06:26,720
um

176
00:06:31,110 --> 00:06:28,560
and and to use those commercial

177
00:06:32,870 --> 00:06:31,120
capabilities for our own so our for our

178
00:06:34,390 --> 00:06:32,880
own uh benefit

179
00:06:37,029 --> 00:06:34,400
and then of course we have international

180
00:06:39,350 --> 00:06:37,039
partners that have their own uh economic

181
00:06:42,230 --> 00:06:39,360
opportunities that then feed what we

182
00:06:44,710 --> 00:06:42,240
need to do for our missions for future

183
00:06:46,870 --> 00:06:44,720
elements current and future elements so

184
00:06:49,350 --> 00:06:46,880
from my perspective we are part of the

185
00:06:53,749 --> 00:06:49,360
space economy and look forward to using

186
00:06:57,589 --> 00:06:54,550
right

187
00:06:58,870 --> 00:06:57,599
yeah hi i'm ken bowersox from space

188
00:07:01,029 --> 00:06:58,880

operations

189
00:07:04,309 --> 00:07:01,039
um it's it's really wonderful to be here

190
00:07:05,189 --> 00:07:04,319
in colorado springs with all of you

191
00:07:09,670 --> 00:07:05,199
it's

192
00:07:12,230 --> 00:07:09,680
interact here and how

193
00:07:14,710 --> 00:07:12,240
relationships are built that will be

194
00:07:16,230 --> 00:07:14,720
indispensable in building the space

195
00:07:17,909 --> 00:07:16,240
economy

196
00:07:20,390 --> 00:07:17,919
you know there are a lot of ways if you

197
00:07:22,550 --> 00:07:20,400
want to make the uh the space economy

198
00:07:25,110 --> 00:07:22,560
bigger one way is just grow the federal

199
00:07:26,629 --> 00:07:25,120
budget and spend more money

200
00:07:27,830 --> 00:07:26,639
another way is to bring in private

201
00:07:30,950 --> 00:07:27,840
capital

202
00:07:33,909 --> 00:07:30,960
um it's it's a lot harder uh from a

203
00:07:35,589 --> 00:07:33,919
government uh perspective i think uh to

204
00:07:37,909 --> 00:07:35,599
come up with ways to bring in that

205
00:07:40,390 --> 00:07:37,919
private capital and expand the work

206
00:07:42,309 --> 00:07:40,400
that's going on uh but i think it's got

207
00:07:44,150 --> 00:07:42,319
the biggest potential for helping us

208
00:07:47,350 --> 00:07:44,160
accomplish the things that that we want

209
00:07:48,550 --> 00:07:47,360
to do in space exploration

210
00:07:50,790 --> 00:07:48,560
over the last

211
00:07:53,350 --> 00:07:50,800
20 years it's been really exciting to

212
00:07:56,230 --> 00:07:53,360
see the progress we've been making

213
00:07:58,469 --> 00:07:56,240

in low earth orbit trying new ways to

214
00:08:02,790 --> 00:07:58,479
bring in commercial partners

215
00:08:04,629 --> 00:08:02,800
and and to develop the the different

216
00:08:06,790 --> 00:08:04,639
capabilities that we need on the

217
00:08:08,150 --> 00:08:06,800
international space station for crew and

218
00:08:09,909 --> 00:08:08,160
cargo

219
00:08:11,029 --> 00:08:09,919
but as i've watched

220
00:08:13,670 --> 00:08:11,039
those

221
00:08:16,469 --> 00:08:13,680
capabilities develop

222
00:08:18,790 --> 00:08:16,479
the thing that struck me most is is one

223
00:08:21,029 --> 00:08:18,800
of the hardest things for us on the

224
00:08:22,550 --> 00:08:21,039
government side has been

225
00:08:24,629 --> 00:08:22,560
to release

226
00:08:26,550 --> 00:08:24,639
some of the control that we had by

227
00:08:28,550 --> 00:08:26,560
releasing some of the control

228
00:08:30,309 --> 00:08:28,560
exceeding some of that control to

229
00:08:31,270 --> 00:08:30,319
commercial partners that that we've

230
00:08:33,829 --> 00:08:31,280
built

231
00:08:36,149 --> 00:08:33,839
trust relationships with we can get so

232
00:08:38,709 --> 00:08:36,159
much more back and i think

233
00:08:41,990 --> 00:08:38,719
we're going to see that trend continue

234
00:08:43,990 --> 00:08:42,000
into artemis and i think it has a lot of

235
00:08:47,190 --> 00:08:44,000
wonderful potential as we explore

236
00:08:49,829 --> 00:08:47,200
further out into the solar system

237
00:08:51,350 --> 00:08:49,839
well i'm really excited to be here

238
00:08:53,190 --> 00:08:51,360

jim already mentioned that of course

239
00:08:54,389 --> 00:08:53,200
science is an important part of artemis

240
00:08:56,070 --> 00:08:54,399
and we see it

241
00:08:57,509 --> 00:08:56,080
both as a responsibility and an

242
00:08:59,509 --> 00:08:57,519
opportunity

243
00:09:00,630 --> 00:08:59,519
the responsibility for us to provide the

244
00:09:02,310 --> 00:09:00,640
information

245
00:09:04,389 --> 00:09:02,320
that help us pick the right landing

246
00:09:07,030 --> 00:09:04,399
sites with our orbital asset that has

247
00:09:09,670 --> 00:09:07,040
been there lunar reconnaissance orbiter

248
00:09:10,710 --> 00:09:09,680
provide the information about resources

249
00:09:13,190 --> 00:09:10,720
on

250
00:09:19,670 --> 00:09:13,200
and

251
00:09:21,750 --> 00:09:19,680
the technology side of the house the

252
00:09:24,070 --> 00:09:21,760
operation side of the house to really

253
00:09:25,910 --> 00:09:24,080
make sure our presence back at the

254
00:09:28,630 --> 00:09:25,920
moment becomes sustainable

255
00:09:30,310 --> 00:09:28,640
the opportunity is overwhelming for us

256
00:09:31,430 --> 00:09:30,320
also what we can do

257
00:09:33,509 --> 00:09:31,440
is with

258
00:09:36,790 --> 00:09:33,519
this new space economy we can do

259
00:09:38,710 --> 00:09:36,800
missions we can do work in ways frankly

260
00:09:40,230 --> 00:09:38,720
that was the stuff of dreams even five

261
00:09:41,750 --> 00:09:40,240
years ago

262
00:09:43,750 --> 00:09:41,760
what i mean with that of course is that

263
00:09:47,030 --> 00:09:43,760

artemis iii you know kind of with the

264
00:09:49,110 --> 00:09:47,040
plan moving forward we're working to

265
00:09:51,670 --> 00:09:49,120
really get the maximum science out of

266
00:09:54,310 --> 00:09:51,680
this it's not the same as it was in a

267
00:09:55,910 --> 00:09:54,320
polo we have virtual reality we have you

268
00:09:58,389 --> 00:09:55,920
know kind of the communication system

269
00:10:01,430 --> 00:09:58,399
that is being built and as being

270
00:10:03,910 --> 00:10:01,440
deployed by uh sox and his team you know

271
00:10:06,150 --> 00:10:03,920
and and the entire uh system that is

272
00:10:08,710 --> 00:10:06,160
being built with uh

273
00:10:10,310 --> 00:10:08,720
jim and his commercial team uh we're

274
00:10:12,470 --> 00:10:10,320
basically have the opportunity of doing

275
00:10:14,470 --> 00:10:12,480
amazing science the way we treat that

276
00:10:16,550 --> 00:10:14,480
kind of science is like we treat any

277
00:10:18,310 --> 00:10:16,560
other mission whether it's james webb

278
00:10:19,750 --> 00:10:18,320
whether it's a planetary mission and so

279
00:10:21,829 --> 00:10:19,760
forth we figure out what's the best

280
00:10:24,150 --> 00:10:21,839
science we can do and we build a science

281
00:10:26,630 --> 00:10:24,160
and technology definition team for that

282
00:10:28,949 --> 00:10:26,640
so we actually get the maximum out of it

283
00:10:31,110 --> 00:10:28,959
that's opportunity we're really excited

284
00:10:33,030 --> 00:10:31,120
about it yes we opened that sample

285
00:10:34,790 --> 00:10:33,040
because frankly it seemed to me

286
00:10:36,310 --> 00:10:34,800
we believe that there's new samples

287
00:10:38,630 --> 00:10:36,320
coming so let's make sure that the

288
00:10:40,230 --> 00:10:38,640

community is ready to really address

289
00:10:42,790 --> 00:10:40,240
those samples they need to practice

290
00:10:45,350 --> 00:10:42,800
again really deploy that excitement of

291
00:10:47,509 --> 00:10:45,360
doing this sample analysis looking at

292
00:10:50,389 --> 00:10:47,519
questions that frankly at the apollo

293
00:10:53,030 --> 00:10:50,399
time period were crazy questions about

294
00:10:54,069 --> 00:10:53,040
volatiles sometimes we refer to them as

295
00:10:56,230 --> 00:10:54,079
water

296
00:10:58,470 --> 00:10:56,240
volatiles which of course we could use

297
00:11:00,870 --> 00:10:58,480
for uh for fuel

298
00:11:02,710 --> 00:11:00,880
perhaps to survive but also because of

299
00:11:04,470 --> 00:11:02,720
the fact that they provide enormous

300
00:11:06,710 --> 00:11:04,480
amounts of information about the moon

301
00:11:09,269 --> 00:11:06,720
itself and its history information we

302
00:11:10,310 --> 00:11:09,279
didn't know was even 15 years ago so so

303
00:11:12,069 --> 00:11:10,320
for us

304
00:11:14,069 --> 00:11:12,079
that's really exciting again at the

305
00:11:15,829 --> 00:11:14,079
opportunity but also in this case the

306
00:11:17,910 --> 00:11:15,839
responsibility because that information

307
00:11:20,630 --> 00:11:17,920
is absolutely critical as we go forward

308
00:11:22,550 --> 00:11:20,640
and look at isru's and so forth well

309
00:11:24,310 --> 00:11:22,560
we're not waiting for artemis three

310
00:11:26,150 --> 00:11:24,320
though to go to the moon and and we're

311
00:11:28,790 --> 00:11:26,160
really excited at the commercial lunar

312
00:11:31,910 --> 00:11:28,800
payload services now everybody was paid

313
00:11:33,509 --> 00:11:31,920

attention realizes that uh it's uh uh

314
00:11:35,590 --> 00:11:33,519
you know we wanted to launch some of

315
00:11:37,590 --> 00:11:35,600
these missions last year

316
00:11:39,430 --> 00:11:37,600
i want to tell you that we struggled in

317
00:11:41,670 --> 00:11:39,440
a number of missions with covet supply

318
00:11:43,190 --> 00:11:41,680
chain issues but also frankly these are

319
00:11:45,670 --> 00:11:43,200
the first missions these companies are

320
00:11:47,829 --> 00:11:45,680
doing we're standing right behind them

321
00:11:49,590 --> 00:11:47,839
you know with astrobotic with its 11

322
00:11:52,310 --> 00:11:49,600
payloads that will go to the surface of

323
00:11:54,949 --> 00:11:52,320
the moon and uh you know intuitive

324
00:11:57,430 --> 00:11:54,959
machines with another six payloads and

325
00:11:59,030 --> 00:11:57,440
then uh frankly one in partnership with

326
00:12:00,710 --> 00:11:59,040
you what has happened with the

327
00:12:03,990 --> 00:12:00,720
commercial owner payload services with

328
00:12:06,550 --> 00:12:04,000
the various uh contracts there uh it

329
00:12:09,350 --> 00:12:06,560
created kind of an innovative flywheel

330
00:12:11,350 --> 00:12:09,360
that has frankly created an amount of

331
00:12:13,590 --> 00:12:11,360
innovation and planetary instrumentation

332
00:12:14,870 --> 00:12:13,600
and technology that we haven't seen we

333
00:12:17,670 --> 00:12:14,880
haven't seen

334
00:12:19,430 --> 00:12:17,680
in decades uh the total amount of

335
00:12:22,150 --> 00:12:19,440
technologies and of instruments are

336
00:12:24,710 --> 00:12:22,160
being built on range in the order 40.

337
00:12:27,269 --> 00:12:24,720
i'll talk talk to you about one of them

338
00:12:29,829 --> 00:12:27,279

on the far side of the moon when the sun

339
00:12:31,269 --> 00:12:29,839
and the uh uh the earth are on the same

340
00:12:34,790 --> 00:12:31,279
side of the moon the far side of the

341
00:12:37,990 --> 00:12:34,800
moon is really dark and really quiet and

342
00:12:39,910 --> 00:12:38,000
when jupiter and saturn are also on the

343
00:12:42,230 --> 00:12:39,920
same side of the moon

344
00:12:43,990 --> 00:12:42,240
as is the sun and the earth so it's full

345
00:12:46,310 --> 00:12:44,000
moon on earth if you want

346
00:12:49,110 --> 00:12:46,320
on the far side it's the most radio

347
00:12:51,670 --> 00:12:49,120
quiet place in the solar system

348
00:12:52,389 --> 00:12:51,680
so we're deploying a payload to that far

349
00:12:53,509 --> 00:12:52,399
side

350
00:12:55,269 --> 00:12:53,519
and we're coming up with new

351
00:12:57,829 --> 00:12:55,279
technologies to make sure they can make

352
00:12:58,949 --> 00:12:57,839
measurements during the dark side there

353
00:13:00,710 --> 00:12:58,959
to look

354
00:13:01,990 --> 00:13:00,720
at the universe in ways we've never been

355
00:13:04,230 --> 00:13:02,000
able to do we're doing that with the

356
00:13:05,829 --> 00:13:04,240
department of energy that's one

357
00:13:08,230 --> 00:13:05,839
of many of those technologies we

358
00:13:10,389 --> 00:13:08,240
couldn't have dreamt uh to do it viper

359
00:13:13,350 --> 00:13:10,399
of course the rover that will go uh you

360
00:13:15,350 --> 00:13:13,360
know uh uh in mid-decade here we're

361
00:13:16,870 --> 00:13:15,360
getting ready for i just recently was

362
00:13:19,590 --> 00:13:16,880
there i want to know i want you to know

363
00:13:22,069 --> 00:13:19,600

that every single instrument on viper is

364
00:13:23,590 --> 00:13:22,079
already on the lander going to the moon

365
00:13:25,910 --> 00:13:23,600
before

366
00:13:27,509 --> 00:13:25,920
that creates a development paradigm

367
00:13:30,389 --> 00:13:27,519
that's very much different than what i'm

368
00:13:31,990 --> 00:13:30,399
used to normally this is the only

369
00:13:34,389 --> 00:13:32,000
rover i've ever worked on where the

370
00:13:35,910 --> 00:13:34,399
instruments are not on the critical path

371
00:13:38,949 --> 00:13:35,920
that's what happens if you have a new

372
00:13:41,430 --> 00:13:38,959
space economy you can start driving new

373
00:13:43,670 --> 00:13:41,440
development paradigms can take more risk

374
00:13:45,990 --> 00:13:43,680
create innovation platforms that are

375
00:13:48,389 --> 00:13:46,000
otherwise not there and create of course

376
00:13:51,269 --> 00:13:48,399
a community that will be available

377
00:13:52,949 --> 00:13:51,279
for you sucks for you jim if you need

378
00:13:54,629 --> 00:13:52,959
that community and of course for the

379
00:13:56,310 --> 00:13:54,639
important technology you do jim so why

380
00:13:58,310 --> 00:13:56,320
don't you take over all right well thank

381
00:13:59,990 --> 00:13:58,320
you thomas and it's a great pleasure for

382
00:14:01,269 --> 00:14:00,000
me to be here especially with my steven

383
00:14:03,750 --> 00:14:01,279
colleagues

384
00:14:04,870 --> 00:14:03,760
and and working together as as we do

385
00:14:06,870 --> 00:14:04,880
um

386
00:14:09,750 --> 00:14:06,880
we in space tech

387
00:14:12,790 --> 00:14:09,760
pursue transformative technologies for

388
00:14:14,310 --> 00:14:12,800

both human and robotic mission enabling

389
00:14:16,150 --> 00:14:14,320
and also enabling the growth of

390
00:14:18,230 --> 00:14:16,160
commercial space in the process and of

391
00:14:19,910 --> 00:14:18,240
course like all of us a core element of

392
00:14:21,430 --> 00:14:19,920
what we're doing is to inspire the next

393
00:14:23,750 --> 00:14:21,440
generation

394
00:14:26,150 --> 00:14:23,760
we we developed this we do a broad

395
00:14:28,629 --> 00:14:26,160
portfolio across the entire technology

396
00:14:31,189 --> 00:14:28,639
readiness level scale

397
00:14:31,990 --> 00:14:31,199
we work for things all the way from very

398
00:14:37,030 --> 00:14:32,000
low

399
00:14:38,389 --> 00:14:37,040
trl um

400
00:14:40,790 --> 00:14:38,399
demonstrating the lab and all the way to

401
00:14:41,990 --> 00:14:40,800
flying a core element of what we try to

402
00:14:44,389 --> 00:14:42,000
do is is

403
00:14:46,150 --> 00:14:44,399
is get across those valleys of death as

404
00:14:48,710 --> 00:14:46,160
we talk about and get into an infusion

405
00:14:50,870 --> 00:14:48,720
path and and i'll say um the clips and

406
00:14:53,110 --> 00:14:50,880
other opportunities that are there just

407
00:14:55,430 --> 00:14:53,120
are a tremendous resource for us

408
00:14:56,870 --> 00:14:55,440
um i like to say our the breath the

409
00:14:59,670 --> 00:14:56,880
breath of our organization is our

410
00:15:01,670 --> 00:14:59,680
strength we we can when we deploy a

411
00:15:04,389 --> 00:15:01,680
problem or try to solve a problem we use

412
00:15:06,790 --> 00:15:04,399
our sbirs we use um tipping point

413
00:15:08,629 --> 00:15:06,800

solicitations and and and in-house

414
00:15:10,790 --> 00:15:08,639
activities and stuff and look across

415
00:15:12,790 --> 00:15:10,800
that and and research grants across that

416
00:15:14,710 --> 00:15:12,800
to try to have a coordinated effort in

417
00:15:16,629 --> 00:15:14,720
addressing a problem and and we can do

418
00:15:18,230 --> 00:15:16,639
that in large part and it results in we

419
00:15:20,150 --> 00:15:18,240
have about 140 or so flight

420
00:15:21,910 --> 00:15:20,160
demonstrations on the books for what

421
00:15:23,350 --> 00:15:21,920
we're doing and when when you consider a

422
00:15:26,470 --> 00:15:23,360
lot of the smaller stuff we do as well

423
00:15:29,269 --> 00:15:26,480
over 1400 projects overall

424
00:15:32,629 --> 00:15:29,279
and and when we get to a mid to high trl

425
00:15:34,710 --> 00:15:32,639
a big push for us is to do so uh in a

426
00:15:36,790 --> 00:15:34,720
public private partnership because there

427
00:15:38,870 --> 00:15:36,800
is it is just a game changer of how

428
00:15:41,350 --> 00:15:38,880
different it is today with the the space

429
00:15:43,030 --> 00:15:41,360
economy the way it is is there is a lot

430
00:15:44,710 --> 00:15:43,040
of private capital that we're we can

431
00:15:47,189 --> 00:15:44,720
leverage and we get the much stronger

432
00:15:49,189 --> 00:15:47,199
product as a result uh the one of the

433
00:15:50,550 --> 00:15:49,199
key ways we do that i mentioned is is

434
00:15:51,910 --> 00:15:50,560
our tipping point solicitation and

435
00:15:53,269 --> 00:15:51,920
actually the preliminary proposals are

436
00:15:55,430 --> 00:15:53,279
due friday

437
00:15:56,949 --> 00:15:55,440
and by all indications of what we had

438
00:15:58,389 --> 00:15:56,959

from what we've seen so far and what

439
00:16:00,150 --> 00:15:58,399
we're hearing is as we talk to people

440
00:16:01,509 --> 00:16:00,160
here is is it will be far and away a

441
00:16:03,350 --> 00:16:01,519
record for us in terms of number of

442
00:16:05,430 --> 00:16:03,360
solicitations and i can tell you it's

443
00:16:07,269 --> 00:16:05,440
going to be some fantastic stuff these

444
00:16:08,470 --> 00:16:07,279
are i'm always amazed at the creativity

445
00:16:10,310 --> 00:16:08,480
of these

446
00:16:11,990 --> 00:16:10,320
a big part of what we do is to support

447
00:16:13,910 --> 00:16:12,000
artemis uh both in the human and

448
00:16:15,749 --> 00:16:13,920
robotics side the solar electric

449
00:16:17,990 --> 00:16:15,759
propulsion system that supports uh the

450
00:16:20,550 --> 00:16:18,000
gateway power and propulsion element

451
00:16:22,230 --> 00:16:20,560
a big success story actually is the

452
00:16:23,269 --> 00:16:22,240
rollout solar arrays that are deployed

453
00:16:24,949 --> 00:16:23,279
on on

454
00:16:28,150 --> 00:16:24,959
the power and propulsion element that

455
00:16:29,509 --> 00:16:28,160
also is deployed on dart and and also on

456
00:16:32,389 --> 00:16:29,519
the iss

457
00:16:35,430 --> 00:16:32,399
among other places that started uh with

458
00:16:37,590 --> 00:16:35,440
about a dozen sbirs and and then through

459
00:16:39,110 --> 00:16:37,600
time we developed it and and it was

460
00:16:41,749 --> 00:16:39,120
taken over by missions as we went

461
00:16:44,150 --> 00:16:41,759
through a great success story uh we fly

462
00:16:46,230 --> 00:16:44,160
it was mentioned uh by pam i think that

463
00:16:49,030 --> 00:16:46,240

the capstone mission which is a small

464
00:16:51,350 --> 00:16:49,040
12-view cubesat a size of a

465
00:16:54,310 --> 00:16:51,360
a small microwave oven um

466
00:16:55,990 --> 00:16:54,320
and it'll be going into the the near the

467
00:16:57,430 --> 00:16:56,000
near earth uh the

468
00:16:59,269 --> 00:16:57,440
well the the

469
00:17:00,870 --> 00:16:59,279
i'm stumbling over the words so it'll be

470
00:17:03,189 --> 00:17:00,880
going into the gateway orbit the near

471
00:17:04,789 --> 00:17:03,199
record selenium halo orbit and stuff and

472
00:17:06,630 --> 00:17:04,799
it'll be our first time to demonstrate

473
00:17:08,789 --> 00:17:06,640
this in a very small package and and

474
00:17:11,270 --> 00:17:08,799
very creative as what they're doing

475
00:17:13,189 --> 00:17:11,280
um on the lunar surface we have over 30

476
00:17:16,230 --> 00:17:13,199
technologies flying on on the cliffs of

477
00:17:17,669 --> 00:17:16,240
of of thomas's um doing all kinds of

478
00:17:19,189 --> 00:17:17,679
things that like

479
00:17:20,789 --> 00:17:19,199
for us to try to help establish a

480
00:17:22,470 --> 00:17:20,799
sustainable presence on the moon and

481
00:17:25,029 --> 00:17:22,480
that sustainable presence means the

482
00:17:26,789 --> 00:17:25,039
power systems that we might deploy uh

483
00:17:28,549 --> 00:17:26,799
how do we utilize in situ resource

484
00:17:30,630 --> 00:17:28,559
utilization are there construction

485
00:17:32,950 --> 00:17:30,640
activities that we can do and and so on

486
00:17:34,549 --> 00:17:32,960
and how do we access areas that are

487
00:17:36,230 --> 00:17:34,559
extremely hard to do and difficult to

488
00:17:39,190 --> 00:17:36,240

reach

489
00:17:41,190 --> 00:17:39,200
all that um in concert with with um

490
00:17:43,909 --> 00:17:41,200
universities and and with the industry

491
00:17:45,750 --> 00:17:43,919
and and within our own nasa folks

492
00:17:49,029 --> 00:17:45,760
we there's two other things that we try

493
00:17:51,669 --> 00:17:49,039
to um develop as we go through this um

494
00:17:54,310 --> 00:17:51,679
uh consortium uh one one of the areas

495
00:17:56,230 --> 00:17:54,320
that we're trying to have in order to to

496
00:17:57,990 --> 00:17:56,240
develop our lunar surface system into a

497
00:18:00,470 --> 00:17:58,000
sustainable presence a big part of that

498
00:18:02,230 --> 00:18:00,480
is to engage uh the community as we go

499
00:18:04,390 --> 00:18:02,240
along and so the reason we established

500
00:18:07,430 --> 00:18:04,400
the lunar service innovation consortium

501
00:18:09,270 --> 00:18:07,440
is is to gain a great input uh and

502
00:18:11,430 --> 00:18:09,280
coordination with the communication with

503
00:18:13,270 --> 00:18:11,440
the entire community space community and

504
00:18:14,390 --> 00:18:13,280
in the two years or so that we've been

505
00:18:16,310 --> 00:18:14,400
operating now

506
00:18:17,669 --> 00:18:16,320
there's now over 600 organizations that

507
00:18:20,390 --> 00:18:17,679
actively

508
00:18:25,750 --> 00:18:20,400
participate on a regular basis

509
00:18:29,029 --> 00:18:27,190
oh well

510
00:18:30,950 --> 00:18:29,039
over 600 organizations that participate

511
00:18:31,830 --> 00:18:30,960
across all 50 states

512
00:18:33,270 --> 00:18:31,840
um

513
00:18:34,950 --> 00:18:33,280

and then just kind of to wrap up there's

514
00:18:36,630 --> 00:18:34,960
a couple things we also you know look

515
00:18:38,310 --> 00:18:36,640
for okay what's it's not just a

516
00:18:40,789 --> 00:18:38,320
sustainable presence on the moon but

517
00:18:42,549 --> 00:18:40,799
what do we look for uh and what are the

518
00:18:44,230 --> 00:18:42,559
tall poles in reaching and going humans

519
00:18:45,590 --> 00:18:44,240
to mars there's three

520
00:18:48,310 --> 00:18:45,600
there's three key activities that we

521
00:18:50,950 --> 00:18:48,320
have ongoing now to do so uh the first

522
00:18:53,590 --> 00:18:50,960
pla first item is a deep space optical

523
00:18:55,830 --> 00:18:53,600
communications demonstration that's on

524
00:18:57,909 --> 00:18:55,840
the psyche mission for thomas and we'll

525
00:18:59,909 --> 00:18:57,919
be demonstrating from uh of optical

526
00:19:02,310 --> 00:18:59,919
communications from mars

527
00:19:04,789 --> 00:19:02,320
environment and potentially from beyond

528
00:19:07,110 --> 00:19:04,799
we also have what we call our lofted

529
00:19:09,110 --> 00:19:07,120
demonstration it was uh pam mentioned

530
00:19:11,350 --> 00:19:09,120
that when she talked uh and and what

531
00:19:13,430 --> 00:19:11,360
that is is a hypersonic uh decelerator

532
00:19:16,230 --> 00:19:13,440
that's an inflatable well then it's it's

533
00:19:17,669 --> 00:19:16,240
a it's a um a public-private partnership

534
00:19:19,990 --> 00:19:17,679
with ula

535
00:19:22,230 --> 00:19:20,000
um and we're demonstrating a six meter

536
00:19:24,870 --> 00:19:22,240
inflatable system to large

537
00:19:27,430 --> 00:19:24,880
uh heavy payloads ultimately when we get

538
00:19:29,430 --> 00:19:27,440

to a 15 meter or so we can we can large

539
00:19:31,669 --> 00:19:29,440
we can land those large payloads on on

540
00:19:33,830 --> 00:19:31,679
the moon at 20 tons or so

541
00:19:36,630 --> 00:19:33,840
um and then also this is a time for us

542
00:19:38,310 --> 00:19:36,640
to be developing nuclear systems uh

543
00:19:41,190 --> 00:19:38,320
nuclear fission surface power is in our

544
00:19:43,909 --> 00:19:41,200
budget uh and is is the top priority for

545
00:19:45,350 --> 00:19:43,919
us but also in our budget is is the

546
00:19:46,630 --> 00:19:45,360
early development activities for nuclear

547
00:19:48,390 --> 00:19:46,640
propulsion

548
00:19:49,830 --> 00:19:48,400
and and so it's an exciting time i've

549
00:19:52,390 --> 00:19:49,840
never seen a more exciting time than

550
00:19:53,990 --> 00:19:52,400
right now it's a pleasure to be here

551
00:19:55,669 --> 00:19:54,000
outstanding thank you so much for that

552
00:19:57,430 --> 00:19:55,679
contact see you all did great they were

553
00:19:58,630 --> 00:19:57,440
teasing me before this we have opening

554
00:20:00,870 --> 00:19:58,640
remarks

555
00:20:03,270 --> 00:20:00,880
is this panel about artemis but

556
00:20:05,190 --> 00:20:03,280
you're just pulling my leg um

557
00:20:06,789 --> 00:20:05,200
so moving on to the questions let's

558
00:20:09,029 --> 00:20:06,799
let's pull the thread of the space

559
00:20:11,110 --> 00:20:09,039
economy just a little bit further and go

560
00:20:14,149 --> 00:20:11,120
deeper into that so that's kind of the

561
00:20:15,909 --> 00:20:14,159
focus area for this panel but for a lot

562
00:20:17,750 --> 00:20:15,919
of us i think the concept of a space

563
00:20:20,549 --> 00:20:17,760

economy is still relatively new and

564
00:20:22,470 --> 00:20:20,559
perhaps not specifically defined so what

565
00:20:24,870 --> 00:20:22,480
does the space economy mean to you and

566
00:20:27,430 --> 00:20:24,880
and why is artemis key to building it

567
00:20:28,710 --> 00:20:27,440
jim would you start sure um so the

568
00:20:33,350 --> 00:20:28,720
example

569
00:20:34,390 --> 00:20:33,360
commercial leo destinations not to

570
00:20:38,070 --> 00:20:34,400
steal from

571
00:20:39,669 --> 00:20:38,080
from ken here but that's key to us we we

572
00:20:41,669 --> 00:20:39,679
have things where

573
00:20:44,149 --> 00:20:41,679
risk we're buying down on space station

574
00:20:46,470 --> 00:20:44,159
today when space station reaches end of

575
00:20:48,710 --> 00:20:46,480
life we'll continue to use the

576
00:20:51,590 --> 00:20:48,720
commercial leo destinations which to me

577
00:20:53,990 --> 00:20:51,600
is a a great example of the the space

578
00:20:55,909 --> 00:20:54,000
economy to do our buy down our risk for

579
00:20:57,990 --> 00:20:55,919
lunar and mars missions to take

580
00:21:00,549 --> 00:20:58,000
advantage of that microgravity where we

581
00:21:03,110 --> 00:21:00,559
can cycle payloads up and down very

582
00:21:05,590 --> 00:21:03,120
quickly so for me i look at that's our

583
00:21:07,990 --> 00:21:05,600
that's our first opportunity the other

584
00:21:09,990 --> 00:21:08,000
is as the space economy i think pam

585
00:21:11,990 --> 00:21:10,000
talked about it about folks early in

586
00:21:13,669 --> 00:21:12,000
their career about the opportunities

587
00:21:15,750 --> 00:21:13,679
many of you here

588
00:21:17,830 --> 00:21:15,760

that bring those opportunities

589
00:21:20,310 --> 00:21:17,840
we have that to benefit from as we

590
00:21:22,870 --> 00:21:20,320
develop our architecture to go to mars

591
00:21:26,310 --> 00:21:22,880
so we'll have uh keep our architecture

592
00:21:29,350 --> 00:21:26,320
open as technologies develop in in other

593
00:21:30,470 --> 00:21:29,360
parts of the space economy that can then

594
00:21:33,510 --> 00:21:30,480
improve

595
00:21:35,510 --> 00:21:33,520
our reliability our safety or our

596
00:21:38,549 --> 00:21:35,520
mission duration for our mars missions

597
00:21:39,510 --> 00:21:38,559
so to me i look at those two examples

598
00:21:42,149 --> 00:21:39,520
excellent

599
00:21:44,470 --> 00:21:42,159
i mean to me the space economy is just

600
00:21:47,029 --> 00:21:44,480
the production of goods and services in

601
00:21:50,870 --> 00:21:47,039
space uh for all different kinds of

602
00:21:53,430 --> 00:21:50,880
reasons uh for amusement for uh to

603
00:21:56,070 --> 00:21:53,440
scientific knowledge to go further than

604
00:21:58,149 --> 00:21:56,080
we've ever gone before um and i think

605
00:21:59,830 --> 00:21:58,159
there are lots of ways that that we can

606
00:22:00,870 --> 00:21:59,840
develop it

607
00:22:02,950 --> 00:22:00,880
but

608
00:22:05,669 --> 00:22:02,960
the best way is to bring in more and

609
00:22:07,270 --> 00:22:05,679
more participants and watch

610
00:22:09,430 --> 00:22:07,280
more and more missions start to

611
00:22:11,190 --> 00:22:09,440
proliferate both government missions and

612
00:22:12,390 --> 00:22:11,200
non-government missions

613
00:22:14,950 --> 00:22:12,400

and for me

614
00:22:16,950 --> 00:22:14,960
the way it becomes part of

615
00:22:18,230 --> 00:22:16,960
our life and kind of the science mission

616
00:22:19,590 --> 00:22:18,240
directorate one of the things i really

617
00:22:21,830 --> 00:22:19,600
want us to do

618
00:22:24,070 --> 00:22:21,840
is continually ask

619
00:22:27,029 --> 00:22:24,080
what are the opportunity spaces that are

620
00:22:30,470 --> 00:22:27,039
no that are there so we focus tunnel

621
00:22:32,710 --> 00:22:30,480
vision on new signs and signs per dollar

622
00:22:35,270 --> 00:22:32,720
and we use the tools that are there so

623
00:22:38,310 --> 00:22:35,280
we can in fact become first customers in

624
00:22:40,710 --> 00:22:38,320
some of these new places or we can take

625
00:22:42,789 --> 00:22:40,720
advantage of opportunities that

626
00:22:45,909 --> 00:22:42,799
that frankly were not there to do

627
00:22:47,830 --> 00:22:45,919
amazing signs and so for me uh even if

628
00:22:49,350 --> 00:22:47,840
you know the government assets the space

629
00:22:52,230 --> 00:22:49,360
station you know together with our

630
00:22:53,990 --> 00:22:52,240
international partners uh he really

631
00:22:55,270 --> 00:22:54,000
taught us i believe and kind of taught

632
00:22:57,430 --> 00:22:55,280
the science community you know science

633
00:22:59,590 --> 00:22:57,440
community was very much used to building

634
00:23:01,430 --> 00:22:59,600
their own stuff all by themselves like

635
00:23:03,110 --> 00:23:01,440
what happens frankly on the space

636
00:23:04,789 --> 00:23:03,120
station you have more payloads than we

637
00:23:06,390 --> 00:23:04,799
can accommodate uh we have an

638
00:23:08,149 --> 00:23:06,400

embarrassment of i call that a good

639
00:23:09,669 --> 00:23:08,159
problem because people you know

640
00:23:10,789 --> 00:23:09,679
especially for those out there who want

641
00:23:13,270 --> 00:23:10,799
to build

642
00:23:14,789 --> 00:23:13,280
uh commercial uh space stations right

643
00:23:17,350 --> 00:23:14,799
well we have instruments that want to

644
00:23:18,950 --> 00:23:17,360
sit on the outside of these uh we have

645
00:23:21,190 --> 00:23:18,960
science that we want to do on the inside

646
00:23:23,350 --> 00:23:21,200
of these so look through the lens of

647
00:23:25,669 --> 00:23:23,360
what is the science opportunity and how

648
00:23:27,029 --> 00:23:25,679
can we be customers we don't want to own

649
00:23:29,029 --> 00:23:27,039
these companies

650
00:23:31,110 --> 00:23:29,039
so we'd like to always say if somebody

651
00:23:34,230 --> 00:23:31,120
uses the word commercial and i'm 80 off

652
00:23:35,750 --> 00:23:34,240
the market not so interested because and

653
00:23:37,909 --> 00:23:35,760
my worry is i will squeeze all the

654
00:23:39,350 --> 00:23:37,919
commercial spirit out of them

655
00:23:41,590 --> 00:23:39,360
you know by the time we're done with the

656
00:23:43,990 --> 00:23:41,600
contract but what i really what i'd like

657
00:23:46,390 --> 00:23:44,000
us to do is really be a customer and

658
00:23:48,230 --> 00:23:46,400
kind of stand and learn how we can

659
00:23:50,149 --> 00:23:48,240
create opportunity spaces that otherwise

660
00:23:52,070 --> 00:23:50,159
were not there so that's how i see it

661
00:23:53,990 --> 00:23:52,080
it's a in every evolving field of

662
00:23:55,830 --> 00:23:54,000
opportunity

663
00:23:58,310 --> 00:23:55,840

and and what i'd say is um the space

664
00:24:00,390 --> 00:23:58,320
economy right now is defined by the

665
00:24:02,789 --> 00:24:00,400
these consumption of resources to for

666
00:24:04,390 --> 00:24:02,799
the betterment and use of space is a 400

667
00:24:05,909 --> 00:24:04,400
billion dollar industry right now and

668
00:24:08,470 --> 00:24:05,919
it's on the way to targeting towards the

669
00:24:10,310 --> 00:24:08,480
trillion dollars and i suspect um it'll

670
00:24:13,510 --> 00:24:10,320
get here faster than we think

671
00:24:16,310 --> 00:24:13,520
uh and and for us uh as i said that that

672
00:24:18,950 --> 00:24:16,320
really equates to now it's not just the

673
00:24:21,190 --> 00:24:18,960
the venture capitalists that are highly

674
00:24:23,190 --> 00:24:21,200
uh you know that are geeks for space

675
00:24:25,750 --> 00:24:23,200
it's also it's also much more

676
00:24:27,510 --> 00:24:25,760
conventional people who are looking for

677
00:24:29,990 --> 00:24:27,520
opportunities and yes space is exciting

678
00:24:31,830 --> 00:24:30,000
so it draws a lot of extra but it's it's

679
00:24:34,310 --> 00:24:31,840
a lot more opportunities for for

680
00:24:35,909 --> 00:24:34,320
investment into capital investment and

681
00:24:37,830 --> 00:24:35,919
and that leads us to being able to take

682
00:24:40,870 --> 00:24:37,840
advantage of that and utilize this and

683
00:24:43,590 --> 00:24:40,880
and those uh that community is is is

684
00:24:44,710 --> 00:24:43,600
obviously low earth orbit suborbital

685
00:24:47,110 --> 00:24:44,720
orbit

686
00:24:48,789 --> 00:24:47,120
geo and stuff is is obviously a mainstay

687
00:24:50,789 --> 00:24:48,799
right now but it also is there's a

688
00:24:53,029 --> 00:24:50,799

strong push towards this lunar space and

689
00:24:54,710 --> 00:24:53,039
the utilization of that from an economy

690
00:24:55,830 --> 00:24:54,720
standpoint and so we're seeing a lot of

691
00:24:57,909 --> 00:24:55,840
investment that we can really take

692
00:25:00,070 --> 00:24:57,919
advantage of

693
00:25:01,830 --> 00:25:00,080
so as we move i guess into this space

694
00:25:02,789 --> 00:25:01,840
economy that's continuing to develop and

695
00:25:05,269 --> 00:25:02,799
grow

696
00:25:08,470 --> 00:25:05,279
we know that we need vision we need

697
00:25:10,710 --> 00:25:08,480
talent but we also need resources so can

698
00:25:12,630 --> 00:25:10,720
you help us understand and from your

699
00:25:14,549 --> 00:25:12,640
perspective how the recently released

700
00:25:17,350 --> 00:25:14,559
nasa budget supports artemis and the

701
00:25:18,870 --> 00:25:17,360
goals that we have

702
00:25:20,630 --> 00:25:18,880
you want me to start

703
00:25:23,029 --> 00:25:20,640
you offered all right

704
00:25:24,390 --> 00:25:23,039
um so so the

705
00:25:26,310 --> 00:25:24,400
the budget

706
00:25:29,510 --> 00:25:26,320
in supports us

707
00:25:31,029 --> 00:25:29,520
um with our our sls and orion vehicles

708
00:25:34,230 --> 00:25:31,039
that we need that's our that's our

709
00:25:36,070 --> 00:25:34,240
building block um it's a supports us

710
00:25:38,230 --> 00:25:36,080
getting to artemis three

711
00:25:39,909 --> 00:25:38,240
uh which includes the development of the

712
00:25:40,870 --> 00:25:39,919
lander and the suits

713
00:25:43,269 --> 00:25:40,880

um

714
00:25:44,870 --> 00:25:43,279
it it supports us starting this next

715
00:25:45,990 --> 00:25:44,880
lander procurement

716
00:25:48,630 --> 00:25:46,000
um

717
00:25:52,230 --> 00:25:48,640
what what i think we we nasa need to

718
00:25:54,390 --> 00:25:52,240
continue to focus on is where can we

719
00:25:55,350 --> 00:25:54,400
maximize those dollars on the budget to

720
00:25:57,350 --> 00:25:55,360
get

721
00:25:59,510 --> 00:25:57,360
to to go after things that other folks

722
00:26:01,909 --> 00:25:59,520
have already developed and where can we

723
00:26:05,510 --> 00:26:01,919
do better in how we perform on our

724
00:26:07,110 --> 00:26:05,520
program and and project work

725
00:26:09,269 --> 00:26:07,120
i talked at the beginning about the

726
00:26:11,590 --> 00:26:09,279
relationship between exploration systems

727
00:26:12,470 --> 00:26:11,600
development and space operations

728
00:26:17,269 --> 00:26:12,480
our

729
00:26:19,430 --> 00:26:17,279
uh space operations when they finish

730
00:26:22,310 --> 00:26:19,440
development and each one looks a little

731
00:26:24,950 --> 00:26:22,320
bit different but how we do that is

732
00:26:26,470 --> 00:26:24,960
intended to free up dollars to come back

733
00:26:29,269 --> 00:26:26,480
and start the next development if we

734
00:26:31,590 --> 00:26:29,279
don't do that then uh the budget that

735
00:26:34,230 --> 00:26:31,600
request is is there today and in the

736
00:26:36,230 --> 00:26:34,240
future is is not a value that's that's

737
00:26:39,190 --> 00:26:36,240
why these mission directives were set up

738
00:26:40,789 --> 00:26:39,200

and that's completely our job so

739
00:26:43,110 --> 00:26:40,799
i think the budget is there to support

740
00:26:45,430 --> 00:26:43,120
us through three start this new lander

741
00:26:47,190 --> 00:26:45,440
development help us get gateway up there

742
00:26:48,789 --> 00:26:47,200
get that infrastructure to start the

743
00:26:50,950 --> 00:26:48,799
science

744
00:26:53,350 --> 00:26:50,960
yeah you mentioned vision talent and

745
00:26:55,590 --> 00:26:53,360
resources and space ops we have

746
00:26:57,669 --> 00:26:55,600
resources to do lots of great things

747
00:26:59,190 --> 00:26:57,679
with commercial allele platforms

748
00:27:01,269 --> 00:26:59,200
continuing our

749
00:27:03,430 --> 00:27:01,279
commercial crew and cargo capabilities

750
00:27:05,190 --> 00:27:03,440
for the international space station

751
00:27:07,909 --> 00:27:05,200
maintain the international space station

752
00:27:08,789 --> 00:27:07,919
do new activities there and set up some

753
00:27:10,230 --> 00:27:08,799
new

754
00:27:13,190 --> 00:27:10,240
commercial approach to procuring

755
00:27:15,830 --> 00:27:13,200
communication services so there's a

756
00:27:17,190 --> 00:27:15,840
a lot in in the budget that we're

757
00:27:19,669 --> 00:27:17,200
allowed to do

758
00:27:22,470 --> 00:27:19,679
um you know the the vision part i i

759
00:27:24,630 --> 00:27:22,480
think is harder for us

760
00:27:27,110 --> 00:27:24,640
to to try and exactly see where we're

761
00:27:29,350 --> 00:27:27,120
going and what we need to do and and to

762
00:27:31,590 --> 00:27:29,360
stay out of the way as our commercial

763
00:27:34,310 --> 00:27:31,600

partners come up with with new ways of

764
00:27:36,549 --> 00:27:34,320
doing business um is tougher yeah the

765
00:27:39,269 --> 00:27:36,559
other thing that's that's tough is is

766
00:27:41,750 --> 00:27:39,279
having a sort of a unified regulatory

767
00:27:45,590 --> 00:27:41,760
framework because developing the the

768
00:27:48,549 --> 00:27:45,600
space economy is in nasa's interest

769
00:27:50,710 --> 00:27:48,559
we have taken on a lot ourselves

770
00:27:53,350 --> 00:27:50,720
where we try to facilitate the growth of

771
00:27:56,070 --> 00:27:53,360
different uh commercial entities uh and

772
00:27:57,909 --> 00:27:56,080
and and enable them to to get their job

773
00:27:59,990 --> 00:27:57,919
done but at some point that's not really

774
00:28:01,669 --> 00:28:00,000
nasa's job that needs to move out and

775
00:28:03,110 --> 00:28:01,679
into other parts of the government and

776
00:28:04,789 --> 00:28:03,120
and we're already seeing discussions

777
00:28:07,029 --> 00:28:04,799
there and that's one way you'll know the

778
00:28:09,190 --> 00:28:07,039
economy is growing is is work that nasa

779
00:28:11,350 --> 00:28:09,200
is doing now will move to commerce and

780
00:28:13,269 --> 00:28:11,360
the faa and we're seeing it start and

781
00:28:16,789 --> 00:28:13,279
we'll see more of it

782
00:28:18,389 --> 00:28:16,799
you know and from the talent side

783
00:28:20,149 --> 00:28:18,399
there's a number of companies that tell

784
00:28:22,149 --> 00:28:20,159
us how they're having a hard time

785
00:28:23,269 --> 00:28:22,159
holding on to their talent because the

786
00:28:24,630 --> 00:28:23,279
companies are growing in their

787
00:28:26,310 --> 00:28:24,640
neighborhood

788
00:28:27,830 --> 00:28:26,320

and i always thought what an amazing

789
00:28:29,430 --> 00:28:27,840
thing if you're an entrant into this

790
00:28:31,669 --> 00:28:29,440
industry because they're chasing you

791
00:28:34,149 --> 00:28:31,679
people are chasing you around town

792
00:28:36,070 --> 00:28:34,159
and i'm like that's that's an amazing

793
00:28:38,630 --> 00:28:36,080
thing it's kind of i see people that

794
00:28:40,070 --> 00:28:38,640
used to be i used to teach uh used to be

795
00:28:41,909 --> 00:28:40,080
in my classroom

796
00:28:43,990 --> 00:28:41,919
uh 10 plus years ago and they're in

797
00:28:45,990 --> 00:28:44,000
these leadership positions and companies

798
00:28:48,470 --> 00:28:46,000
they're in these leadership positions

799
00:28:50,950 --> 00:28:48,480
within uh within

800
00:28:52,789 --> 00:28:50,960
uh you know the agency frankly in many

801
00:28:55,190 --> 00:28:52,799
of the projects that half the shifts of

802
00:28:56,870 --> 00:28:55,200
the james webb space telescope at night

803
00:28:59,750 --> 00:28:56,880
the night shifts were run by one of my

804
00:29:02,310 --> 00:28:59,760
former students as the shift lead and so

805
00:29:03,909 --> 00:29:02,320
so i'm just tremendously proud of both

806
00:29:05,590 --> 00:29:03,919
what they're achieving this kind of

807
00:29:08,230 --> 00:29:05,600
generation that's behind us and i

808
00:29:09,590 --> 00:29:08,240
consider it our job as we're opening up

809
00:29:11,669 --> 00:29:09,600
that opportunity space both the

810
00:29:14,070 --> 00:29:11,679
commercial one but also from the talent

811
00:29:16,470 --> 00:29:14,080
perspective to really help the

812
00:29:18,070 --> 00:29:16,480
talent pipeline uh but i'm also just uh

813
00:29:19,430 --> 00:29:18,080

just in awe about the opportunities of

814
00:29:21,750 --> 00:29:19,440
the ones that are just

815
00:29:23,190 --> 00:29:21,760
you know coming out of schools now and

816
00:29:26,149 --> 00:29:23,200
kind of the opportunities that they have

817
00:29:28,870 --> 00:29:26,159
going forward including uh some of these

818
00:29:30,870 --> 00:29:28,880
skill sets such as welding and kind of

819
00:29:35,110 --> 00:29:30,880
manufacturing that are

820
00:29:39,669 --> 00:29:37,510
and what i'd say is um

821
00:29:41,909 --> 00:29:39,679
first of all the spacex budget for fy23

822
00:29:43,830 --> 00:29:41,919
we're pleased with it a lot it's enough

823
00:29:45,990 --> 00:29:43,840
for for us it maybe isn't everything

824
00:29:48,070 --> 00:29:46,000
we'd like to do but it never is um and

825
00:29:50,149 --> 00:29:48,080
it's enough to allow us to to really

826
00:29:52,470 --> 00:29:50,159
look at it and maintain a very broad

827
00:29:55,110 --> 00:29:52,480
portfolio perspective perspective

828
00:29:57,510 --> 00:29:55,120
portfolio as we i talked about sooner um

829
00:29:59,110 --> 00:29:57,520
a key part of this i think is to to

830
00:30:00,870 --> 00:29:59,120
really how do we operate with the

831
00:30:02,870 --> 00:30:00,880
community to ensure in the

832
00:30:05,750 --> 00:30:02,880
innovativeness and creativity as we're

833
00:30:07,430 --> 00:30:05,760
going along and uh so and the more we do

834
00:30:08,470 --> 00:30:07,440
things where we kind of leave open this

835
00:30:10,710 --> 00:30:08,480
trade space

836
00:30:13,190 --> 00:30:10,720
and and and have it have an open thought

837
00:30:14,870 --> 00:30:13,200
of how we do it uh of what what they

838
00:30:16,230 --> 00:30:14,880

might accomplish the eclipse is a great

839
00:30:18,389 --> 00:30:16,240
example of that and the payloads that

840
00:30:19,830 --> 00:30:18,399
are that are there as well uh and

841
00:30:21,669 --> 00:30:19,840
wherever we give something we're not

842
00:30:23,990 --> 00:30:21,679
quite as prescriptive creative things

843
00:30:26,710 --> 00:30:25,590
excellent so we talked a little bit

844
00:30:28,789 --> 00:30:26,720
about how there are so many

845
00:30:30,389 --> 00:30:28,799
opportunities now which i mean as a

846
00:30:32,149 --> 00:30:30,399
young professional myself i definitely

847
00:30:33,750 --> 00:30:32,159
see that i've got friends that are kind

848
00:30:35,430 --> 00:30:33,760
of have all these opportunities when

849
00:30:37,909 --> 00:30:35,440
they graduate which is a fantastic place

850
00:30:39,830 --> 00:30:37,919
for us to be i think as an industry

851
00:30:41,590 --> 00:30:39,840
but there are some out here you know

852
00:30:43,590 --> 00:30:41,600
perhaps future industry partners that

853
00:30:45,750 --> 00:30:43,600
are not involved in artemis right now

854
00:30:47,909 --> 00:30:45,760
they want to be part of it so what

855
00:30:49,830 --> 00:30:47,919
tactical steps can they take

856
00:30:52,149 --> 00:30:49,840
to join this whole mission for artemis

857
00:30:53,430 --> 00:30:52,159
and i think uh and jim i'll start with

858
00:30:54,549 --> 00:30:53,440
you because i think you mentioned some

859
00:30:57,269 --> 00:30:54,559
of that just a little bit in your

860
00:30:59,669 --> 00:30:57,279
opening remarks okay sure uh what i

861
00:31:01,990 --> 00:30:59,679
would say is probably the first way to

862
00:31:03,509 --> 00:31:02,000
that you need in order to get engaged

863
00:31:05,590 --> 00:31:03,519

you know is is to have a really good

864
00:31:07,990 --> 00:31:05,600
idea and or have something that that you

865
00:31:09,669 --> 00:31:08,000
address a need that's out there and and

866
00:31:12,070 --> 00:31:09,679
you have a prospect prospect for going

867
00:31:13,830 --> 00:31:12,080
to get it then we and then we have a lot

868
00:31:15,830 --> 00:31:13,840
of solicitations across the board here

869
00:31:17,990 --> 00:31:15,840
with that nasa where some of those ideas

870
00:31:19,430 --> 00:31:18,000
can be can be brought out for us that

871
00:31:20,870 --> 00:31:19,440
you know if you're a small business a

872
00:31:23,190 --> 00:31:20,880
great place to start is small business

873
00:31:24,950 --> 00:31:23,200
innovative research uh because because

874
00:31:26,870 --> 00:31:24,960
there's several hundred uh

875
00:31:28,870 --> 00:31:26,880
uh contracts small contracts that we

876
00:31:30,630 --> 00:31:28,880
have for a year to check it out along

877
00:31:31,750 --> 00:31:30,640
with a lot of other solicitations and i

878
00:31:33,350 --> 00:31:31,760
mentioned the tipping point that it's

879
00:31:35,830 --> 00:31:33,360
going now

880
00:31:38,470 --> 00:31:35,840
but and then beyond that um we have ways

881
00:31:40,389 --> 00:31:38,480
to to to have the to communicate with

882
00:31:42,149 --> 00:31:40,399
the community uh the i mentioned the

883
00:31:43,909 --> 00:31:42,159
lunar surface consortium that we have

884
00:31:45,430 --> 00:31:43,919
performed that's a great place that on a

885
00:31:47,669 --> 00:31:45,440
monthly basis you can see what's going

886
00:31:49,350 --> 00:31:47,679
on johns hopkins apl is the lead for

887
00:31:51,190 --> 00:31:49,360
that and so you can find you can readily

888
00:31:52,710 --> 00:31:51,200

find uh your your way to that through

889
00:31:55,110 --> 00:31:52,720
their website and so there's a lot of

890
00:31:57,029 --> 00:31:55,120
interaction in exchange we also from our

891
00:31:58,870 --> 00:31:57,039
standpoint have developed a strategic

892
00:32:00,549 --> 00:31:58,880
technology framework and with that

893
00:32:01,990 --> 00:32:00,559
framework we've identified the the

894
00:32:03,590 --> 00:32:02,000
outcomes that we're trying to achieve

895
00:32:05,830 --> 00:32:03,600
and then the capabilities that we need

896
00:32:07,190 --> 00:32:05,840
to have that have have to in order to

897
00:32:08,789 --> 00:32:07,200
achieve that

898
00:32:10,149 --> 00:32:08,799
and and those are things that we've

899
00:32:12,549 --> 00:32:10,159
we've developed now through our

900
00:32:13,750 --> 00:32:12,559
principal technologies how to put those

901
00:32:16,549 --> 00:32:13,760
things into

902
00:32:18,070 --> 00:32:16,559
what where is our um desired enhance uh

903
00:32:20,549 --> 00:32:18,080
desired uh

904
00:32:21,830 --> 00:32:20,559
future to be and our intent is here in

905
00:32:24,549 --> 00:32:21,840
the next couple months every couple

906
00:32:26,310 --> 00:32:24,559
months is is to release in four sets uh

907
00:32:27,909 --> 00:32:26,320
these these activities so so we get

908
00:32:29,669 --> 00:32:27,919
feedback from the community hopefully

909
00:32:30,789 --> 00:32:29,679
it's a two-way thing so you can see

910
00:32:32,149 --> 00:32:30,799
better of what we're thinking from a

911
00:32:34,389 --> 00:32:32,159
technology standpoint and also help

912
00:32:36,950 --> 00:32:34,399
guide us and so i think there's a very

913
00:32:40,710 --> 00:32:36,960

broad perspective spectrum but start

914
00:32:42,630 --> 00:32:40,720
with your good idea and start working it

915
00:32:44,070 --> 00:32:42,640
excellent any other ideas thoughts on

916
00:32:45,590 --> 00:32:44,080
how we can get involved you've got

917
00:32:47,669 --> 00:32:45,600
excited people out here in the audience

918
00:32:50,470 --> 00:32:47,679
that want to join in artemis i i would

919
00:32:53,110 --> 00:32:50,480
say we our architecture team for a

920
00:32:55,110 --> 00:32:53,120
number of years now has done some i'll

921
00:32:59,190 --> 00:32:55,120
say forward-leaning engagements with

922
00:33:01,430 --> 00:32:59,200
industry across the board big to small

923
00:33:03,190 --> 00:33:01,440
where we understand where where those

924
00:33:04,310 --> 00:33:03,200
entities are going with the work they'd

925
00:33:05,509 --> 00:33:04,320
like to

926
00:33:08,070 --> 00:33:05,519
pursue

927
00:33:10,870 --> 00:33:08,080
understand how it helps the overall

928
00:33:13,269 --> 00:33:10,880
architecture that we have and and and

929
00:33:16,070 --> 00:33:13,279
figure out where are those opportunities

930
00:33:18,789 --> 00:33:16,080
that we can utilize that technology and

931
00:33:20,870 --> 00:33:18,799
work with jim to figure out calls

932
00:33:23,350 --> 00:33:20,880
that uh that can elicit the things we're

933
00:33:25,990 --> 00:33:23,360
trying to buy down in our architecture

934
00:33:28,789 --> 00:33:26,000
so uh that was that's been led by uh

935
00:33:29,990 --> 00:33:28,799
greg chavers and doug craig uh i know

936
00:33:34,070 --> 00:33:30,000
they're they're

937
00:33:36,789 --> 00:33:34,080
think uh reaching out to them being

938
00:33:38,710 --> 00:33:36,799

proactive um i know that they have a

939
00:33:40,950 --> 00:33:38,720
couple industry uh

940
00:33:42,389 --> 00:33:40,960
interactions uh every year i know we're

941
00:33:44,710 --> 00:33:42,399
thinking about having one this summer

942
00:33:47,509 --> 00:33:44,720
that that's the way to understand here's

943
00:33:50,070 --> 00:33:47,519
what company x wants to pursue how can

944
00:33:51,990 --> 00:33:50,080
we help further that how can we utilize

945
00:33:54,149 --> 00:33:52,000
that much like we do with our critical

946
00:33:56,549 --> 00:33:54,159
international partners too yeah

947
00:33:58,310 --> 00:33:56,559
you know i think to get involved um

948
00:33:59,750 --> 00:33:58,320
the most important thing is a passion

949
00:34:03,029 --> 00:33:59,760
for the work

950
00:34:06,230 --> 00:34:03,039
and then some some great creative ideas

951
00:34:09,349 --> 00:34:06,240
um it's it's been fun to watch the small

952
00:34:12,149 --> 00:34:09,359
companies uh get involved

953
00:34:14,389 --> 00:34:12,159
just like the big companies um you know

954
00:34:16,710 --> 00:34:14,399
in our contracting efforts we've got

955
00:34:19,430 --> 00:34:16,720
requirements that big companies have to

956
00:34:20,790 --> 00:34:19,440
include small companies um so so i

957
00:34:21,669 --> 00:34:20,800
wouldn't um

958
00:34:26,550 --> 00:34:21,679
uh

959
00:34:27,990 --> 00:34:26,560
just a a graduate student right now with

960
00:34:29,829 --> 00:34:28,000
a neat idea

961
00:34:32,149 --> 00:34:29,839
i wouldn't let the fact that i'm a

962
00:34:33,430 --> 00:34:32,159
one-person company frighten me away from

963
00:34:36,069 --> 00:34:33,440

doing the business because if you've got

964
00:34:38,149 --> 00:34:36,079
the passion and you've got the ideas you

965
00:34:40,230 --> 00:34:38,159
can find a way to get built into the

966
00:34:42,310 --> 00:34:40,240
system and become part of what we do in

967
00:34:44,069 --> 00:34:42,320
low earth orbit and what we'll do beyond

968
00:34:45,109 --> 00:34:44,079
low earth orbit

969
00:34:47,190 --> 00:34:45,119
excellent

970
00:34:48,470 --> 00:34:47,200
so i have a question from the audience

971
00:34:50,470 --> 00:34:48,480
now we're going to transition to some of

972
00:34:52,389 --> 00:34:50,480
your questions thanks for sending them

973
00:34:54,470 --> 00:34:52,399
and this one's for you dr z

974
00:34:56,389 --> 00:34:54,480
uh what are the key science objectives

975
00:34:59,190 --> 00:34:56,399
that you want to achieve on the lunar

976
00:35:00,790 --> 00:34:59,200
surface beyond 2024.

977
00:35:03,670 --> 00:35:00,800
this is our bookends because it's got

978
00:35:04,870 --> 00:35:03,680
science in it that's right

979
00:35:06,630 --> 00:35:04,880
uh look uh

980
00:35:08,710 --> 00:35:06,640
i think the core objective and by the

981
00:35:10,630 --> 00:35:08,720
way i'm talking about both what i'm

982
00:35:12,790 --> 00:35:10,640
hearing from

983
00:35:14,710 --> 00:35:12,800
the national academies you should know

984
00:35:17,349 --> 00:35:14,720
next week i will get

985
00:35:19,670 --> 00:35:17,359
the strategy uh the the planetary

986
00:35:21,430 --> 00:35:19,680
strategy from the national academies i i

987
00:35:23,829 --> 00:35:21,440
ask for that not because i don't know

988
00:35:26,390 --> 00:35:23,839

how to make decisions but i'm not good

989
00:35:28,230 --> 00:35:26,400
in most science so i'm just good in very

990
00:35:30,470 --> 00:35:28,240
little science so basically trading

991
00:35:33,190 --> 00:35:30,480
science against science i really want

992
00:35:35,349 --> 00:35:33,200
another body that is smarter than me uh

993
00:35:37,270 --> 00:35:35,359
to make this and so you should know that

994
00:35:40,069 --> 00:35:37,280
that decadal that we're going to get

995
00:35:42,710 --> 00:35:40,079
actually has as a task the integration

996
00:35:45,349 --> 00:35:42,720
uh or into artemis directly so i just

997
00:35:47,030 --> 00:35:45,359
want to tell everybody even though what

998
00:35:48,150 --> 00:35:47,040
i'm going to tell you is what my belief

999
00:35:50,470 --> 00:35:48,160
is today

1000
00:35:51,510 --> 00:35:50,480
next week i'm getting really important

1001
00:35:52,950 --> 00:35:51,520
guidance

1002
00:35:54,870 --> 00:35:52,960
the highest priority is really focused

1003
00:35:57,190 --> 00:35:54,880
on resources and volatiles both because

1004
00:35:59,190 --> 00:35:57,200
of the science uh that kind of water

1005
00:36:00,950 --> 00:35:59,200
cycle on the surface of mars uh sorry if

1006
00:36:03,750 --> 00:36:00,960
surprise of mood there's one on mars two

1007
00:36:06,310 --> 00:36:03,760
but uh surface on the moon uh is really

1008
00:36:08,950 --> 00:36:06,320
critical i think the other thing is uh

1009
00:36:10,870 --> 00:36:08,960
really the if you want uh understanding

1010
00:36:12,790 --> 00:36:10,880
the history of the earth system and we

1011
00:36:14,550 --> 00:36:12,800
actually think that dating the earth the

1012
00:36:16,310 --> 00:36:14,560
best way of doing that is at the moon we

1013
00:36:18,470 --> 00:36:16,320

have specific areas you want to go take

1014
00:36:20,550 --> 00:36:18,480
measurements that really take kind of

1015
00:36:22,390 --> 00:36:20,560
ambiguities in our kind of chronology

1016
00:36:24,470 --> 00:36:22,400
off the table of course the history of

1017
00:36:26,230 --> 00:36:24,480
the moon is our history so there's

1018
00:36:29,190 --> 00:36:26,240
important signs for that and i think the

1019
00:36:31,589 --> 00:36:29,200
third piece is really utilizing the moon

1020
00:36:32,950 --> 00:36:31,599
uh kind of in its environment as to do

1021
00:36:34,790 --> 00:36:32,960
measurements that otherwise are not

1022
00:36:36,310 --> 00:36:34,800
possible i want to refer back to the

1023
00:36:38,390 --> 00:36:36,320
lucid instrument i already described

1024
00:36:40,310 --> 00:36:38,400
that uses the radio quiet regions so

1025
00:36:41,510 --> 00:36:40,320
those are the three that i would focus

1026
00:36:42,630 --> 00:36:41,520
on

1027
00:36:44,870 --> 00:36:42,640
thank you

1028
00:36:46,310 --> 00:36:44,880
so another question from our audience

1029
00:36:47,589 --> 00:36:46,320
with international collaboration

1030
00:36:49,510 --> 00:36:47,599
missions such as james webb space

1031
00:36:51,109 --> 00:36:49,520
telescope and other successful stories

1032
00:36:53,349 --> 00:36:51,119
of us all coming together around

1033
00:36:55,589 --> 00:36:53,359
important missions do you see european

1034
00:36:57,750 --> 00:36:55,599
space partners and more global space

1035
00:37:01,270 --> 00:36:57,760
partners also embracing and shaping that

1036
00:37:04,870 --> 00:37:03,270
yeah i guess i'll start

1037
00:37:08,230 --> 00:37:04,880
those international partners i mentioned

1038
00:37:11,750 --> 00:37:08,240

earlier are absolutely critical to us

1039
00:37:12,950 --> 00:37:11,760
and and the agencies that that we

1040
00:37:15,750 --> 00:37:12,960
partner with

1041
00:37:17,349 --> 00:37:15,760
have an industry that they rely on to uh

1042
00:37:19,589 --> 00:37:17,359
to build that hardware

1043
00:37:21,430 --> 00:37:19,599
and i would expect that innovation i

1044
00:37:23,510 --> 00:37:21,440
think i wrote it down thomas the

1045
00:37:25,030 --> 00:37:23,520
innovative flywheel that you you

1046
00:37:28,150 --> 00:37:25,040
mentioned earlier every time i listen to

1047
00:37:30,230 --> 00:37:28,160
thomas i learned something um

1048
00:37:32,790 --> 00:37:30,240
is is spinning just as well in those

1049
00:37:34,950 --> 00:37:32,800
other countries and and seeing the way

1050
00:37:36,950 --> 00:37:34,960
the space economy has taken off i would

1051
00:37:38,950 --> 00:37:36,960
expect that that commercial and i think

1052
00:37:41,349 --> 00:37:38,960
you're seeing it now that commercial to

1053
00:37:42,310 --> 00:37:41,359
roll out of out of that that effort as

1054
00:37:43,750 --> 00:37:42,320
well

1055
00:37:45,670 --> 00:37:43,760
so one of the things that i want to talk

1056
00:37:47,190 --> 00:37:45,680
about that i think

1057
00:37:48,630 --> 00:37:47,200
it's just that there's a lot of learning

1058
00:37:51,829 --> 00:37:48,640
ahead of us

1059
00:37:53,109 --> 00:37:51,839
and i don't think i certainly didn't

1060
00:37:54,790 --> 00:37:53,119
want to give the impression that we

1061
00:37:56,630 --> 00:37:54,800
figured i figured it out i don't want to

1062
00:37:58,470 --> 00:37:56,640
speak for my colleagues let me give you

1063
00:38:00,230 --> 00:37:58,480

one of the examples it's really clear

1064
00:38:02,630 --> 00:38:00,240
that the entrepreneurial ecosystem just

1065
00:38:05,109 --> 00:38:02,640
if you look at just sheer amount of uh

1066
00:38:07,829 --> 00:38:05,119
you know venture capital or kind of

1067
00:38:10,470 --> 00:38:07,839
expanded in the united states by far uh

1068
00:38:12,230 --> 00:38:10,480
eclipses where what happens elsewhere so

1069
00:38:14,310 --> 00:38:12,240
what that does it creates kind of

1070
00:38:15,990 --> 00:38:14,320
tension so we of course

1071
00:38:19,030 --> 00:38:16,000
our international partners are dear to

1072
00:38:20,630 --> 00:38:19,040
us and and uh we love working with them

1073
00:38:22,470 --> 00:38:20,640
on the missions two-thirds of science

1074
00:38:24,710 --> 00:38:22,480
missions have international partnership

1075
00:38:27,349 --> 00:38:24,720
all of the core kind of elements that

1076
00:38:29,349 --> 00:38:27,359
that we're doing have them and we think

1077
00:38:31,270 --> 00:38:29,359
that makes us stronger but what we need

1078
00:38:32,950 --> 00:38:31,280
to figure out now is how do we make sure

1079
00:38:34,790 --> 00:38:32,960
that in fact the

1080
00:38:36,550 --> 00:38:34,800
industries in these other partnerships

1081
00:38:39,109 --> 00:38:36,560
wherever they are whether in europe in

1082
00:38:41,990 --> 00:38:39,119
japan whether they're elsewhere that

1083
00:38:43,270 --> 00:38:42,000
they too cannot find kind of

1084
00:38:45,589 --> 00:38:43,280
support

1085
00:38:47,430 --> 00:38:45,599
without really if you if you want taking

1086
00:38:48,630 --> 00:38:47,440
energy out of the commercial ecosystem

1087
00:38:50,069 --> 00:38:48,640
i'll give you an example just so you

1088
00:38:51,510 --> 00:38:50,079

know what i'm talking about

1089
00:38:53,030 --> 00:38:51,520
we could be working with every

1090
00:38:55,190 --> 00:38:53,040
international partner and creating

1091
00:38:57,750 --> 00:38:55,200
agreements to fly their instruments to

1092
00:38:59,430 --> 00:38:57,760
the moon using commercial lunar payload

1093
00:39:01,270 --> 00:38:59,440
services i think that would be a

1094
00:39:03,589 --> 00:39:01,280
horrific mistake

1095
00:39:04,950 --> 00:39:03,599
because what i just do is i destroy part

1096
00:39:06,470 --> 00:39:04,960
of the market

1097
00:39:09,030 --> 00:39:06,480
uh for the commercial lunar payload

1098
00:39:11,430 --> 00:39:09,040
surfaces the kind of a freak a less a

1099
00:39:14,630 --> 00:39:11,440
market with less friction as one where

1100
00:39:16,790 --> 00:39:14,640
over time that commercial you know

1101
00:39:18,470 --> 00:39:16,800
our international partners say hey i'm

1102
00:39:19,510 --> 00:39:18,480
going to work with this company

1103
00:39:22,310 --> 00:39:19,520
and go

1104
00:39:24,230 --> 00:39:22,320
work with them directly so how we get

1105
00:39:25,990 --> 00:39:24,240
from where we are today we're perfectly

1106
00:39:28,069 --> 00:39:26,000
excited to have these discussions but

1107
00:39:30,230 --> 00:39:28,079
how do we get to this world that's much

1108
00:39:32,230 --> 00:39:30,240
more seamless and kind of without

1109
00:39:33,670 --> 00:39:32,240
boundary kind of like the commercial

1110
00:39:35,270 --> 00:39:33,680
entities are something we're still

1111
00:39:37,109 --> 00:39:35,280
learning

1112
00:39:37,829 --> 00:39:37,119
excellent

1113
00:39:40,470 --> 00:39:37,839

so

1114
00:39:42,710 --> 00:39:40,480
as we kind of i guess reset tai bo on

1115
00:39:44,230 --> 00:39:42,720
this conversation we started with

1116
00:39:46,390 --> 00:39:44,240
talking a little bit about what artemis

1117
00:39:48,230 --> 00:39:46,400
really is what artemis means and we've

1118
00:39:49,990 --> 00:39:48,240
detailed some really important pieces of

1119
00:39:51,750 --> 00:39:50,000
the partnerships the talent you know all

1120
00:39:53,670 --> 00:39:51,760
the resources but what i want to

1121
00:39:55,750 --> 00:39:53,680
challenge us to do just to kind of close

1122
00:39:56,790 --> 00:39:55,760
out our panel is to fast forward a few

1123
00:39:59,430 --> 00:39:56,800
decades

1124
00:40:01,670 --> 00:39:59,440
and look to the future so if artemis as

1125
00:40:03,510 --> 00:40:01,680
we understand it today all goes as

1126
00:40:05,670 --> 00:40:03,520
planned what do you think the space

1127
00:40:08,950 --> 00:40:05,680
economy looks like maybe 20 years from

1128
00:40:13,670 --> 00:40:10,870
uh i guess i'll go first and they'll

1129
00:40:15,829 --> 00:40:13,680
improve on any answer i come up with um

1130
00:40:18,870 --> 00:40:15,839
i i think i see it evolving

1131
00:40:21,430 --> 00:40:18,880
much like low earth orbit has

1132
00:40:22,470 --> 00:40:21,440
our access to low earth orbit to space

1133
00:40:25,829 --> 00:40:22,480
station

1134
00:40:27,510 --> 00:40:25,839
is now a service i would expect us

1135
00:40:29,829 --> 00:40:27,520
to have

1136
00:40:32,069 --> 00:40:29,839
built the sustainability that pam talked

1137
00:40:35,030 --> 00:40:32,079
about on the lunar surface

1138
00:40:37,670 --> 00:40:35,040

that allows us to

1139
00:40:40,790 --> 00:40:37,680
access the lunar surface in a commercial

1140
00:40:43,430 --> 00:40:40,800
way as well our job at nasa is to not

1141
00:40:45,349 --> 00:40:43,440
hold on uh hold on to things many folks

1142
00:40:47,750 --> 00:40:45,359
say why are we doing services for

1143
00:40:49,750 --> 00:40:47,760
landers because we we don't want to own

1144
00:40:51,589 --> 00:40:49,760
that forever we want to use that as a

1145
00:40:53,990 --> 00:40:51,599
service so that we're pushing the next

1146
00:40:55,589 --> 00:40:54,000
boundary so in 20 years i'm hopeful that

1147
00:40:57,990 --> 00:40:55,599
there is some kind of infrastructure on

1148
00:41:00,230 --> 00:40:58,000
the lunar surface that is available to

1149
00:41:02,470 --> 00:41:00,240
commercial entities that is used by

1150
00:41:05,430 --> 00:41:02,480
commercial entities that we still use

1151
00:41:08,150 --> 00:41:05,440
but not as the the sole owner and we are

1152
00:41:10,309 --> 00:41:08,160
pushing on our way to mars if that's the

1153
00:41:14,309 --> 00:41:10,319
case then there's an economy there that

1154
00:41:16,710 --> 00:41:14,319
we have been a part of creating

1155
00:41:19,030 --> 00:41:16,720
yeah um you know it's always fraught

1156
00:41:23,030 --> 00:41:19,040
with peril to try and predict the future

1157
00:41:24,710 --> 00:41:23,040
but um what i see is is like jim said

1158
00:41:27,510 --> 00:41:24,720
what we've got going on in leo right now

1159
00:41:29,030 --> 00:41:27,520
will move out to cis-lunar space

1160
00:41:31,030 --> 00:41:29,040
and we'll see

1161
00:41:32,630 --> 00:41:31,040
private missions that that go to the

1162
00:41:34,390 --> 00:41:32,640
lunar surface

1163
00:41:36,790 --> 00:41:34,400

i think we'll see

1164
00:41:38,870 --> 00:41:36,800
some people that go there for

1165
00:41:41,270 --> 00:41:38,880
private science reasons or to explore

1166
00:41:43,589 --> 00:41:41,280
for resources we'll see missions that

1167
00:41:45,109 --> 00:41:43,599
aren't driven by government requirements

1168
00:41:47,910 --> 00:41:45,119
but they're driven by private

1169
00:41:49,910 --> 00:41:47,920
requirements and at some point 20 years

1170
00:41:50,950 --> 00:41:49,920
is probably a little too soon but at

1171
00:41:53,430 --> 00:41:50,960
some point we're going to see

1172
00:41:55,510 --> 00:41:53,440
exploration missions that are driven by

1173
00:41:57,030 --> 00:41:55,520
uh corporations on earth rather than by

1174
00:41:58,630 --> 00:41:57,040
the government

1175
00:41:59,990 --> 00:41:58,640
and i think there's important

1176
00:42:00,950 --> 00:42:00,000
transitions that are really hard to

1177
00:42:03,109 --> 00:42:00,960
predict

1178
00:42:05,349 --> 00:42:03,119
but are already at the horizon now the

1179
00:42:06,870 --> 00:42:05,359
availability of big launch

1180
00:42:08,309 --> 00:42:06,880
large launch systems whether it's the

1181
00:42:10,470 --> 00:42:08,319
one that you're you talked about the

1182
00:42:12,790 --> 00:42:10,480
beginning uh some of the commercial

1183
00:42:14,550 --> 00:42:12,800
options fundamentally change how we do

1184
00:42:17,430 --> 00:42:14,560
things you know standing in front of the

1185
00:42:19,589 --> 00:42:17,440
uh ariane 5 with the james webb space

1186
00:42:21,750 --> 00:42:19,599
telescope on it uh 10 billion dollars of

1187
00:42:23,510 --> 00:42:21,760
investment you know like i don't wish

1188
00:42:25,910 --> 00:42:23,520

that on another person necessarily and

1189
00:42:28,069 --> 00:42:25,920
the ariane 5 team did such an amazing

1190
00:42:30,550 --> 00:42:28,079
job but the question is how do we kind

1191
00:42:32,630 --> 00:42:30,560
of transfer you know a future kind of in

1192
00:42:35,430 --> 00:42:32,640
this environment how do we create

1193
00:42:38,150 --> 00:42:35,440
solutions for advanced telescopes for uh

1194
00:42:40,630 --> 00:42:38,160
earth observing systems that really use

1195
00:42:44,069 --> 00:42:40,640
these these kind of tool sets that that

1196
00:42:46,550 --> 00:42:44,079
we've talked about uh to me i think uh a

1197
00:42:49,190 --> 00:42:46,560
significant fraction of signs will move

1198
00:42:51,990 --> 00:42:49,200
in that space uh and our job is of

1199
00:42:53,030 --> 00:42:52,000
course that as an agency is to uh first

1200
00:42:55,190 --> 00:42:53,040
both

1201
00:42:57,270 --> 00:42:55,200
utilize that but also focus on the

1202
00:42:59,750 --> 00:42:57,280
leading edge and trying to make sure

1203
00:43:02,230 --> 00:42:59,760
that we build i hope 20 years from now a

1204
00:43:04,630 --> 00:43:02,240
spacecraft that goes to other stars

1205
00:43:07,430 --> 00:43:04,640
right and i mean of course we need to do

1206
00:43:09,510 --> 00:43:07,440
that we have nuclear systems that are

1207
00:43:12,230 --> 00:43:09,520
really providing power

1208
00:43:14,309 --> 00:43:12,240
in many as places and also propulsion in

1209
00:43:16,390 --> 00:43:14,319
every kind of orders of magnitude above

1210
00:43:18,150 --> 00:43:16,400
what we currently have and so so it's

1211
00:43:19,030 --> 00:43:18,160
these things that we should be focused

1212
00:43:21,510 --> 00:43:19,040
on

1213
00:43:22,790 --> 00:43:21,520

yeah and what i'd say is first of all i

1214
00:43:24,550 --> 00:43:22,800
hope there's a rough parallel with the

1215
00:43:26,470 --> 00:43:24,560
airline industry

1216
00:43:28,710 --> 00:43:26,480
that we start seeing that especially in

1217
00:43:29,510 --> 00:43:28,720
in in the places where it's more natural

1218
00:43:35,430 --> 00:43:29,520
and

1219
00:43:37,430 --> 00:43:35,440
that that there's some technology

1220
00:43:39,829 --> 00:43:37,440
advancements we can still

1221
00:43:41,349 --> 00:43:39,839
engage in like we do with their armd

1222
00:43:42,710 --> 00:43:41,359
with our research organization

1223
00:43:45,030 --> 00:43:42,720
aeronautics

1224
00:43:47,430 --> 00:43:45,040
but but that too largely it's a service

1225
00:43:49,510 --> 00:43:47,440
thing and we we set our attention on the

1226
00:43:51,109 --> 00:43:49,520
next great thing and i i don't think in

1227
00:43:52,630 --> 00:43:51,119
20 or 40 years we're going to run out of

1228
00:43:54,230 --> 00:43:52,640
next great things

1229
00:43:56,150 --> 00:43:54,240
and but we'll go farther and further in

1230
00:43:58,470 --> 00:43:56,160
our exploration we'll we'll leave this

1231
00:43:59,910 --> 00:43:58,480
solar system and we'll go beyond

1232
00:44:01,349 --> 00:43:59,920
outstanding all right so i'm going to

1233
00:44:03,030 --> 00:44:01,359
bring us back from the future we're here

1234
00:44:04,870 --> 00:44:03,040
today in colorado springs or if you're

1235
00:44:06,309 --> 00:44:04,880
online with us virtually

1236
00:44:07,829 --> 00:44:06,319
so i want to thank you all of our

1237
00:44:09,750 --> 00:44:07,839
distinguished panelists for the

1238
00:44:11,670 --> 00:44:09,760

wonderful discussion i think the future

1239
00:44:13,109 --> 00:44:11,680
is bright in space and artemis just

1240
00:44:15,670 --> 00:44:13,119
shines so brightly

1241
00:44:16,950 --> 00:44:15,680
thank you all for joining us and

1242
00:44:35,500 --> 00:44:16,960
hope you have a wonderful rest of your